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Influence of organic inputs on yield, quality of custard apple and biological properties of soil in inceptisols

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Abstract

This study examines the influence of various organic inputs on yield, quality of custard apple (*Annona squamosa* L.) and biological properties of soil in a tropical environment. The experiment was Conducted at Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, in randomized block design with seven treatments and replicated thrice. Organic inputs viz vermicompost, compost, *sesbania* and vermiwash were applied in various combinations. Application of vermicompost significantly improved fruit yield (8.50 t/ha), total soluble solids, reducing sugars and biological activities such as CO_2 evolution, dehydrogenase and urease enzyme activities. The findings support the adoption of nutrient management through organic sources for sustainable custard apple cultivation in Inceptisols.

Keywords: Custard apple, organic inputs, vermicompost, soil biological activity

1. Introduction

Custard apple (*Annona squamosa* L.) is a delicious and nutritionally rich minor fruit crop belonging to the family Annonaceae. Originating from the West Indies, it is widely cultivated in tropical and subtropical regions of India including Maharashtra, Madhya Pradesh, Andhra Pradesh, Telangana, Odisha and others, occupying approximately 55,000 hectares. The fruit is widely consumed fresh and its pulp is also used in ice creams, beverages and medicinal formulations due to high vitamin C, potassium, thiamine and fibre content. Despite its potential, custard apple cultivation faces serious challenges in India due to poor soil fertility and limited attention to scientific nutrient management. The inherent fertility constraints affect fruit quality, yield and long-term sustainability. Modern agriculture has long relied on chemical fertilizers to enhance productivity but increasing awareness of their negative environmental impacts including soil degradation, nutrient leaching and loss of biodiversity has prompted a shift toward organic farming. Organic inputs like vermicompost, compost, green manure (*sesbania*) and vermiwash offer a sustainable alternative that can improve soil structure, microbial activity, enzymatic function and overall fertility. Organic amendments enhance microbial populations and enzyme activities, thereby increasing nutrient efficiency, disease resistance and physical properties such as porosity and water retention. Therefore, integrating organic nutrient management in custard apple cultivation, especially in Inceptisols, offers both ecological and agronomic benefits.

2. Materials and Methods

The experiment was conducted during the year 2024-2025 at the Agroecology and Environment Centre, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra (20.42° N latitude, 77.02° E longitude; elevation: 307.4 m AMSL). The region experiences a tropical climate with an average annual rainfall of 802.4 mm. The soil was classified under Inceptisol, moderately alkaline, with low organic carbon and moderate fertility. The experiment was laid out in a Randomized Block Design with 7 treatments replicated thrice. The cultivar 'Balanagar' was used during the experimentation.

Treatment Details

T_1	100% N through Vermicompost
T_2	100% N through Compost
T_3	75% N through Vermicompost + 25% N from *In-situ Sesbania*
T_4	75% N through Compost + 25% N from *In-situ Sesbania*
T_5	75% N through Vermicompost + 10% foliar spray of Vermiwash
T_6	75% N through Compost + 10% foliar spray of Vermiwash
T_7	Absolute Control

The soil of experimental plot was light and medium with uniform texture, colour and having inferior drainage. It was alkaline having less organic carbon, low available nitrogen, phosphorus and high potassium. The calcium carbonate was 9.0% and little bit prone to calcareousness. The experiment was conducted on well-established orchard of custard apple plants planted at 4.0 X 4.0 m^2. Representative soil samples were collected for knowing nutritional status prior conducting the experiment. The recommended dose of nutrients for custard apple was 500g N, 250g P and 250g K per plant. In all the treatments, organic inputs have been applied in two splits, 50% at pruning and 50% at 60 days after pruning. However, the full dose of N through *sesbania* was applied after 60 days of pruning.

