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Effect of different chemicals on yield and chemical parameters in Custard Apple (*Annona squamosa* L.) cv. Dharur-6

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ABSTRACT

The present investigation entitled "Effect of different chemicals on yield and chemical parameters in Custard Apple (*Annona squamosa* L.) cv. Dharur-6" was carried out at Custard Apple Research Station, Ambajogai, Dist. Beed, during the year 2025-26. The experiment was laid out in a Randomized Block Design with different chemical treatments. The results revealed that treatment T_9 (GA_3 50 ppm) recorded the maximum values for average fruit weight (375.57 g), pulp weight (185.20 g), peel weight (159.82 g), TSS (24.98 °Brix), acidity (0.294 %), total sugar (21.17 %), reducing sugar (19.14 %) and non-reducing sugar (2.03 %). While treatment T_5 (NAA 100 ppm) recorded the maximum fruit yield per plant (21.05 kg/tree) and fruit yield (13.15 t/ha).

Keywords: Fruit weight, Fruit yield, Urea, NAA, GA_3 , CPPU

Introduction

The custard apple (*Annona squamosa* L.) is also known as Sugar apple, Sweet sop, Sitaphal and Sharifa. It originated in the tropical region of Tropical America and is a member of the Annonaceae family. In India, it is a significant dryland fruit. In India's tropical and warmer subtropical regions, custard apples can be grown. There are 14 pairs of chromosomes in a custard apple ($2n = 14$). The genus *Annona* contains more than 100 species. The pulp of *Annona squamosa* is slightly granular, creamy yellow or white, sweet, with a pleasant flavour and low acidity. It is considered the sweetest of the annona fruits (FAO, 1990) [1].

The custard apple is extensively cultivated worldwide in tropical, semi-arid and arid regions for its succulent fruit. Custard apple fruit is mainly grown in Maharashtra's Marathwada, Vidarbha, and Western Maharashtra region. The important districts for this fruit are Solapur, Pune, Nagpur, Dhule, Ch. Sambhaji Nagar, Beed, Dharashiv, and others. In year 2024-2025 the crop covers 61,000 ha nationwide, producing 583,000 metric tons. While in Maharashtra, custard apple covers 25380 ha, producing 244680 metric tons. (APEDA, 2025) [2]

The custard apple is primarily a cross-pollinated crop with bisexual hermaphrodite flowers; however, effective self-pollination is limited since stigma receptivity and pollen release occur at different times. In custard apple, flowering extend from spring to the end of rainy season. A medium-sized tree bears 1000 to 1500 flowers in a season, but only 2 % flowers set and bear fruits. During the rainy season, fruit-set takes place. By that time the temperature is lower and the relative humidity is high. Higher percentage of fruit-set by hand pollination has been reported by various workers (Bose *et al.*, 2001) [3].

Custard apple bears the flowers during the period from April to August. However, no fruit set occurs during spring and summer, and it begins only in the rainy season due to favorable climatic conditions. Due to high temperature, low atmospheric humidity, lack of irrigation water and natural stresses resulted less number of flowers, poor fruit setting and low yield and degraded quality of fruit too. (Patel *et al.*, 2010 and Chaudhari *et al.*, 2016) [4].

The custard apple is a very good source of carbohydrates, proteins, fiber, minerals like calcium and iron, and vitamins, especially Vitamin C. Custard apple has good calorific value; that is, it gives 104 kcal per 100 grams of fruit. Furthermore, custard apple consists of 21.3 g of carbohydrates, 5.2 g of protein, 7.25 g of fiber, 60 mg of calcium, 80 mg of phosphorus, 105 mg of iron, 91 mg of Vit. C in 100g edible portion, and 70 to 80 % moisture content. (Nair *et al.*, 2017) [5].

There are also encouraging results due the use of chemicals, such as a means of NAA, GA_3 in custard apple with respect to improvement in yield and chemical properties. However, research work on this aspect in custard apple is very scanty and sporadic. Being a hardy crop, its cultivation of is increasing in Maharashtra, considering the importance and future scope of this crop the present experiment was carried out.

