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Effect of integrated nutrient sources on soil parameters of custard apple (*Annona squamosa* L.) Cv. Balanagar field

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Abstract
The field study was carried out at Custard apple Research Station, Ambejogai, Dist. Beed. The experiment was laid out in Randomized Block Design (RBD) with fourteen treatments and three replications. In respect of soil properties, the result indicated that, minimum soil pH (7.12) and maximum electrical conductivity (0.47), available nitrogen (160 kg ha^{-1}), available phosphorus (12.79 kg ha^{-1}) and available potassium (252.30 kg ha^{-1}) were found higher in the treatment T_2 (100% RDF + FYM + *Azotobacter* + PSB) followed by treatment T_3 (100 % RDF + FYM + *Azotobacter*) while the lowest values for these observations were recorded under control treatment (T_{14}).

Keywords: Composition, *Azotobactor*, pH, Inorganic, PSB, RBD, VAM

Introduction

Custard apple (*Annona squamosa* L.) is the most ancient dry land fruit crop in India. They are originated from tropical region of America and widely distributed throughout the tropics and subtropics. The conspicuous presence of these fruits in Ajanta Paintings and Ellora caves has been found and explicit mention of these fruits in Sanskrit literature indicated that these fruits are known in India since very old time.

Annonaceous fruits form an important part of diet of the people in the South India. It belongs to family Annonaceae and comprises of 40 genera and 120 species of which only five of them produce edible fruits. Among the annonas, custard apple (*Annona squamosa* L.) is valued more than other fruits. Other species are *Annona reticulata* L. (Ramphal), *Annona glabra* L., *Annona atemoya* Hort. (Hanumanphal) and *Annona cherimola* Mill. (Laxmanphal). The custard apple (*Annona squamosa* L.) is commonly known as 'Sitaphal' in the South India and 'Sharifa' in North India. It is best among annonaceous fruits growing under Indian condition. It exceeds all the annona in precocity, productivity and palatability. The Sitaphal is called as a 'poor man's fruit' as well as food.

The origin of different species of annona is reported to be at different regions. *Annona squamosa* L. is originated in Central America from there; it was distributed to Mexico and Tropical America (Popenoe, 1974) [13]. The annonas are distributed in the entire globe, due to their suitability to different climatic conditions. Custard apple is grown commercially in West Indies, Florida, Mexico, Brazil, Malaysia, Thailand, Philippines and Egypt. In general annonas are consumed as dessert but they also widely used in semi-processed and processed products. It is widely distributed throughout the tropics and occupies more than any other species of annona. In Maharashtra State, it is cultivated in the area of 52,695 thousand hectare (Anon., 2012) [1]. This fruit crop is mainly grown in Vidharbha, Western Maharashtra and Marathwada region. The major districts are Solapur, Pune, Nagpur, Dhule, Aurangabad, Beed etc. The custard apple prefers sandy or light soil although heavy soil with proper drainage is also good.

The fruits are medium in size (250-300 g), globular, green skin, conspicuous reticulation on fruit surface, non acidic, having good quality and sweet pulp. Edible portion or pulp of fruit is creamy, granular with good blend of sweetness and acidity which vary with the species. Fruit pulp contains proteins, fatty acids, fibre, carbohydrates, minerals and vitamins (Lizana and Reginato, 1990) [8]. The pleasant flavour and mild aroma have universal liking. The fruit contains vitamin C and minerals such as calcium, phosphorus and potassium.

Table 1: Nutritional composition of custard apple (per 100 g of Pulp)

Sr. No.	Constituents	Values
1.	Carbohydrates	20-25.2 g
2.	Protein	1.17-2.47 g
3.	Fat	0.5-0.6 g
4.	Crude fibre	0.9-6.6 g
5.	Calcium	17.6-27 mg
6.	Phosphorus	14.7-32.1 mg
7.	Iron	0.42-1.14 mg
8.	Thiamine	0.075-0.018 mg
9.	Riboflavin	0.086-0.175 mg
10.	Niacin	0.528-1.190 mg
11.	Ascorbic acid	15.0-44.4 mg

(Navaneethakrishnan and Nattar, 2011).

Custard apple has slightly granular, creamy, yellow or white, sweet pulp with good flavour and low acidity, thus it is considering the sweetest fruit of the other annonas (FAO, 1990) [3]. Fruit contains sugar 16-20 per cent and lipids 0.35 per cent of edible part of fruit (Leal, 1990) [7].