3. Results and Discussion

3.1 Fruit Yield

From an economic standpoint, fruit yield is an important consideration. Both fruit weight and quantity have an impact on fruit yield per plant. Table 1 presents the fruit yield (t ha^{-1}) of custard apple, while figure 1 provides an illustration of yield data. Treatment T_1, which provides 100% of its nitrogen through vermicompost, have registered highest yield (8.50 t ha^{-1}), followed by Treatment T_2, which provides 100% nitrogen through compost. The control treatment, where any input was not applied, measured the lowest yield (3.38 t ha^{-1}). Vermicompost enhances fruit yield by improving soil health, providing essential nutrients, and promoting plant growth. It increases nutrient availability, improves soil structure, and stimulates beneficial microbial activity, leading to healthier plants and increased fruit production. Singh *et al*. (2024) [14] conducted an experiment in Custard Apple cv. "Balanagar". As a result, the treatment T_{10}, which consisted of Azospirillum (AZS) at 50 g + Vermicompost (V.C.) at 10 kg/plant was found to be significantly superior to all other treatment combinations in terms yield/plant and yield/ha.

Table 1: Influence of organic inputs on yield of Custard apple

Treat.	Treatments details	Fruit yield (t ha^{-1})
T_1	100% Nitrogen through Vermicompost	8.50
T_2	100% Nitrogen through Compost	7.65
T_3	75% Nitrogen through Vermicompost + 25% Nitrogen through *In-situ Sesbania*	7.20
T_4	75% Nitrogen through Compost + 25% Nitrogen through *In-situ Sesbania*	6.80
T_5	75% N through Vermicompost + 10% Foliar Spray of Vermiwash(At flowering and Bud initiation)	7.63
T_6	75%N through Compost + 10% Foliar Spray of Vermiwash (At flowering and Bud initiation)	7.02
T_7	Absolute Control	3.38
	SE (m)±	0.47
	CD at 5%	1.47

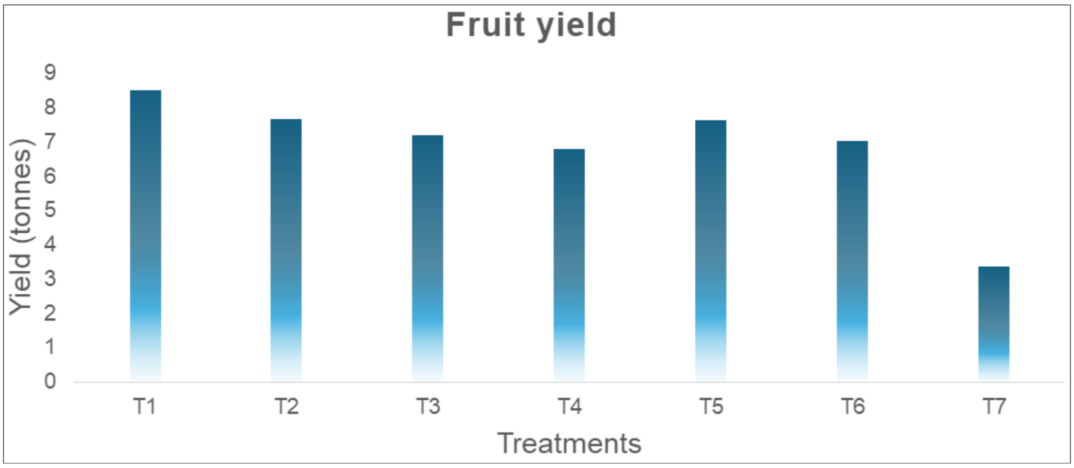

Fig 1: Influence of organic inputs on Fruit yield (t ha^{-1}) of custard apple

3.2 Fruit Quality

3.2.1 Reducing Sugar

Sugars, such as glucose and fructose, have free aldehyde or ketone groups that can be oxidized to reduce other substances, such as Fehling's solution or Tollen's reagent, known as a reducing sugar. In this investigation, the reducing sugar varied greatly throughout various nitrogen treatments. Data on reducing sugar of custard apple is presented in Table 2 and illustrated in figure 2. Treatment T_1 (100% Nitrogen through Vermicompost) has recorded the highest reducing sugar (23.67%), followed by Treatment T_2 (22.00%) where 100% Nitrogen through Compost was applied. The lowest reducing sugar (19.80%) was registered in T_7 (Absolute Control). The lower levels of reducing sugars in treatment T_3 and T_4 where nitrogen substitution by *Sesbania* green manure was made and which releases nutrients more slowly and this could be the cause of the decreased reducing sugar level. Chatterjee *et al*. (2013) [10], Sharma *et al*. (2022) [12] and Zhao *et al*. (2020) [17] reported some similar results in Tomato, Kiwifruit and 'Summer Black' Grapes.

