

Original Research Article

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Effect of Different Nitrogenous Fertilizers on Quality Parameters of Custard Apple (*Annona squamosa* L.)

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ABSTRACT

An experiment was conducted to evaluate the “Effect of different nitrogenous fertilizers on growth, yield and quality of Custard apple (*Annonas quamosa* L.)” at the Demonstration-cum-Research Farm, Manjra, KVK, Latur during 2018-19 .The experiment was carried out on the 8 years old Balanagar Custard apple with seven different sources of nitrogenous fertilizes viz. Urea (T₁), Ammonium sulphate (T₂), Sodium nitrate (T₃), Ammonium chloride (T₄), Neem coated urea (T₅), Calcium ammonium nitrate (T₆) and Calcium nitrate (T₇) as treatments and replicated thrice and laid out in RBD. The maximum increase in plant height (0.96 m, 53.03%), stem girth (6.43 cm, 48.56%), plant spread (1.82 m², 96.80% East-West and 1.92 m², 96.96% North- South) and plant volume (3.80 m³, 376.23%) were recorded with the N application through neem coated urea per tree (T₅) and it was closely followed by the application of N through ammonium sulphate (T₂). The minimum number of days (39.33) required for flowering, days required for fruit set (22.33) and days required from fruit set to maturity (71.67) were recorded with the application of N through ammonium sulphate (T₂). Yield and yield contributing characters were viz. total number of fruits per tree (93.00), number of marketable fruits per tree (89.00), total yield (21.15 kg/tree and 8.46 t/ha) and marketable yield (20.24 kg/tree and 8.10 t/ha) were recorded with the N application through ammonium sulphate (T₂).

Keywords

Nitrogenous fertilizers, Custard apple, Ammonium sulphate

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Introduction

Custard apple (*Annonas quamosa* L.) is a delicious and important fruit crop which is cultivated in tropical and subtropical climate. It comes under family Annonaceae and native of the West Indies and cultivated since early times throughout Central America to Southern Mexico (Popenoe, 1974). The fruit is also popularly known as “Sugar apple”, “Monkey fruit” and “Sweetsop”. Custard apple is an important dry land fruit crop of India. Custard

apple has slightly granular, creamy, yellow or white sweet pulp with good flavour and low acidity, thus it is considering the sweetest fruits among other annonas (Annon, 1990). Its diploid chromosome number is 2n=14.

This crop is becoming popular and commercial now-a-days. Productivity of custard apple is very low. Low productivity is due to imbalanced nutrition, incidence of pest and diseases and lack of adoption of advanced technology or improved production

techniques. Imbalanced use of chemical fertilizers is a common practice adopted by the farmers. Large scale use of chemical fertilizers causes problem of ground water and environmental pollution through leaching, volatilization and denitrification in addition to wastage of nutrients through costly fertilizers. The disproportionate use of chemical fertilizers has widened the soil imbalance in terms of NPK ratio. The occurrence of multinutrient deficiencies and overall decline in productive capacity of the soil has been widely reported due to non-judicious fertilizer use (Chhonkar, 2008). The low productivity of custard apple is mainly due to less adoption of improved technology in respect of planting system, nutrition, plant protection etc. Among several other factors, probably nutrition is a key factor affecting the productivity of custard apple trees. Among the different nutrients needed by the plants, nitrogen is most essential for the vegetative growth of the plant. Potassium increases root growth and improves drought tolerance. This plant requires adequate soil moisture during the growing season, and to achieve higher fruit yields, the soil must be fertilized generously, with nitrogen, which is the nutrient most required by the custard apple (Pleguezuelo *et al.*, 2011; Cavalcante *et al.*, 2012). Nitrogen uptake by plant roots is directly affected by soil, plant and environmental factor. The nitrogen is most crucial element in plant growth with as much as 78% in the atmosphere and 98% in the soil organic matter, nitrogen is abundant in nature. Yet, it is most deficient in all cultivable soils. Nitrogen deficiency symptoms are most prevalent and easiest to identify. Young plants exhibit yellowish green foliage and stunted growth while older plants show yellowing or falling of leaves. Nitrogen deficiency impedes good yield. An effective, integrated approach employs organic manures, biofertilizers, chemical fertilizers, nitrification inhibitors, coated and long-persisting nitrogen fertilizers,

which are the key to sustainable agriculture (Gowarikar, 2005). The information on utility of these nitrogenous fertilizers in fruit crops is very scanty. Under prevailing conditions it is the need of the day to generate the information on effectiveness and economics of available nitrogenous fertilizers in dryland fruit crop like custard apple. Hence the present investigation entitled "Effect of different nitrogenous fertilizers on growth, yield and quality of custard apple (*Annonasquamosa* L.)" is planned.