It has many health and nutritional benefits. It is a rich source of dietary fibre, which helps in digestion. It contains magnesium, which plays a vital role in relaxing muscles and protecting heart against diseases. Flesh of the fruit is used for the preparation of milk shakes and ice-cream. It can be made a delicious sauce for cake and puddings by blending the seeded flesh with mashed banana and with a little cream. The seeds of the fruits have insecticidal and abortifacient properties. Similarly, seed oil is suitable for soap making and seed cake can be used as manure (Naidu and Saetor, 1954) [9]. Custard apple has many alkaloids, such as aporohine, romerine, norocoydine, squamonine corydine, norisocroriydine, glaucine and anononaine in different parts of the plant (Kowlska and Putt, 1990) [6].

Use of biofertilizers results in reducing the inorganic fertilizer application and at the same time increasing the crop yield besides maintaining soil fertility is well recognised. In other words, biofertilizers based on renewable energy sources and are eco-friendly compared to commercial fertilizers (Verma and Bhattacharyya, 1994) [16]. An assessment of nutrient efficiency revealed that nitrogen deficiency is universal and will be continued. Nitrogen has many functions in plant life. Being as a part of protein, nitrogen is an important constituent of protoplasm. It is also responsible for the biosynthesis of enzymes, nucleoproteins, amino acids, amines, amino sugars, polypeptides, chlorophylls and encourages cell division. Phosphorus is a component of ADP, ATP, DNA and various RNA. It plays a role in photosynthesis, respiration, energy storage and transfer, cell division, cell enlargement and several other processes in the living plant. It promotes early root formation and growth. It also improves the quality of fruits. Potassium is the third important nutrient, essential for protein synthesis, in fruit formation. Potassium has a great impact on crop quality.

The custard apple gives better response to fertilizer application in respect to yield and quality of fruits. But, the low productivity of custard apple may be due to less adoption of improved crop management technology in respect of planting system, nutrition, plant protection and irrigation etc. Among several other factors affecting the productivity of fruit trees, as custard apple trees removes large amount of nutrients from soil, balance fertilization seems to be an important factor governing the productivity of custard apple trees. Large scale use of chemical fertilizers causes problem of ground water and environmental pollution through leaching, volatilization and denitrification. The disproportionate of chemical fertilizers has widened soil imbalance in terms of NPK ratio. The occurrence of multinutrient deficiencies and overall decline in productive capacity of soil has been widely reported due to non judicious fertilizer use (Chhonkar, 2008) [2].

Custard apple is very hardy to soil and agro-climatic conditions and gives good response to manuring in terms of increasing fruit production and quality of fruits. Fertilizer experiment conducted in India showed that custard apple has given good response to balance use of inorganic fertilizers along with organic manures and biofertilizers.

In recent days, consumers are becoming more and more health conscious and are ready to pay more prices for organically grown quality fruits, due to its taste, appearance, more shelf life and richness in nutritive parameters. During last few years, the demand for organically grown fruits is more as compared to fruits produced from chemical farming system. The growers also have realized the importance of the same as the cost of chemical fertilizers is increasing day by day. Hence, keeping these views in mind and to know if the quantum of inorganic fertilizers can be substituted with biofertilizers without reducing the yield and deteriorating the quality of fruits, the present investigation was carried out.

2. Material and Methods

The details of the material used and methods adopted during the course of the present investigation are described.

Table 2: Treatment details

S. No	Treat. No	Treatment details
1.	T_1	100 % RDF (250 g N, 125g P_2O_5 and 125g K_2O tree^{-1})
2.	T_2	100 % RDF + FYM + *Azotobacter* + PSB
3.	T_3	100% RDF + FYM + *Azotobacter*
4.	T_4	100 % RDF + *Azotobacter* + PSB
5.	T_5	100 % RDF + FYM + PSB
6.	T_6	75% RDF + FYM + *Azotobacter* + PSB
7.	T_7	75% RDF + FYM + *Azotobacter*
8.	T_8	75% RDF + *Azotobacter* + PSB
9.	T_9	75% RDF + FYM + PSB
10.	T_{10}	50 % RDF + FYM + *Azotobacter* + PSB
11.	T_{11}	50% RDF + FYM + *Azotobacter*
12.	T_{12}	50 % RDF + *Azotobacter* + PSB
13.	T_{13}	50 % RDF + FYM + PSB
14.	T_{14}	Control (Absolute)

FYM @ 20 Kg tree^{-1}

Azotobacter and PSB @ 80 g each tree^{-1}

Table 3: Chemical composition of organic manures and fertilizers

Organic Manures / Fertilizers	Nutrient contents		
	N (%)	P_2O_5 (%)	K_2O (%)
Urea	46	-	-
Single Super Phosphate	-	16	-
Muriate of Potash	-	-	60
Farm Yard Manure	0.75	0.20	0.50

Soil Analysis

Soil profile samples were collected from the custard apple orchard. Soil analysis was done twice, once at the start and secondly at the end of the experiment. Separate samples were taken from different horizons of the soil at the depth of 0-30, 30-60 and 60-90 cm and mixed together. The mixed soil sample were air dried, grind in mortar and pestle, passed through 2 mm sieve and used for further chemical analysis as per standard procedure given for collection and preparation of soil samples by Piper (1966) [12] and used for analysis of different parameters.