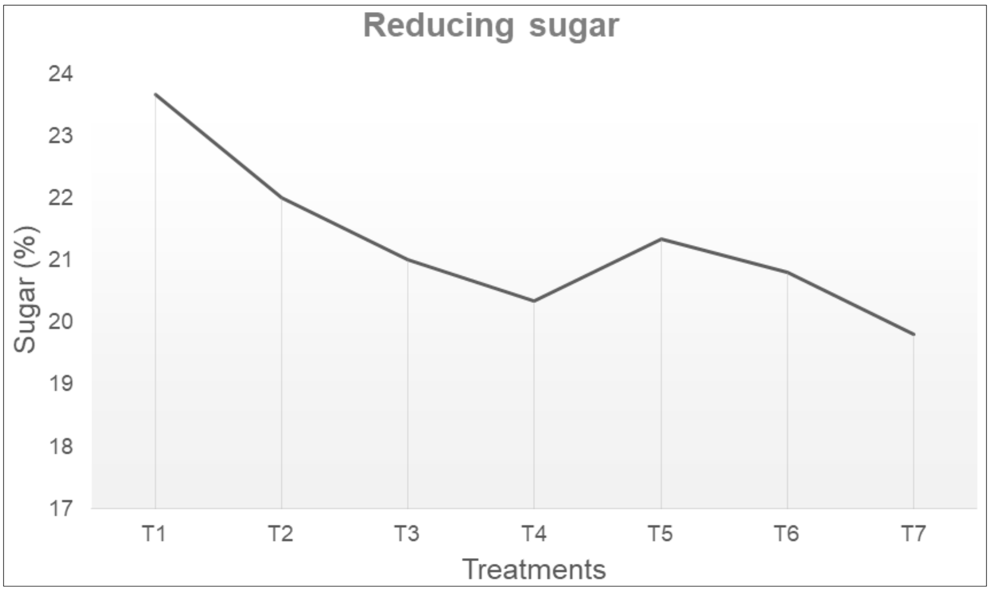

Fig 2: Influence of organic inputs on reducing sugar of custard apple

3.2.2 Non-Reducing Sugar

A carbohydrate without a free aldehyde or ketone group available for oxidation is known as a non-reducing sugar. This is an important factor in determining the quality of custard apple. In this study, the non-reducing sugar varied significantly throughout various organic inputs. Data on non-reducing sugar of custard apple is presented in Table 2 and illustrated in figure 3. The highest non-reducing sugar content (4.10%) was found in Treatment T_1 (100% Nitrogen through Vermicompost), which was followed by treatment T_2 (100% Nitrogen through Compost) i.e. 3.99%. The lowest non-reducing sugar (3.20%) was found in T_7 (Absolute Control), where external nitrogen source was not applied. Vermicompost is superior to compost in terms of improving nutrient availability and sugar synthesis, as evidenced by the slightly greater non-reducing sugar content in treated plots. Some investigations that are reported by Athani *et al*. (2005) [9], Chatterjee *et al*. (2013) [10], Zhao *et al*. (2020) [17] and Sharma *et al*. (2022) [12] shows the similar results of organic inputs on sugar content of different fruit crops.

