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Comparative evaluation of organic, integrated and conventional nutrient management practices in Mango (*Mangifera indica* L.)

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Abstract
Mango is a perennial fruit crop that remains in the field for many years and continuously removes nutrients from the soil. Relying only on chemical fertilizers can lead to nutrient imbalance, declining soil health, and reduced productivity over time. Integrated Nutrient Management combines organic manures, biofertilizers, and inorganic fertilizers to provide balanced nutrition while maintaining soil fertility. Identifying efficient nutrient management practices is essential for improving nutrient use efficiency, reducing input costs, enhancing fruit quality, and maintaining soil fertility. Hence, the present investigation was carried out at Dr. YSRHU- mango Research Station, Nuzvid, Andhra Pradesh to know the effect of organic, inorganic sources of nutrients and their combination on growth and yield of mango. The experiment was conducted with six treatments in a Randomized block Design, replicated four replications. The results revealed that tree height (4.68 m), Canopy spread in East-West direction (5.23 m), South-North direction (5.29 m), Canopy volume (52.91m^3) and stem girth (57.36 cm) were found significantly highest in T_5 (50% Nitrogen through FYM) whereas minimum values (4.59 m, 4.54 m, 34.53 m^3 and 48.06 cm respectively) were recorded in T_4 (25% Nitrogen through FYM + 25% Nitrogen through Vermicompost + 50% RDF). Number of fruits /tree (108.12) was recorded significantly highest in T_4 (25% Nitrogen through FYM + 25% Nitrogen through Vermicompost + 50% RDF). Among the treatments, T_4 (25% Nitrogen through FYM + 25% Nitrogen through Vermicompost + 50% RDF) recorded significantly highest Number of fruits per tree (108.12). fruit yield (42.76 kg/tree and 5.26 t/ha) which was followed by T_3 (25% Nitrogen through vermicompost + 75% RDF) (36.51kg/tree and 4.49 t/ha) and T_2 (25% Nitrogen through FYM + 75% RDF) recorded 34.80 kg/tree and 4.28 t/ha whereas T_6 (50% Nitrogen through vermicompst) recorded lowest fruit yield of 28.30 kg/tree and 3.49 t/ha. However, B-C ratio was found highest (3.5) with 25% Nitrogen through vermicompost + 75% RDF followed by 100% RDF which was recorded B-C ratio of 3.4

Keywords: Mango, organic manures, inorganic fertilizers, INM, growth and yield

Introduction
Mango (*Mangifera indica* L.), popularly known as the "King of Fruits," is one of the most important tropical fruit crops grown in India (Radha Rani *et al* 2026) [5, 6]. Our country ranks first in mango production and contributes nearly half of the global production. Mango cultivation provides livelihood support to millions of farmers and plays a significant role in nutritional security, employment generation (Radha Rani 2026) [5, 6], and export earnings. However, sustaining high productivity and fruit quality has become increasingly challenging due to declining soil fertility, nutrient imbalances, and the excessive dependence on chemical fertilizers (Shukla *et al* 2022) [8]. Mango orchards in many parts of India are experiencing declining productivity due to nutrient depletion, low organic matter content, and imbalanced fertilizer application. Farmers often rely heavily on chemical fertilizers to achieve higher yields, resulting in increased production costs and gradual deterioration of soil health (Singh *et al*, 2001) [11]. Such practices threaten the long-term sustainability and profitability of mango cultivation.

Nutrient management is a critical component in mango production due to perennial nature of the crop and its continuous extraction of nutrients from the soil. Conventional fertilizer-based nutrient management practices have undoubtedly increased productivity; however, their prolonged and indiscriminate use has resulted in deterioration of soil physical, chemical, and biological properties. Declining soil organic carbon, reduced microbial activity, nutrient mining, and lower fertilizer use efficiency are becoming major concerns in mango orchards. Balanced nutrition is a pre requisite to get higher and quality yield without detracting soil health. This could be possible only through choice of various organic, inorganic and biological sources of nutrients, which are easy to apply (Vala *et al* 2020) [12]. Integrated Nutrient Management offers a practical solution by combining the advantages of chemical fertilizers with organic and biological nutrient sources. Organic manures improve soil structure, water-holding capacity, and microbial activity, while biofertilizers enhance nutrient availability and uptake. The integrated use of these nutrient sources can reduce dependence on synthetic fertilizers without compromising crop productivity (Gautam *et al* 2012) [2].