Soil Reaction

Soil pH was estimated by maintaining soil: water (1:2.5) suspension using Buckman pH meter with glass electrode (Jackson, 1973) [5].

Electrical Conductivity (dSm^{-1})

Electrical conductivity was measured in soil: water (1:2.5) suspension after settlement of solids using Toshniwal conductivity bridge (Jackson, 1973) [5].

Available nitrogen (kg ha^{-1})

It was determined with alkaline potassium permagnate method as suggested by Subbiah and Asija (1956).

Available phosphorus (kg ha^{-1})

The available phosphorus was extracted from the soil with 0.5M sodium bicarbonate as an extracting agent and determined by using double beam UV-VIS spectrophotometer with Olsens method as described by Olsen *et al.,* (1954) [11].

Available potassium (kg ha^{-1})

The available potassium in soil was extracted with Neutral Normal Ammonium Acetate as an extractant and the potassium in the extract was determined by using Flame photometer (Jackson, 1967) [4].

3. Results and Discussion

Analysis of soil samples from different treatments was done. The data regarding pH, electrical conductivity, available nitrogen, available phosphorus and available potassium were recorded and is presented in Table 4.

It is clear from the data that, different soil characters under study were significantly influenced due to different combinations of inorganic fertilizers and biofertilizers.

3.1. Soil pH

Data pertaining to soil pH indicated that minimum soil pH (7.12) was recorded in the treatment of 100% RDF + FYM + *Azotobacter* + PSB (T_2) which was statistically at par with T_3 (7.19), T_6 (7.20), T_7 (7.28) and T_{10} (7.31). The maximum soil pH (7.57) was recorded in treatment of 50% RDF + FYM + PSB (T_{13}). Reduction in soil pH was observed in all the treatments except control (T_{14}) as compared to initial value.

3.2. Electrical conductivity (dSm^{-1})

Data regarding the electrical conductivity was significantly affected by different treatments. Maximum electrical conductivity (0.47 dSm^{-1}) was recorded in the treatment of 100% RDF + FYM + *Azotobacter* + PSB (T_2) which was statistically at par with T_3 (0.45 dSm^{-1}), T_6 (0.44 dSm^{-1}), T_4 (0.43 dSm^{-1}), T_7 and T_{10} (0.42 dSm^{-1}). The lowest electrical conductivity (0.38 dSm^{-1}) was recorded in the treatment of 100% RDF-250 g N + 125 g P_2O_5 + 125 g K_2O/plant (T_1) and (T_{13}). All treatments except control (T_{14}) showed increase in electrical conductivity as compared to initial electrical conductivity.

3.3. Available nitrogen (kg ha^{-1})

From the data it is clear that the available nitrogen was significantly affected by various treatments. The maximum available nitrogen (160.00 kg ha^{-1}) was observed in the treatment of 100% RDF + FYM + *Azotobacter* + PSB (T_2) which was statistically at par with T_3 (158.00 kg ha^{-1}) and T_6 (149.10 kg ha^{-1}). The lowest available nitrogen (128.30 kg ha^{-1}) was recorded in the treatment of 50% RDF + FYM + PSB (T_{13}). Available nitrogen contents were significantly increased over initial nitrogen content except in control (T_{14}).

3.4. Available phosphorus (kg ha^{-1})

Data clearly reveals that, the available phosphorus was significantly affected by various combinations of inorganic and biofertilizers. The maximum available phosphorus (12.79 kg ha^{-1}) was observed in the treatment of 100% RDF + FYM + *Azotobacter* + PSB (T_2) which was statistically at par with the treatments T_3 (12.52 kg ha^{-1}), T_6 (12.20 kg ha^{-1}), T_4 and T_7 (12.10 kg ha^{-1}). The minimum available phosphorus (9.40 kg ha^{-1}) was recorded in 50% RDF + FYM + PSB (T_{13}). Available phosphorus contents were increased significantly over initial phosphorus content except in control (T_{14}).

Table 4: Effect of inorganic and biofertilizers on soil nutrient status.