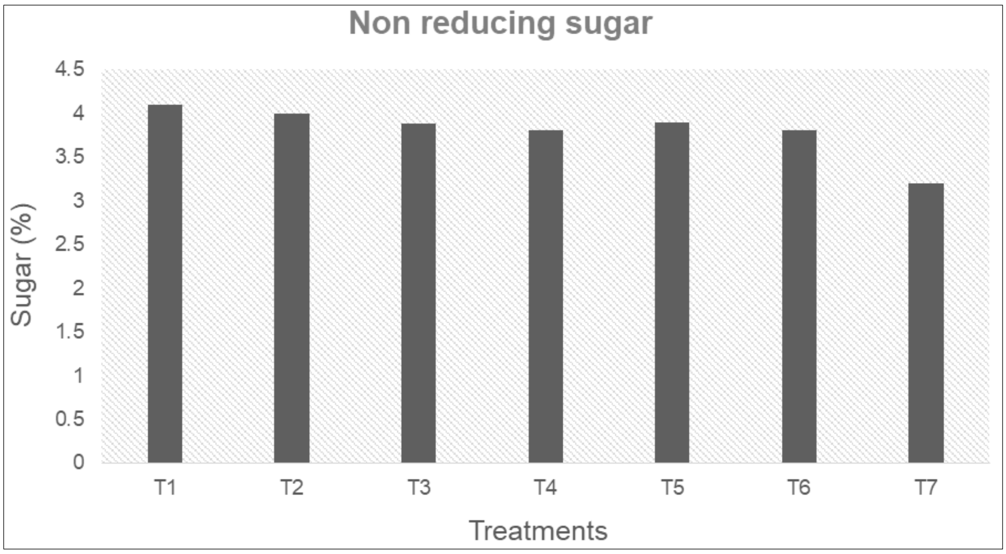

Fig 3: Influence of organic inputs on Non-reducing sugar of custard apple

3.2.3 TSS (Total Soluble Solids)

Total Soluble Solids, or TSS, is the term used to describe the number of dissolved solids in fruit juice, mainly sugars, acids and other organic materials. It is a key indicator of overall quality and sweetness as it can indicate the level of sweetness and overall taste. Data on Total soluble solid of custard apple is presented in Table 2 and illustrated in figure 4. Under various nitrogen management techniques, the total soluble solids (TSS) content varied considerably. Treatment T_1 consist of 100 percent nitrogen through vermicompost has the highest TSS (25.57 ºBrix), followed by T_2 (100% nitrogen through compost) 24.80 ºBrix. The T_7 (Absolute Control) has registered lowest (21.00 ºBrix) TSS, suggesting that the soluble solids content was significantly influenced by the nitrogen application. Increased enzymatic activities linked to sugar synthesis, improved soil microbial activity and increased nutrient availability and uptake are the reasons for the rise in TSS. The similar trend of increase in TSS of fruits was also noted by Athani *et al.* (2005) [9], Singh *et al.* (2010) [13], Chatterjee *et al.* (2013) [10], Truong *et al.* (2018) and Sharma *et al.* (2022) [12] in various fruit crops.

Table 2: Influence of organic inputs on quality parameters of custard apple

Treat.	Treatments details	Reducing sugar (%)	Non reducing sugar (%)	Total sugar (%)	Total soluble solid (ºBrix)
T_1	100% Nitrogen through Vermicompost	23.67	4.10	27.77	25.57
T_2	100% Nitrogen through Compost	22.00	3.99	25.99	24.80
T_3	75% Nitrogen through Vermicompost + 25% Nitrogen through *In-situ Sesbania*	21.00	3.88	24.88	24.30
T_4	75% Nitrogen through Compost + 25% Nitrogen through *In-situ Sesbania*	20.33	3.80	24.13	23.80
T_5	75% Nitrogen through Vermicompost + 10% Foliar Spray of Vermiwash (At flowering and Bud initiation)	21.33	3.89	25.22	23.87
T_6	75% Nitrogen through Compost + 10% Foliar Spray of Vermiwash (At flowering and Bud initiation)	20.80	3.81	24.61	23.10
T_7	Absolute Control	19.80	3.20	23.00	21.00
SE (m)±		0.71	0.07	0.73	0.59
CD at 5%		2.19	0.31	2.25	1.84