Materials and Methods

The experiment was conducted during 2025-26 at the Custard Apple Research Station, Ambajogai, Dist. Beed, which is situated on an elevation of 631 m above the mean sea level between 18.75° North latitude and 76.37° East longitude. Eight-year-old custard apple trees with uniform growth were selected for the experiment. The trees were planted at a spacing of 4 m × 4 m. Thirteen treatments were evaluated in a Randomized Block Design (RBD) with two replications. Each treatment consisted of three plants, resulting in a total of 78 experimental plants. In June 2025, the experiment was started. Chemicals were applied in the form of foliar spray as per treatments. The treatment included T₁ i.e. Urea 0.5%, T₂ i.e. Urea 1.0%, T₃ i.e. Urea 1.5%, T₄ i.e. NAA 50 ppm, T₅ i.e. NAA 100 ppm, T₆ i.e. NAA 200 ppm, T₇ i.e. GA₃ 30 ppm, T₈ i.e. GA₃ 40 ppm, T₉ i.e. GA₃ 50 ppm, T₁₀ i.e. CPPU 30 ppm, T₁₁ i.e. CPPU 40 ppm, T₁₂ i.e. CPPU 50 ppm and T₁₃ i.e. Control.

The observations on average fruit weight (g), pulp weight (g), peel weight (g), seed weight (g), fruit yield per plant (kg/tree), fruit yield (t/ha), TSS (%), acidity (%), total sugar (%), reducing sugar (%), non-reducing sugar (%) were recorded. The data obtained on these various characters were subjected to RBD analysis and interpretation of the data was carried out in accordance to Panse *et al.* (1995) [6].

Results and Discussion

Average fruit weight (g): The results regarding average fruit weight are presented in Table 1. It showed that maximum fruit weight was recorded in treatment T₉ (375.57) which was followed by treatment T₈ (372.35), T₅ (371.43), and T₄ (368.26). While minimum fruit weight was recorded in control T₁₃ (351.10). This might be due to cell division in the initial stage and later due to faster cell expansion associated with the influx of water and metabolites into the fruits which cause an overall increase in weight of fruit. The result is in agreement with the finding reported by Kulkarni *et al.* (1995) [7]; Memane *et al.* (2013) [8]; Laila *et al.* (2018) [9] in Custard apple.

Pulp weight (g): The data with respect to pulp weight presented in Table 1. Showed that maximum pulp weight was recorded in treatment T₉ (185.20) was followed by treatment T₈ (183.20), T₅ (182.80), T₄ (179.80) and T₁₂ (178.00). Minimum pulp weight was recorded in control T₁₃ (169.20). Fruit pulp weight may rise as a result of cell enlargement and multiplication, improved water absorption, higher storage of sugar and other food reserves, and an increase in the volume of intercellular spaces. Additionally, increased accumulation and transfer of excess metabolites from other plant parts toward growing fruits may be the cause of increase in pulp content (Barkule *et al.*, 2018) [10]. The results are in agreement with the findings reported by Kulkarni (1991) [11], Memane *et al.*, (2013) [8], Laila *et al.*, (2018) [9] in Custard apple.

Table 1. Effect of different chemicals on average fruit weight (g), pulp weight (g), peel weight (g), seed weight (g) fruit yield per plant (kg/tree) and fruit yield (t/ha) of Custard apple cv. Dharur-6.

Tr. no.	Treatments	Avg. fruit weight (g)	Pulp weight (g)	Peel weight (g)	Seed weight (g)	Fruit yield per plant (kg/tree)	Fruit yield (t/ha)
T ₁	Urea 0.5 %	354.39	171.80	149.88	32.71	13.35	8.34
T ₂	Urea 1.0 %	356.04	173.20	150.20	32.64	12.70	7.94
T ₃	Urea 1.5 %	358.45	175.40	150.45	32.60	13.50	8.44
T ₄	NAA 50 ppm	368.26	179.80	156.46	32.00	20.01	12.51
T ₅	NAA 100 ppm	371.43	182.80	156.98	31.65	21.05	13.15
T ₆	NAA 200 ppm	362.31	176.60	153.42	32.29	17.51	10.94
T ₇	GA ₃ 30 ppm	360.66	176.40	152.80	31.46	16.35	10.22
T ₈	GA ₃ 40 ppm	372.35	183.20	158.20	30.95	19.36	12.10
T ₉	GA ₃ 50 ppm	375.57	185.20	159.82	30.55	20.78	12.99
T ₁₀	CPPU 30 ppm	359.56	175.80	151.20	32.56	12.59	7.87
T ₁₁	CPPU 40 ppm	364.45	177.80	154.10	32.55	14.58	9.11
T ₁₂	CPPU 50 ppm	365.70	178.00	155.72	31.98	17.56	10.97
T ₁₃	Control	351.10	169.20	149.16	32.74	11.35	7.10
	S.E.m ±	0.55	0.48	0.36	0.45	0.04	0.03
	C.D. at 5 %	1.71	1.48	1.12	1.40 (NS)	0.13	0.08