Despite the recognized benefits of INM, location-specific information on optimum combinations of organic and inorganic sources for mango is limited. Variations in soil type, climatic conditions, orchard age, and management practices necessitate systematic evaluation of INM strategies under local agro-climatic conditions. Identifying efficient nutrient management practices is essential for improving nutrient use efficiency, reducing input costs, enhancing fruit quality, and maintaining soil fertility. Hence, the present investigation was carried out to know the effect of organic, inorganic sources of nutrients and combination of both on growth and yield of mango under coastal region of Andhra Pradesh.

Materials and Methods

The experiment was conducted at Mango Research Station, Nuzvid, Dr.YSR Horticultural University, Andhra Pradesh during 2023 to 2025. The experimental site was geographically situated at 16° 46' 48'' N latitude and 80° 50' 59''E longitude. The orchard soil type is red loamy soil. The experiment was laid out in Randomized Block Design (RBD) with four replications consisting of six treatments. The treatment details were presented in Table 1. Need based plant protection measures and other cultural practices like irrigation, weeding etc. were taken uniformly in all treatments. Nitrogen, Phosphorus and Potassium nutrients were given through Urea, Single Super phosphate and Muriate of Potash respectively under inorganic sources of nutrients. All the treatments were imposed in 2 split doses as first dose applied during rainy season (July) and second dose at marble stage of fruit (February). The experiment was done on Baneshan variety of mango which is a commercial variety in Andhra Pradesh. The data was recorded on the growth and yield parameters and were statistically analysed as per the method suggested by Panse and Sukhatme, (1985) [4]. The fruit length and width were measured by digital vernier callipers and expressed in centimetres (cm). The relative economics were estimated in each treatment considering the cost of fertilizers, manures, chemicals for plant protection, labour cost for irrigation, weeding, sprayings etc. Based on the marketable quality of the produce in different treatments during the study period and market rate fluctuations, the gross income was calculated. The cost of production per each treatment varied due to variation in the input cost, hence, the net income was calculated by deducting the cost of production from gross returns under each treatment. Accordingly, the Benefit-Cost ratio was calculated.

Table 1: Treatment details of the experiment

T_1	**100% RDF (Recommended Dose Fertilizers) as chemical fertilizers**
T_2	25% Nitrogen through FYM + 75% RDF
T_3	25% Nitrogen through vermicompost + 75% RDF
T_4	25% Nitrogen through FYM + 25% Nitrogen through Vermicompost + 50% RDF
T_5	50% Nitrogen through FYM
T_6	50% Nitrogen through vermicompost

Results and Discussion

The results pertaining to growth and yield parameters were presented in Table 2 & 3 respectively.

Table 2: Effect of organic, integrated and conventional nutrient management on growth parameters of mango

Treatments	Tree height (m)	Canopy spread E-W(m)	Canopy spreadN-S(m)	Canopy volume (m^3)	Stem girth (cm)
T_1	4.53	4.87	5.04	45.30	52.74
T_2	4.51	4.76	5.00	43.51	50.77
T_3	4.56	4.76	4.78	40.89	52.65
T_4	4.12	4.59	4.54	34.53	48.06
T_5	4.68	5.23	5.29	52.91	57.36
T_6	4.39	4.87	4.95	42.04	54.52
CD (0.05P)	0.19	0.20	0.31	4.66	2.95
SEM±	0.06	0.07	0.10	1.53	0.97
CV%	2.80	2.78	4.16	7.09	3.68