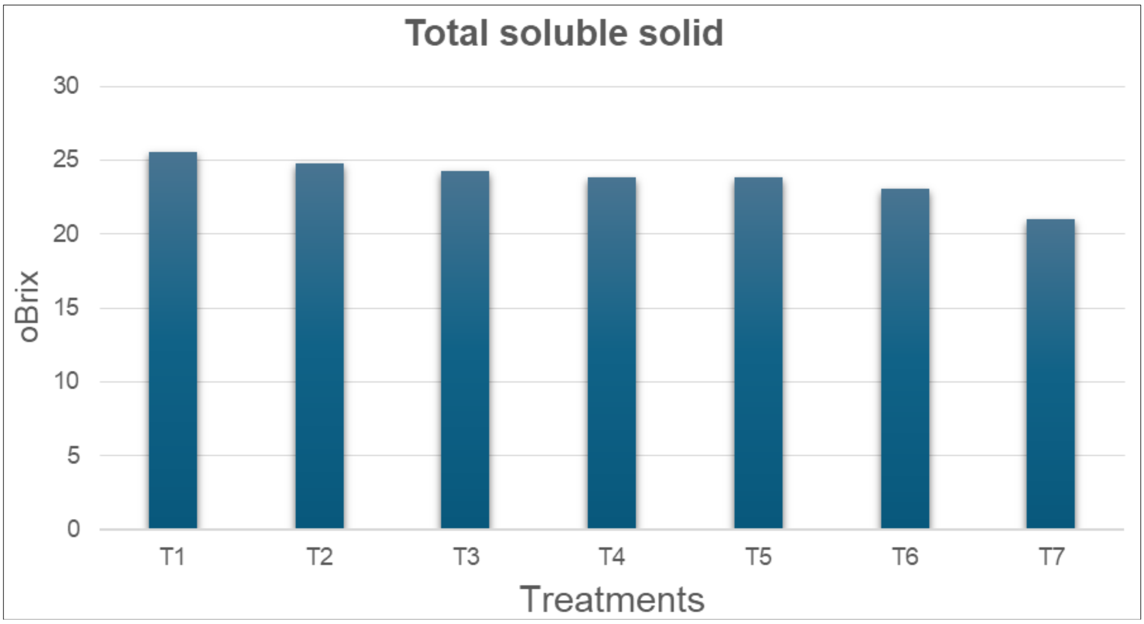

Fig 4: Influence of organic inputs on Total soluble solid of custard apple

3.3 Soil Biological Properties

3.3.1 CO_2 Evolution

The term "soil carbon dioxide (CO_2) evolution" describes how CO_2 is released into the atmosphere from the soil, mostly because of root and microbial respiration. The data on CO_2 Evolution, presented in Table 3 and illustrated in figure 5. The study shows the effect of various organic inputs on CO_2 Evolution in soil. The highest CO_2 evolution (64.23 mg 100 g^{-1} soil) was recorded in T_4 consist of 75% Nitrogen through Compost + 25% Nitrogen through *In-situ Sesbania*, followed by (63.97 mg 100 g^{-1} soil) T_3 (75% Nitrogen through Vermicompost + 25% Nitrogen through *In-situ Sesbania*). The lowest CO_2 evolution was observed in T_7 (Absolute Control). Investigation shows that changes in the soil's microbial dynamics, organic matter content and nutrient availability can have an important impact on CO_2 evolution when green manure is mixed with compost and vermicompost. Tejada *et al.* (2011) [15] both are reported that application of green manure have positive effect on CO_2 evolution.

3.3.2 Dehydrogenase activity

A sensitive indicator of soil fertility and health, dehydrogenase activity (DHA) in soil is a measurement of microbial activity. The data on dehydrogenase activity, presented in Table 3 and illustrated in figure 6. The highest dehydrogenase activity (67.68 µg TPF g^{-1} soil 24 hr^{-1}) was recorded in T_2 consist of 100% Nitrogen through Compost, closely followed by T_4 (75% Nitrogen through Compost + 25% Nitrogen through *In-situ Sesbania*) i.e. (67.60 µg TPF g^{-1} soil 24 hr^{-1}). The lowest dehydrogenase activity was observed in T_7 (Absolute Control). Dehydrogenase enzymes are good indicators of total soil biological activity and the application of compost has a significant impact on soil dehydrogenase activity (DHA), indicating increased microbial metabolic activity. Garcia-Gil *et al.* (2000) quoted that soils amended with compost can improve soil quality and soil biological properties (DHA, urease etc.).