Materials and Methods

An experiment was conducted at the Demonstration-cum-Research Farm, Manjra, KVK, Latur during 2018-19. The experiment was carried out on the 8 years old Balanagar Custard apple with seven different sources of nitrogenous fertilizers viz. Urea (T₁), Ammonium sulphate (T₂), Sodium nitrate (T₃), Ammonium chloride (T₄), Neem coated urea (T₅), Calcium ammonium nitrate (T₆) and Calcium nitrate (T₇) as treatments and replicated thrice and laid out in RBD. The experiment was conducted in a well established orchard of eight years age Balanagar custard apple trees planted at 5.0 x 5.0 m spacing.

The selected trees in the experimental orchard were pruned as per the recommendation during second week of May 2018. All diseased, dried and criss-cross branches were removed. The basins were prepared by digging the soil around tree trunk. The FYM @ 20 kg/tree was applied in first week of June 2018. The recommended dose of fertilizers for custard apple as per the recommendation of V.N.M.K.V, Parbhani is 250 g N: 125 g P₂O₅: 125 g K₂O per tree and half dose of N through different sources as per treatments viz., Urea, Neem coated urea, Ammonium sulphate, Calcium nitrate was applied as per the treatments on 11/06/2018 along with full dose

of phosphorus and potash. The remaining half dose of nitrogen as per the treatments was applied during fruit development stage on 10/08/2018.

Results and Discussion

The maximum values of physical fruit quality parameters like fruit weight (227.47 g), fruit volume (179.60 ml), pulp weight (108.89 g), peel weight (103.64 g), pulp percentage (47.73 %), peel to pulp ratio (0.95) and minimum number of seeds per fruit (24.47) and weight of seeds (14.94 g) were recorded with the application of N through ammonium sulphate per tree (T₂) which was statistically at par with the application of N through neem coated urea per tree (T₅) and application of N through urea per tree (T₁). While, the minimum values of these parameters like fruit weight (169.66 g), fruit volume (144.81 ml), pulp weight (77.39 g), peel weight (69.11 g), pulp percentage (45.61%), peel to pulp ratio (0.65) and maximum number of seeds (41.80) and weight of seeds (23.16 g) were noticed with the application of N through sodium nitrate per tree (T₃).

The improvement in physical quality parameters in the custard apple fruits produced from the trees receiving N in the form of ammonium sulphate and neem coated urea may be due to supply of nutrients in available form required for the photosynthetic activities at faster rate which might have resulted in

supply of carbohydrates towards the developing fruits, that might have resulted in production of better quality fruits on trees applied with this treatment. The quality improvement in terms of physical attributes of fruits with the application of 250 g N through ammonium sulphate has also been reported by Budu *et al.*, (1998) in sweet orange, Marzouk *et al.*, (2011) and Kassem (2012) in date palm and Bakshi *et al.*, (2012) in papaya. The quality improvement in terms of physical attributes of fruits with the application of 600 g N through neem coated urea has also been reported by Ram *et al.*, (1999) in guava. Neem coated urea acts as nitrogen inhibitor and results in reduced loss of nutrients from soil. Similar trend of result has been reported by Osman *et al.*, (2009) in guava. The lowest values of physical attributes of custard apple fruits produced on the trees receiving nitrogen through sodium nitrate could be the result of poor vegetative growth on account of non availability of required amount of nutrients during the fruit development stage might have produced fruits with poor quality attributes.

The maximum values of chemical quality parameters like TSS (25.08 °Brix), reducing sugars (15.16 %), non reducing sugars (2.44 %) and total sugars (17.60 %) were recorded with the application of N through ammonium sulphate per tree (T₂) which was statistically at par with the application of N through urea per tree (T₁) and the application of N through neem coated urea per tree (T₅) (Table 1–4).

Table.1 Treatment details

Treatment No.	Dose nitrogen/tree	Source of nitrogen
T ₁	250 g	Urea
T ₂	250 g	Ammonium sulphate
T ₃	250 g	Sodium nitrate
T ₄	250 g	Ammonium chloride
T ₅	250 g	Neem coated urea
T ₆	250 g	Calcium ammonium nitrate
T ₇	250 g	Calcium nitrate

Table.2 Effect of different nitrogenous fertilizers on physical fruit quality parameters of custard apple

Tr. No	Source of nitrogen	Fruit weight (g)	Fruit volume (ml)	Pulp Weight (g)	Peel weight (g)	Pulp percentage (%)	Peel to pulp ratio	No. of seeds/ fruit	Weight of seeds (g)
T ₁	Urea	211.86	176.43	100.60	95.23	47.48	0.94	28.07	16.03
T ₂	Ammonium sulphate	227.47	179.60	108.89	103.64	47.73	0.95	24.47	14.94
T ₃	Sodium nitrate	169.66	144.81	77.39	69.11	45.61	0.65	41.80	23.16
T ₄	Ammonium chloride	175.58	152.64	80.39	72.31	45.78	0.89	39.13	22.88
T ₅	Neem coated urea	207.11	169.32	98.33	91.63	47.47	0.93	30.47	17.15
T ₆	Calcium ammonium nitrate	185.09	159.32	85.60	78.07	46.24	0.91	37.93	21.42
T ₇	Calcium nitrate	196.70	165.48	92.00	85.09	46.77	0.92	35.30	19.61
	S.E. m +	9.87	7.27	3.90	4.18	0.28	0.03	1.73	1.02
	C. D. at 5 % level	30.42	22.41	12.03	12.90	0.87	0.11	5.35	3.17