Treat. no.	Treatments	pH	EC (dSm^{-1})	N (kg ha^{-1})	P (kg ha^{-1})	K (kg ha^{-1})
	Initial values	7.60	0.30	110.00	9.10	227.20
T_1	100 % RDF (250 g N, 125 g P_20_5 and 125 g K_20 $tree^{-1}$)	7.54	0.38	130.60	9.34	232.20
T_2	100 % RDF + FYM + *Azotobacter* + PSB	7.12	0.47	160.00	12.79	252.30
T_3	100% RDF + FYM + *Azotobacter*	7.19	0.45	158.00	12.52	248.10
T_4	100 % RDF + *Azotobacter* + PSB	7.33	0.43	146.60	12.10	245.20
T_5	100 % RDF + FYM + PSB	7.38	0.41	142.00	11.00	242.35
T_6	75% RDF + FYM + *Azotobacter* + PSB	7.20	0.44	149.10	12.20	246.70
T_7	75% RDF + FYM + *Azotobacter*	7.28	0.42	147.15	12.10	244.00
T_8	75% RDF + *Azotobacter* + PSB	7.40	0.40	140.50	10.70	240.10
T_9	75% RDF + FYM + PSB	7.44	0.39	136.00	10.20	235.00
T_{10}	50 % RDF + FYM + *Azotobacter* + PSB	7.31	0.42	144.00	11.60	245.00
T_{11}	50% RDF + FYM + *Azotobacter*	7.42	0.40	137.00	10.40	238.00

T_{12}	50 % RDF + *Azotobacter* + PSB	7.50	0.39	134.15	9.60	233.26
T_{13}	50 % RDF + FYM + PSB	7.57	0.38	128.30	9.40	230.00
T_{14}	Control	7.60	0.30	110.00	9.10	227.20
S.E.±		0.09	0.02	0.94	0.53	1.59
C.D at 5%		0.27	0.06	2.73	1.55	4.63

3.5. Available potassium (kg ha^{-1})

The data clearly showed that, available potassium was significantly affected by various treatments. The maximum available potassium (252.30 kg ha^{-1}) was observed in the treatment of 100% RDF + FYM + *Azotobacter* + PSB (T_2) which was statistically at par with T_3 (248.10 kg ha^{-1}) and T_6 (246.70 kg ha^{-1}). The minimum available potassium (230.00 kg ha^{-1}) was observed in the treatment of 50% RDF + FYM + PSB (T_{13}). Increase in potassium content was recorded due to the application of different treatments over initial potassium content except in control (T_{14}).

4. References

1. Anonymous. Custard apple Research Station, Ambejogai, Dist. Beed, 2012.
2. Chhonakar PK. Organic farming and its relevance in India. Organic Agriculture. Indian society of soil science, Jodhapur. 2008, 5-33.
3. FAO. Utilization of tropical fruits and leaves. FAO, Food and Nutrition Paper. 1990; 47(7):10-14.
4. Jackson ML. Soil chemical analysis. Prentice Hall of India Pvt. Ltd., New Delhi. 1967, 205.
5. Jackson ML. Soil chemical analysis. Prentice Hall of India Pvt. Ltd., New Delhi. 1973, 498.
6. Kowlska MT, Putt D. Potential Biomedical application for tropical fruit product, tropical garden fruit world. 1990; 1(4):126-127.
7. Leal F. Sugar apple in: fruits of tropical and subtropical origin, composition, properties and uses. Edited by S. Nagy, Shaw, P. E. and Worpowasi, W. F., Florida Science., inc. Lake, alfede Fla. 1990, 149-158.
8. Lizana LA, Reginato G. Cherimoya fruits of tropical and subtropical origin. composition, properties and uses. Florida, U. S. A, 1990, 131-138.
9. Naidu, Sactor. Fruit culture in India, I. O. A. R., New Delhi. 1954, 225-259.
10. Navaneethakrishnan K, Nattar S. Custard apple. Kisan world. 2011, 15-19.
11. Olsen SR, Cole CV, Watanabe FS, Dean LA. Estimation available phosphorus in soils by extraction with sodium bicarbonate. U.S. Department of Agriculture Circular, 1954, 939.
12. Piper CS. Soil and plant analysis. Hans Piblication Bombay, 1966.
13. Popenoe GJ. Status of annona cultural in South Florida. Prop. Florida State. Hort. Society. 1974; 87:342-344.
14. Verma LN, Bhattacharyya P. In: Production Distribution and Promotion of Biofertilizers, Fertilizers, organic manures. Recyclable Wastes and Biofertilizers. FD Co. New Delhi. 1994, 132-147.
15. Ziauddin S. Integrated nutrient management studies in Banana cv. Ardhapuri. The Asian J Hort. 2009; 4(1):126-130.