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Nitrogen management through different organic manures on growth and fruit yield of custard apple (*Annona squamosa* L.)

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Abstract

A field experiment was carried out on “Nitrogen management through different organic manures on growth and fruit yield of custard apple (*Annona squamosa* L.)” at Agroecology and Environment Centre, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola during the *Kharif* season of the year 2022-23. The experiment was laid out in Randomized Block Design with seven treatments and replicated thrice. Among different treatments application of 100% Nitrogen through vermicompost was recorded significantly highest plant height (2.36 m), plant spread (2.10 m), plant volume (10.89 m³), number of flowers plant⁻¹ (54.50), number of fruits plant⁻¹ (40.58), fruit set (74.85%), fruit diameter (7.70 cm), fruit weight (245.75 g), fruit yield (9.97 kg plant⁻¹) and fruit yield (6.23 tonnes ha⁻¹).

Keywords: Custard apple, nitrogen management, organic manure

Introduction

Custard apple (*Annona squamosa* L.) is a delicious and important minor fruit crop cultivated in tropical and subtropical climate. It comes under family Annonaceae and is native of West Indies, but also cultivated throughout Central America to Southern Mexico during early times. Young leaves of custard apple contain steroids, alkaloids, saponins, terpenes, phenolic substances, carbohydrates, mucilage and volatile oil (Kumar and Kumar, 2011) [6].

Custard apple has good pleasant flavour, mild aroma and sweet taste. It is also known as sugar apple, sharifa, sitaphal and noi-na in different parts of India. The ripened fruits are consumed mainly in its fresh form. It has been great demand in preparation of ice-cream and pudding. Due to the presence of annonaine, the leaves, stem and other portions of the plant are bitter so, the plant is not grazed by goats and cattle and also used as bio-pesticide (leaves and seed) in preparation of dashparni ark.

Moreover, the area under custard apple is increasing consistently in India. The successful commercial cultivation of custard apple depends on many factors *viz.*, climate, soil, irrigation, fertilization as well as growing season, etc. In India area under custard apple cultivation is 48,150 ha with production 418,450 Metric tonnes and in Maharashtra 15,740 hectare area with production 119,640 Metric tonnes. (Anonymous 2022) [1].

The concept behind organic agriculture is that soil as living system develop the activities of beneficial microorganism. In healthy soil, the biotic and abiotic component covering organic matter including soil life, mineral particles, soil air and water exists in stage of dynamic equilibrium and regulate ecosystem processes in natural harmony by complementing and supplementing each other (Panaliappan and Annadurai 2006) [8]. Hence efforts are to be made to boost up growth, and yield of custard apple. The present study titled nitrogen management through different organic manures on growth and fruit yield of custard apple (*Annona squamosa* L.)” has emphasized the significance of nitrogen management through organic manures.

Materials and Methods

The experiment was carried out during *Kharif* season of the year 2022-23 at field of Agroecology and Environment Centre, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola.

The experimental site is situated at subtropical zone, about 307.4 meters above mean sea level at the latitude of 22° 42' N and longitude 77° 02' E. The climate of Akola is semi-arid and characterized by three distinct seasons *viz.*, Summer being hot and dry from March to May, warm and humid monsoon from June to October and mildly cold winter from November to February. The soil of the experimental field was light to medium black colour, clayey and moderately deep, slightly alkaline in reaction, moderate in organic carbon, low in available nitrogen (168 kg ha⁻¹), medium in available phosphorus (15.19 kg ha⁻¹) while very high in available potassium (310 kg ha⁻¹).

The experiment was laid out in Randomized Block Design with seven treatments replicated three times consisting different organic sources of nutrients. Treatments include, T1 - 100% Nitrogen through vermicompost, T2-100% Nitrogen through compost, T3 - 75% Nitrogen through vermicompost + intercropping of cowpea and mulching after pod plucking + application of Jeevamrut @10% at every month, T4 - 75% Nitrogen through compost + intercropping of cowpea and mulching after pod plucking + application of Jeevamrut @10% at every month, T5 - 75% Nitrogen through vermicompost + intercropping of sunhemp green manuring at 40 days after sowing + application of Jeevamrut @10% at every month, T6 - 75% Nitrogen through compost + intercropping of sunhemp green manuring at 40 days after sowing + application of Jeevamrut @10% at every month, T7 - Absolute control.