Peel weight (g): The result regarding peel weight are presented in Table 1. Maximum peel weight was obtained in treatment T₉ (159.82) which was followed by treatment T₈ (158.20), T₅ (156.98), T₄ (156.46) and T₁₂ (155.72). While minimum peel weight was recorded in control T₁₃ (149.16). Increased water absorption and the mobilization of sugar and minerals in the mesocarp's expended cells and intracellular spaces might be the cause of this. The result is in confirmation with the finding of Kulkarni *et al.*, (1991) [11], Memane *et al.*, (2013) [8], Laila *et al.*, (2018) [9] in Custard apple.

Seed weight (g): The data regarding seed weight as affected by different treatments are presented in Table 1. Analysis revealed that the treatments had a non-significant effect on seed weight. Minimum seed weight was recorded in T₉ (30.55), followed by T₈ (30.95) and T₇ (31.46). The maximum seed weight was recorded in T₁₃ (32.74).

Fruit yield per plant (kg/tree): The results regarding fruit yield per plant are presented in Table 1. Maximum fruit yield per plant was observed in treatment T₅ (21.05) which was followed by treatment T₉ (20.78), T₄ (20.01), T₈ (19.36) and T₆ (17.51). Minimum fruit yield was observed in control T₁₃ (11.35). Increase in the yield might be

due to the increased number of fruits per plant which directly corresponds to the increased fruit set. The results are in agreement with the findings reported by Kulkarni *et al.* (1996); Patel *et al.*, (2010) [4] and Thorat *et al.*, (2018) [12] in Custard apple.

Fruit yield (t/ha): The results regarding fruit yield as affected by different chemical treatments are presented Table 1. Maximum fruit yield was observed in treatment T₅ (13.15) which was followed by treatment T₉ (12.99), T₄ (12.51), T₈ (12.10) and T₆ (10.97). While minimum fruit yield was seen in treatment control T₁₃ (7.10). Increase in yield under these chemicals was associated with increase in the number of fruits, low percentage of fruit drop, more fruit retention and increased fruit size and weight. The above results were in agreement with those of Patel *et al.*, (2010) [4]; Prajapati *et al.*, (2016) [13] and Chaudhari *et al.*, (2016) [14] in Custard apple.

TSS (°Brix): The results regarding TSS are presented in Table 2. Maximum TSS was observed in treatment T₉ (24.98) which was at par with T₈ (24.72), T₄ (24.46), and T₅ (24.10) respectively. While minimum TSS was recorded in control T₁₃ (21.48). Increase in the total soluble solids by gibberellins 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 Prajapati *et al.*,

(2016) [13]; Chaudhari *et al.*, (2016) [14]; Thorat *et al.*, (2018) [12] in Custard apple.

Table 2. Effect of different chemicals on TSS (°Brix), acidity (%), total sugar (%), reducing sugar (%) and non-reducing sugar (%) of Custard apple cv. Dharur-6.