The results from the Table 2 indicated that among the treatments, T_5 (50% Nitrogen through FYM) recorded significantly maximum tree height (4.68m) and this was on par with T_3 i.e. 25% Nitrogen through vermicompost + 75% RDF (4.56 m), T_1 (100% RDF) has recorded 4.53 m and T_2 (25% Nitrogen through FYM + 75% RDF) (4.51 m) while minimum height was recorded in T_6 (50% Nitrogen through vermicompost) i.e. 4.39 m. Canopy spread in East-West direction (5.23 m), South-North direction (5.29 m), Canopy volume (52.91m^3) and stem girth (57.36 cm) were found significantly highest in T_5 (50% Nitrogen through FYM) whereas minimum values (4.59 m, 4.54 m, 34.53 m^3 and 48.06 cm respectively) were recorded in T_4 (25% Nitrogen through FYM + 25% Nitrogen through Vermicompost + 50% RDF). The maximum vegetative growth parameters of mango may be due to increased photosynthetic rate and carbohydrate accumulation as a result of application of FYM to allow most favourable conditions of the soil with increased availability of plant nutrients responsible for better plant growth. The results were in accordance with the findings of Singh *et al* (2017) [9]. Gautam *et al* (2012) [2] reported that application of 500:250:250g N:P:K/tree + 50kg FYM + 10kg Vermicompost registered maximum plant height, canopy height, plant spread (N-S and E-W) and tree volume compared to the Control 500:250:250g N:P:K/tree in mango cv. Sunderja.

Table 3: Effect of organic, integrated and conventional nutrient management on yield parameters of mango

Treatments	Ave. No. of fruit/tree	Ave. fruit weight (g)	Fruit length (cm)	Fruit Width(cm)	Fruit yield/tree(kg)	Yield/ha(t)	B-C Ratio
T_1	87.10	337.57	13.21	12.39	29.48	3.64	3.4
T_2	94.51	363.92	14.09	12.96	34.80	4.28	2.7
T_3	91.92	380.44	13.97	12.99	36.51	4.49	3.5
T_4	108.12	392.41	14.19	12.76	42.76	5.26	2.3
T_5	75.89	382.51	14.32	12.89	29.12	3.58	1.4
T_6	72.60	385.61	14.11	12.63	28.30	3.49	1.7
CD (0.05P)	12.39	NS	NS	NS	8.92	1.10	-
Sem±	4.07	17.38	0.24	0.15	2.93	0.36	-
CV%	9.22	9.30	3.52	2.42	17.50	17.57	-

Results from Table 3 revealed that number of fruits /tree (108.12) was recorded significantly highest in T_4 (25% Nitrogen through FYM + 25% Nitrogen through Vermicompost + 50% RDF) followed by T_2 i.e. 25% Nitrogen through FYM + 75% RDF (94.51) while lowest (72.60) was recorded in T_6 (50% Nitrogen through vermicompst). Average fruit weight, fruit length and fruit width were found non-significant results among the treatments. Regarding fruit yield, T_4 (25% Nitrogen through FYM + 25% Nitrogen through Vermicompost + 50% RDF) recorded significantly highest fruit yield (42.76 kg/tree and 5.26 t/ha) which was followed by T_3 (25% Nitrogen through vermicompost + 75% RDF) (36.51kg/tree and 4.49 t/ha) and T_2 (25% Nitrogen through FYM + 75% RDF) recorded 34.80 kg/tree and 4.28 t/ha whereas T_6 (50% Nitrogen through vermicompst) recorded lowest fruit yield of 28.30 kg/tree and 3.49 t/ha. The combination of organic and inorganic fertilizers synergistically increased the levels of endogenous hormones, such as GA_3 and auxins in plant cells. This increase may enhance pollen germination and tube elongation, ultimately leading to a higher fruit set and a greater number of fruits per tree (Bhat *et al*., 2017) [1]. Higher nutrient levels near the plant's root zone promote dry matter synthesis, resulting in more fruits per plant and, consequently, higher fruit yield (kg/plant). These findings align with the results reported by Kumar *et al* 2025 [3], Singh *et al*. (2015) [10] and Sau *et al*. (2017) [7] in mango. However, Benefit-Cost ratio was found highest (3.5) in T_3 (25% Nitrogen through vermicompost + 75% RDF) followed by T_1 (100% RDF) recorded B-C ratio of 3.4 while T_5 (50% Nitrogen through FYM) recorded lowest B-C ratio of 1.4.

Conclusion

The results revealed that growth parameters like tree height, canopy spread, canopy volume and stem girth were highest with 50% Nitrogen of recommended dose applied through FYM while number of fruits and fruit yield per tree were found highest with 25% Nitrogen through FYM + 25% Nitrogen through Vermicompost + 50% RDF followed by 25% Nitrogen through FYM + 75% Recommended Dose of Fertilizers. However, B-C ratio was found highest (3.5) with 25% Nitrogen through vermicompost + 75% RDF followed by 100% RDF which was recorded B-C ratio of 3.4

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