The recommended dose of nutrients is 250: 125: 125 NPK g plant⁻¹ which is equated with organic manures, liquid manure jeevamrut and green manure sunhemp and cowpea. The nutrient contents of different organic manures were analysed at laboratory of Centre for Organic Agriculture Research and Training, Department of Agronomy, Dr. PDKV, Akola before the application of organic manures. The nutrient content in vermicompost was 1.50% N, 0.52% P and 0.84% K. The vermicompost added per plant was 16.66 kg for supply of 100% Nitrogen through vermicompost and 12.50 kg for supply of 75% Nitrogen through vermicompost. The nutrient content in compost was 1.12% N, 0.46% P and 0.80% K. The compost added per plant was 22.32 kg for supply of 100% Nitrogen through compost and 16.74 kg for supply of 75% Nitrogen through compost.

The Custard apple orchard was 9 years old planted at spacing 4 × 4 m. The plants were manured only after the pruning was done before start of experiment. Four plants were selected randomly in each treatment of respective repetition for recording data on various plant growth and yield traits *i.e.*, Plant height (m) plant⁻¹, plant spread (m) plant⁻¹ and plant volume (m³) plant⁻¹ was computed using formula suggested by Westwood *et al.*, (1963) and recorded in cubic meter. Number of flowers plant⁻¹, number of fruits plant⁻¹, fruit set (%), fruit diameter (cm), fruit weight (g), fruit yield (kg plant⁻¹), and fruit yield tonnes ha⁻¹. The data pertaining to all the characters studied were subjected to the statistical analysis by 'analysis of variance' method (Panse and Sukhatme, 1978) [9].

Results and Discussion

Growth parameters

The growth parameters of custard apple cv. Balanagar *viz.*, plant height (m), plant spread (m), and plant volume (m³) were significantly influenced by soil application of 100% Nitrogen through vermicompost. The significantly highest values of growth parameters *viz.*, plant height (2.36 m), plant spread (2.10 m), and plant volume (10.89 m³) were recorded with soil application of 100% nitrogen through vermicompost which was followed by treatment 75% Nitrogen through vermicompost + intercropping of sunhemp green manuring at 40 days after sowing + application of Jeevamrut @10% at every month for plant height, plant spread, and plant volume.

The increment in growth parameters might be due to more water holding capacity of organic manure and supply of one or more plant nutrients by vermicompost. The supply of nitrogen by vermicompost increased the nitrogen content of cell sap in the form of protein, amides and amino acids which resulted in the cell elongation and multiplication which ultimately increased the plant height, plant spread, and plant volume of the custard apple plants. Similar results were obtained by Karthikeyan *et al.*, (2006) [5], Naik *et al.*, (2021) [7], Jat *et al.*, (2021) [4].

The maximum plant spread was observed in 100% nitrogen through vermicompost might be due to the use of increased volume of vermicompost enhanced the vegetative growth of custard apple. Similar findings were reported by Gautam *et al.*, (2012) [3], Naik *et al.*, (2021) [7], Jat *et al.*, (2021) [4].

Table 1: Plant height (m) plant⁻¹, Plant spread (m) plant⁻¹, and Plant volume (m³) plant⁻¹ of custard apple as influenced by various treatments of nitrogen management through different organic manures