Tr. no.	Treatments	TSS (°Brix)	Acidity (%)	Total sugar (%)	Reducing sugar (%)	Non-reducing sugar (%)
T ₁	Urea 0.5 %	22.00	0.245	17.62	16.19	1.43
T ₂	Urea 1.0 %	22.36	0.260	17.86	16.40	1.46
T ₃	Urea 1.5 %	22.62	0.265	18.45	16.93	1.53
T ₄	NAA 50 ppm	24.46	0.287	20.81	18.91	1.90
T ₅	NAA 100 ppm	24.10	0.278	19.47	17.78	1.69
T ₆	NAA 200 ppm	23.78	0.275	19.32	17.67	1.65
T ₇	GA ₃ 30 ppm	23.14	0.266	19.88	18.14	1.74
T ₈	GA ₃ 40 ppm	24.72	0.288	20.88	18.94	1.94
T ₉	GA ₃ 50 ppm	24.98	0.294	21.17	19.14	2.03
T ₁₀	CPPU 30 ppm	22.88	0.272	18.75	17.16	1.59
T ₁₁	CPPU 40 ppm	23.56	0.275	20.15	18.39	1.76
T ₁₂	CPPU 50 ppm	23.92	0.275	20.33	18.50	1.83
T ₁₃	Control	21.48	0.241	16.83	15.44	1.39
	S.E.m ±	0.38	0.01	0.34	0.33	0.06
	C.D. at 5 %	1.16	0.03	1.03	1.01	0.19

Acidity (%): The information regarding percentage of acidity as affected by various chemical treatments is presented in Table 2. Maximum acidity was recorded in treatment T₉ (0.294) which was at par with T₈ (0.288), T₄ (0.287), T₅ (0.278) and T₆ (0.275) respectively. While minimum acidity was recorded in treatment T₁₃ (0.241). Titratable acidity is reduced due to the metabolic changes with fast conversion of organic acids into sugars and their derivatives by reactions involving reversal of glycolytic pathway or their utilization in respiration. The results of present findings are in line with Mostafa *et al.* (2018) [15]; Pujari *et al.* (2021) [16] and Rathod *et al.*, (2024) [17] in Custard apple.

Total sugar (%): The results regarding total sugar are presented in Table 2. Maximum total sugar was observed in treatment T₉ (21.17) which was at par with T₈ (20.88), T₄ (20.81) and T₁₁ (20.15) respectively. While minimum total sugar was recorded in treatment control T₁₃ (16.83). Significant enhancement in total sugar content of fruits might be due to mobilization of soluble carbohydrates in fruits, under the influence of applied GA₃ (Leopold, 1955) [18]. The results of present findings are in line with Prajapati *et al.* (2018); Mostafa *et al.* (2018) [15]; Bidave *et al.*, (2019) [19]; Pujari *et al.* (2021) [16] and Rathod *et al.*, (2024) [17] in Custard apple.

Reducing sugar (%): The data presented in Table 2 with respect to reducing sugar showed that maximum reducing sugar was recorded in treatment T₉ (19.14) which was statistically at par with T₈ (18.94), T₄ (18.91) and T₁₂ (18.50). While minimum reducing sugar was recorded in treatment control T₁₃ (15.44). This could be due to raising the activity of enzyme such as amylases which hydrolyse the complex polysaccharides into simple sugars. It has been shown that auxin and GA₃ speed up the transfer of metabolites from other plant sections to growing fruits. The results are in agreement with the findings reported by Chaudhari *et al.* (2016) [14] in Custard apple.

Non-reducing sugar (%): The results pertaining to non-reducing sugar are presented in Table 2. Maximum non-reducing sugar was recorded in treatment T₉ (2.03) which was at par with T₈ (1.94) and T₄ (1.90) followed by T₅ (1.69) and T₆ (1.65). While minimum non-reducing sugar was recorded in treatment control T₁₃ (1.39). This might be due to increase the activity of the enzymes such as amylase which hydrolase complex polysaccharides into simple sugar. The results are in agreement with the findings reported by Kulkarni *et al.* (1996) in Custard apple.

Conclusion: The present investigation clearly revealed that application of different chemicals had a considerable influence on yield and chemical parameters of custard apple cv. Dharur-6. Among treatments, GA₃ @ 50 ppm (T₉) proved to be superior for improving average fruit weight, pulp weight, TSS, total sugar, reducing sugar and non-reducing sugar along with minimum seed weight per fruit. While NAA@ 100 ppm (T₅) showed highest fruit yield per plant as well as fruit yield.

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