Table.3 Influence of nitrogenous fertilizers on chemical quality parameters of custard apple

Tr. No	Source of nitrogen	T.S.S (°Brix)	Reducing sugar (%)	Non reducing sugar (%)	Total sugar (%)
T ₁	Urea	24.08	14.92	2.13	17.05
T ₂	Ammonium sulphate	25.08	15.16	2.44	17.60
T ₃	Sodium nitrate	16.85	10.55	1.39	11.94
T ₄	Ammonium chloride	17.95	11.08	1.61	12.69
T ₅	Neem coated urea	22.27	13.54	2.02	15.56
T ₆	Calcium ammonium nitrate	19.17	12.08	1.79	13.99
T ₇	Calcium nitrate	20.67	12.20	1.92	14.00
	S.E. m +	1.19	0.75	0.13	0.70
	C. D. at 5 % level	3.66	2.31	0.42	2.12

Table.4 Influence of nitrogenous fertilizers on physiological weight loss and shelf life of custard apple fruits

Tr. No.	Source of nitrogen	Initial weight (g)	Weight during storage (g)			Shelf life (Days)
			After 2 days	After 4 days	After 6 days	
T1	Urea	2118.6	2045 (3.47)	1975.2 (6.76)	1918.5	6.61
T2	Ammonium sulphate	2274.7	(9.44)	2204.6	(3.08) 2134.7	6.90
T3	Sodium nitrate	1696.6	(6.15) 2078.7	(8.61)	1592.4	3.20
T4	Ammonium chloride	1755.8	(6.14) 1524.2	(10.16) 1470	(13.35)	4.45
T5	Neem coated urea	2071.1	1661.3	(5.38) 1594	(9.21) 1540.6	6.23
T6	Calcium ammonium nitrate	1850.9	(12.25)	1983.6	(4.22) 1917.4	5.38
T7	Calcium nitrate	1967.0	(7.42) 1863.2	(10.03)	1755.8	5.55
	S.E. m +	---	0.03	0.03	0.03	0.08
	C. D. at 5 % level	---	0.10	0.11	0.09	0.26

Figures in paranthesis indicates the per cent loss in weight.

While, the minimum values of these parameters viz. TSS (16.85⁰Brix), reducing sugars (10.55%), non reducing sugars (1.39%) and total sugars (11.94%) were observed with the application of N through sodium nitrate per tree (T₃).

In the post harvest quality attributes, minimum per cent physiological loss in weight at 2nd, 4th and 6th days of storage (3.08, 6.15 and 8.61 % respectively) and maximum shelf life (6.90 days) of custard apple fruits at ambient storage condition was recorded in the fruits produced with the application of N through ammonium sulphate per tree (T₂), which was closely followed by the application of N through urea (T₁). While, the maximum per cent physiological loss in weight at 2nd, 4th and 6th days of storage (6.14, 10.16 and 13.35 % respectively) and minimum shelf life (3.20 days) of Custard apple fruits were noticed with the fruits obtained with the application of N through sodium nitrate per tree (T₃).

The results of the present study showed that, the quality improvement in custard apple fruits was recorded with the application of nitrogen through ammonium sulphate. This could be due to fact that, ammonium assimilation into plant metabolites requires less energy than nitrate assimilation because, ammonium does not need to be reduced. Plants may save energy by assimilating reduced nitrogen and this saved energy may be used to increase production of secondary metabolites (Elwan and Abd El- Hamed, 2011). In addition, ammonium sulphate resulted in higher fruit quality than other nitrogen sources except urea. This difference could be due to ammonium sulphate decreases the soil PH and might therefore, favour the availability and uptake of elements by the plants in slightly alkaline soils (Guelser, 2005).

The improvement in fruit quality in trees treated with ammonium sulphate may be due

to as ammonium sulphate plays major role in enhancing the enzymatic activities during fruit maturity and ripening. These results are in accordance with the findings of Mansour and Shabaan (2007) in Washington naval orange. They reported that, the fruit quality of Washington naval orange was best when trees were received the nitrogen in the form of ammonium sulphate. Hebasy (2017) also obtained superior quality of naval orange fruits with the application of 120 kg N per fed through ammonium sulphate. Similar findings are also reported by Kassem (2012) in date palm which supports the present findings. The minimum physiological weight loss and maximum shelf life in fruits obtained from trees treated with ammonium sulphate may be due to slower rate of respiration and reduced activities and retarded biochemical changes occurring in the fruits of this treatment. The above findings are similar with Haral (2015) in guava and Waghmare *et al.*, (2018) in custard apple.

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