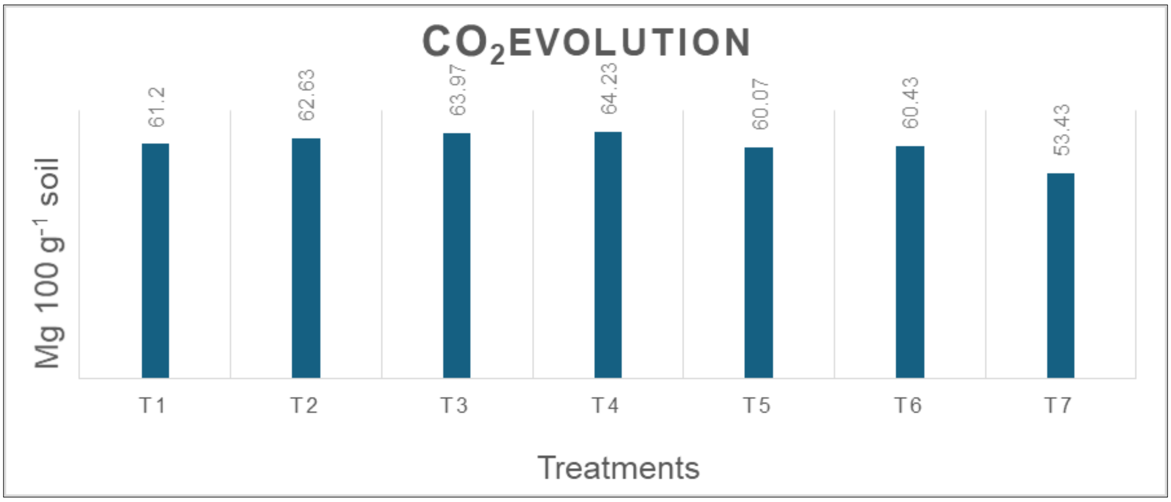

Fig 5: Influence of organic inputs on CO2 Evolution in soil

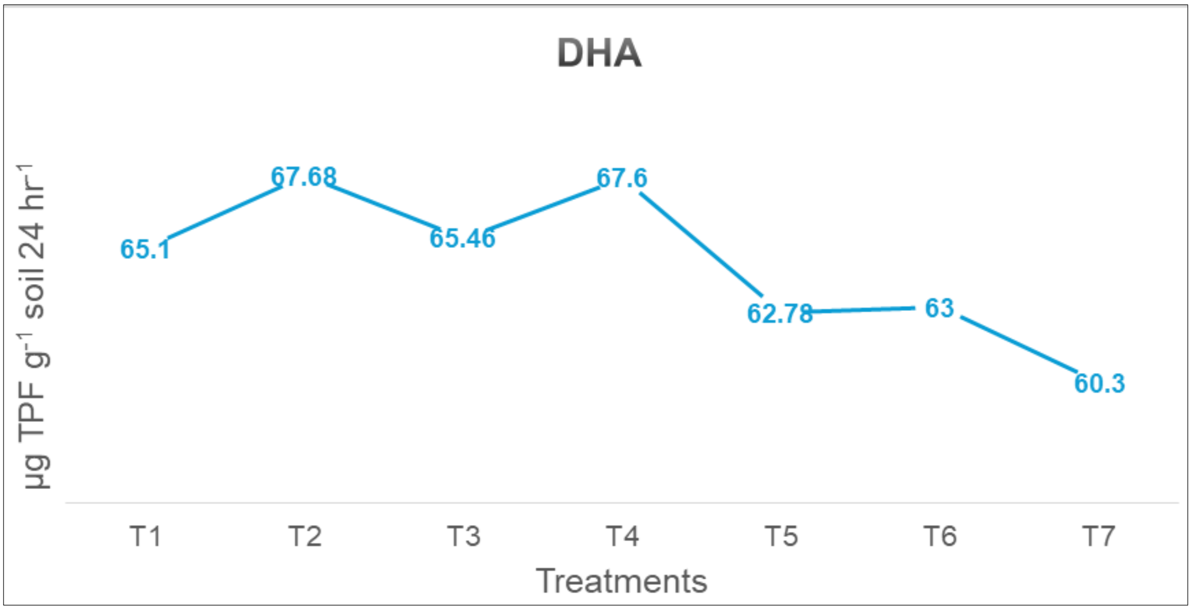

Fig 6: Influence of organic inputs on Dehydrogenase activity in soil

3.3.3 Urease activity

An essential component of the nitrogen cycle in soil is the nickel-containing enzyme urease. It facilitates the hydrolysis of urea to produce carbon dioxide and ammonia. The study shows the effect of various organic inputs on urease activity in soil. The data on urease activity, presented in Table 3 and illustrated in figure 7. The organic input having significant effect on urease activity. The highest urease activity (47.53 µg NH4-N g^{-1} soil 24 hr^{-1}) was recorded in T_1 consist of 100% Nitrogen through Vermicompost, followed (46.10 µg NH4-N g^{-1} soil 24 hr^{-1}) by T_2 (100% Nitrogen through Compost). The lowest urease activity was observed in T_7 (Absolute Control). These results shows that vermicompost and compost are the important organic inputs for improvement of soil health. Vermicompost increases urease activity in soil is by improving microbial activity and overall soil health. It is full of a variety of beneficial microorganisms, many of which either produce urease or