Treatments	Plant height (m) at 120 days after application of manures	Plant spread (m) at 120 days after application of manures	Plant volume (m ³) at 120 days after application of manures
T1: 100% Nitrogen through vermicompost	2.36	2.10	10.89
T2: 100% Nitrogen through compost	2.11	1.89	7.90
T3: 75% Nitrogen through vermicompost + intercropping of cowpea and mulching after pod plucking + application of Jeevamrut @10% at every month	2.26	1.97	9.36
T4: 75% Nitrogen through compost + intercropping of cowpea and mulching after pod plucking + application of Jeevamrut @10% at every month	2.14	1.92	8.25
T5: 75% Nitrogen through vermicompost + intercropping of sunhemp green manuring at 40 days after sowing + application of Jeevamrut @10% at every month	2.32	1.99	9.45
T6: 75% Nitrogen through compost + intercropping of sunhemp green manuring at 40 days after sowing + application of Jeevamrut @10% at every month	2.19	1.94	8.62
T7: Absolute Control	2.07	1.72	6.40
S.E.(m)±	0.01	0.009	0.009
CD at 5%	0.03	0.03	0.03

Yield contributing parameters

The yield parameters of custard apple cv. Balanagar viz., number of flowers plant⁻¹, number of fruits plant⁻¹, fruit set (%), fruit diameter (cm), fruit weight (g), fruit yield (kg plant⁻¹), fruit yield (tonnes ha⁻¹) were significantly influenced by soil application of 100% Nitrogen through vermicompost.

The significantly highest values of yield parameters viz., number of flowers plant⁻¹ (54.40), number of fruits plant⁻¹ (40.58), fruit set (74.85%), fruit diameter (7.70 cm), fruit weight (245.75 g), fruit yield (9.97 kg plant⁻¹), fruit yield (6.23 tonnes ha⁻¹) with an application of 100% Nitrogen through vermicompost. The number of flowers could be associated with the availability of

phosphorus nutrients for plants through vermicompost which play an essential role in fruit setting. The phosphorus proved to be beneficial in stimulating and enhancing bud development, blooming and fruit set. The similar results were obtained with Yadav *et al.*, (2007) [12], Baviskar *et al.*, (2011) [2], Sharma (2015) [10].

The highest fruit yield was observed in 100% nitrogen through vermicompost and it was found significantly superior over other treatments. However, lowest yield was found in treatment absolute control where manures was not applied. The similar result were obtained with Baviskar *et al.*, (2011) [2], Sharma (2015) [10].

Table 2: Yield and yield contributing characters of custard apple as influenced by various treatments of nitrogen management through different organic manures

Treatments	Yield and yield contributing characters of Custard Apple						
	Number of flowers plant ⁻¹	Number of Fruits plant ⁻¹	Fruit set (%)	Fruit diameter (cm)	Fruit weight (g)	Fruit yield (kg plant ⁻¹)	Fruit yield tonnes ha ⁻¹
T1: 100% Nitrogen through Vermicompost	54.50	40.58	74.85	7.70	245.75	9.97	6.23
T2: 100% Nitrogen through compost	45.16	26.16	64.10	7.07	169.25	4.42	2.76
T3: 75% Nitrogen through vermicompost + intercropping of cowpea and mulching after pod plucking + application of Jeevamrut @10% at every month	45.08	32.66	72.54	7.09	198.00	6.46	4.03
T4: 75% Nitrogen through compost + intercropping of cowpea and mulching after pod plucking + application of Jeevamrut @10% at every month	33.31	28.25	62.26	6.92	180	5.08	3.17
T5: 75% Nitrogen through vermicompost + intercropping of sunhemp green manuring at 40 days after sowing + application of Jeevamrut @10% at every month	46.83	34.66	74.11	7.12	234.00	8.11	5.06
T6: 75% Nitrogen through compost + intercropping of sunhemp green manuring at 40 days after sowing + application of Jeevamrut @10% at every month	43.08	30.33	69.59	6.98	180.50	5.47	3.41
T7: Absolute Control	35.50	21.33	60.53	6.74	150	3.19	1.99
S.E.(m)±	0.42	0.007	0.007	0.01	0.91	0.006	0.007
CD at 5%	1.29	0.02	0.02	0.04	2.81	0.02	0.02

Conclusion

On the basis of data generated during the course of investigation, it can be concluded that, an application of 100% Nitrogen through vermicompost recorded significantly highest growth contributing parameters and fruit yield of custard apple under organic nutrient management practices. Similarly, the results also signify the importance of balanced nutrient management in dryland fruit like Custard apple.

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