support native urease-producing microbes. The high amount of organic matter in vermicompost provides soil microbes with energy, which promotes their growth and increases the production of enzymes. Yang *et al*. (2024) [16] conducted a study which shows that vermicompost addition improved Urease enzyme activity.

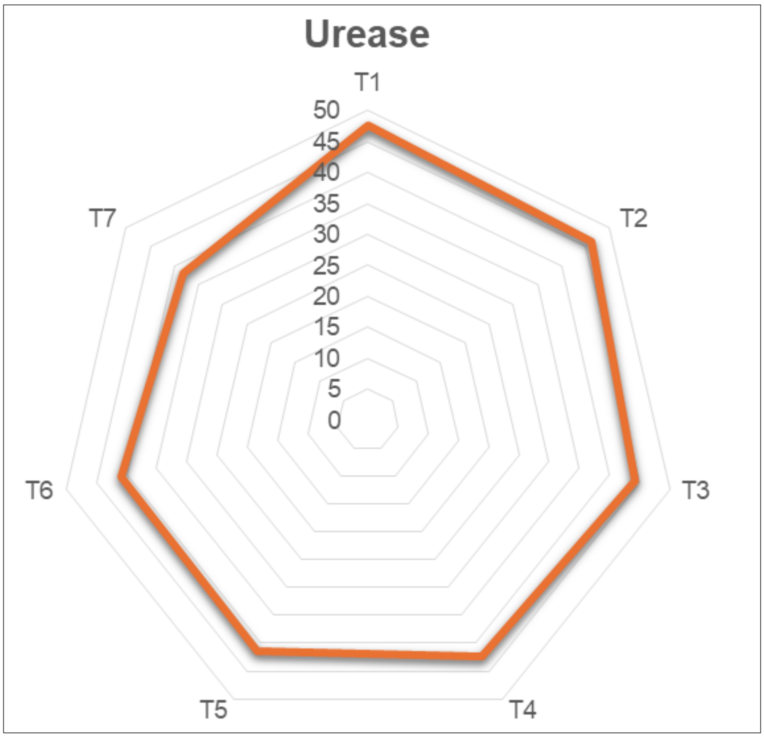

Fig 7: Influence of organic inputs on Urease activity in soil

Table 3: Influence of organic inputs on biological properties of soil

Treat.	Treatments details	CO_2 Evolution (mg 100 g^{-1} soil)	DHA (µg TPF g^{-1} soil 24 hr^{-1})	Urease (µg NH4-N g^{-1} soil 24 hr^{-1})
T_1	100% Nitrogen through Vermicompost	61.20	65.10	47.53
T_2	100% Nitrogen through Compost	62.63	67.68	46.10
T_3	75% Nitrogen through Vermicompost + 25% Nitrogen through *In-situ Sesbania*	63.97	65.46	44.20
T_4	75% Nitrogen through Compost + 25% Nitrogen through *In-situ Sesbania*	64.23	67.60	42.43
T_5	75% N through Vermicompost + 10% Foliar Spray of Vermiwash (At flowering and Bud initiation)	60.07	62.78	41.40
T_6	75%N through Compost + 10% Foliar Spray of Vermiwash (At flowering and Bud initiation)	60.43	63.00	40.80
T_7	Absolute Control	53.43	60.30	38.10
	SE (m)±	1.46	0.99	0.53
	CD at 5%	4.54	3.07	1.63

4. Conclusion
Based on the data generated during investigation, it can be concluded that the yield and fruit quality of custard apples as well as soil biological properties were significantly influenced by nutrient management through organic sources. The application of 100% nitrogen using vermicompost was significant over the other treatments in terms of fruit production and quality characteristics like sugar content and total soluble solids. In respect of biological properties viz urease, dehydrogenase, and CO_2 evolution were enhanced with the integrated application of vermicompost and compost with green manuring of sesbenia

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6. References
1. Anonymous. CMIE. Crop-wise Area Sown, Production and Yield: Custard apple. 2022. Available from: https://commodities.cmie.com/
2. Directorate of Economics and Statistics. Agriculture Statistics at a Glance 2021. Ministry of Agriculture and Farmers Welfare, Government of India; 2021.
3. Anonymous. National Horticulture Board, Ministry of Farmers and Welfare, Government of India. Statistics, Area and Production of Horticulture Crops (3rd Estimates); 2022. p. 1-3.
4. Anonymous. National Institute of Plant Health Management. Available from: https://www.niphm.gov.in
5. Anonymous. Annual Report of All India Coordinated Research Project on Arid Zone Fruits. 2008a. p. 43-4.
6. Anonymous. Annual Report of All India Coordinated Research Project on Arid Zone Fruits. 2008b. p. 45.
7. Anonymous. Annual Report of All India Coordinated Research Project on Arid Zone Fruits. 2010a. p. 43.
8. Anonymous. Annual Report of All India Coordinated Research Project on Arid Zone Fruits. 2010b. p. 80.
9. Athani SI, Ustad AI, Prabhuraj HS, Swamy GSK, Patil PB, Kotikal YK. Influence of vermi-compost on growth, fruit yield and quality of guava cv. Sardar. In: I International Guava Symposium; 2005 Dec; 735:381-5.
10. Chatterjee R, Jana JC, Paul PK. Vermicompost substitution influences shelf life and fruit quality of tomato (*Lycopersicon esculentum* Mill.). Am J Agric Sci Technol. 2013;1:69-76.
11. García-Gil JC, Plaza C, Soler-Rovira P, Polo A. Long-term effects of municipal solid waste compost application on soil enzyme activities and microbial biomass. Soil Biol Biochem. 2000;32(13):1907-13.

12. Sharma S, Rana VS, Rana N, Sharma U, Gudeta K, Alharbi K, *et al*. Effect of organic manures on growth, yield, leaf nutrient uptake and soil properties of kiwifruit (*Actinidia deliciosa* Chev.) cv. Allison. Plants. 2022;11(23):3354.
13. Singh R, Sharma RR, Singh DB. Effect of vermicompost on plant growth, fruit yield and quality of strawberries in irrigated arid region of northern plains. Indian J Hortic. 2010;67(3):318-21.
14. Singh Y, Bhatnagar P, Singh J, Sharma YK, Bisht YS, Arya CK, *et al*. The contribution of *Azospirillum brasilense* and vermicompost to improving plant growth characteristics, yield variables, physical characteristics and maintaining sustainable agriculture in custard apple cv. "Balanagar". Appl Fruit Sci. 2024;66(3):813-21.
15. Tejada M, Benítez C. Organic amendment based on vermicompost and compost: differences on soil properties and maize yield. Waste Manag Res. 2011;29(11):1185-96.
16. Yang Z, Luo Y, Chen H, Zhang Y, Wu S, Yang M, *et al*. Vermicompost addition improved soil aggregate stability, enzyme activity, and soil available nutrients. J Soil Sci Plant Nutr. 2024:1-15.
17. Zhao F, Jiang Y, He X, Liu H, Yu K. Increasing organic fertilizer and decreasing drip chemical fertilizer for two consecutive years improved the fruit quality of 'Summer Black' grapes in arid areas. HortScience. 2020;55(2):196-203.