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Demonstration of Integrated Nutrient Management Practices on Yield, Yield Attributes and Economics of Pomegranate (cv. Bhagwa) in Arid Zone of Andhra Pradesh

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Integrated Nutrient Management (INM) demonstrations on pomegranate were conducted in 20 farmer fields in Krishi Vigyan Kendra, Kalyandurg-operated mandals of Ananthapur district in Andhra Pradesh state during 2022-23 and 2023-24. The aim was to demonstrate the influence of INM practice on enhancing yield attributing features, yield and economics in farmer fields. According to the data, INM practice resulted in a larger number of flowers/plants, fruits/plant, fruit setting percentage, average fruit weight and yield/plant than farmer's practice, who used chemical nutrient management alone. The demonstration of INM practice resulted in 11.56% and 10.52% higher fruit output than farmers' practices in 2022-23 and 2023-24, respectively. The enhanced

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yield in INM practice can be attributed to more fruits per plant and heavier fruit weight. INM approaches also provided a greater economic advantage, and their adoption resulted in a better benefit-cost ratio (5.87) than farmers' use of inorganic nutrient management (5.40). From the findings It can be concluded that, under current circumstances, adopting INM practices in pomegranate cultivation could result in a higher economic benefit than farmers' practices, encouraging more farmers to adopt INM practices not only in pomegranate but also in other major fruit crops in Ananthapur district of Andhra Pradesh.

Keywords: Soil nutrient; nutrient management; horticultural crop; integrated nutrient management practices.

1. INTRODUCTION

Pomegranate, scientifically known as *Punica granatum* L., is a fruit that belongs to the Lythraceae family. It is highly valued and considered as "Fruit of Paradise." It is significant in tropical and sub-tropical regions and can thrive well even in harsh climatic conditions. Pomegranate is known for its high sugar content of 12-16% and acid content of 1.5-2.5%. It contains numerous beneficial compounds such as ellagic acid, catechin, procyanidins, fatty acids, triglycerides, sterols, terpenoids, and flavanols. The medicinal properties of pomegranate are found in its rind, seeds and pulp. It is primarily cultivated for its refreshing juice, which is rich in tannins, anthocyanin, polyphenols and antioxidants A, E, and C. These components play a crucial role in maintaining heart health, blood vessel function and proper blood circulation. The juice punicalagin content helps to reduce blood clotting and lowers blood pressure. Additionally, pomegranate consumption has been associated with a reduced risk of various health conditions, including arthritis, Alzheimer's disease, cancer, piles, fistulas, stomach pain, dysentery, diarrhoea and constipation. The fruit's rind, containing approximately 30% tannin, can also be utilized for leather tanning purposes [1,2]. India ranks seventh in production of pomegranate in the world and the total area under cultivation is around 2,75,500 hectares. In India, the major pomegranate producing states are Maharashtra, Gujarat, Karnataka, Rajasthan and Andhra Pradesh [3]. Because of its high antioxidant content and super fruit characteristics, pomegranate cv '*Bhagwa*' has substantial demand in the overseas markets. Among the various factors which contribute towards the growth, yield and quality of pomegranate, nutrition is the most important and it has direct effect on production and quality [4]. In the past, soil fertility for pomegranate production was not a major concern because the soil naturally met the needs. The primary goal was to increase crop production. However, over time, there has been a movement towards prioritizing the cultivation of high-quality fruits over just expanding production. This trend is particularly visible in the case of pomegranate, which is recognized worldwide as a crop that adds to foreign exchange revenues [5].

Ananthapur district in Andhra Pradesh is located in the hot arid zone of India, characterized by low and unpredictable rainfall, extreme temperatures, low humidity, high wind velocity and high evapotranspiration. The region also faces challenges of nutrient-deficient soils, water scarcity and recurring droughts. Ananthapur receives an annual rainfall of 550 mm with a coefficient of variation ranging from 30 to 80%. To maximize horticultural crop production, proper nutrient management is crucial, including the effective use of nutrients through appropriate dosages, placement and timing to maintain optimal soil nutrient levels while considering the economy, energy and environment. Due to the high cost of inputs such as fertilizers and manures, efficient nutrient management is crucial for increasing fruit and vegetable production, as well as ensuring sustainable fruit production and protecting the environment from hazards caused by the misuse of expensive fertilizers [6]. To fulfill the nutrient requirements of crops and improve soil health, a combination of inorganic, organic and biological sources should be used [7,8]. Integrated nutrient management practices will not only enhance crop productivity but also enrich the soil's biota [9]. In view of this, present study on "Demonstration of integrated nutrient management practices on Yield Attributes, Yield and economics of pomegranate (cv. Bhagwa) under arid zone of Andhra Pradesh" has been carried out.

2. MATERIALS AND METHODS

The study was conducted at Krishi Vigyan Kendra (KVK) Kalyandurg in Anantapur district of

Andhra Pradesh state in farmers' fields during 2022-23 and 2023-24. Ten Front Line Demonstrations (FLDs) conducted in farmer's field of Dasampalli and Boyalpalli villages of KVK operational area. The soils were red sandy loam soils with medium fertility levels, uniformly aged plants spaced at 4.5 m x3.0 m were selected during *Hasta* bahar crop (September-October) of 2022 &2023. The plant is pruned properly and irrigation water is stopped at least 2 months before flowering. After the stress period, land digging is done in shallow and 5% urea is sprayed so that leaves fall down. Recommended doses of manures and fertilizers as per treatments (625g N, 250g P_2O_5 and 250g K_2O per plant) were applied and light irrigation (8-12 litres/plant) was given to crop. Three to four days later, normal irrigation (16-20 litres/plant) is given at regular intervals. In INM demonstration plots - 25 kg FYM, 2 kg Neem cake, 800g $MgSO_4$ & 250g P_2O_5 before first irrigation; 625g N and 250g K_2O per plant were applied in three equal split doses at just before first irrigation, fruit setting stage and at fruit development stages. Azotobacter, PSB, KMB each @ 15g per plant were applied at before first irrigation. Foliar application of $ZnSO_4$ @ 5 g/lit, $FeSO_4$ @2.5 g/lit and Boron@2 g/lit were sprayed at new flush emergence stage and fruit setting stage. Farmers practice includes application of 625g N, 250g P_2O_5 and 250g K_2O per plant in two splits, one at before first irrigation and the 2nd at fruit development stage. Data on No of flowers/Plant, No of fruits/Plant and fruit set (%) were recorded after 40 days of first irrigation. Data on yield attributes like Fruit Weight (g), Yield /Plant (Kg) and yield were recorded at the time of harvest. Tree responds readily and produces new flush; flower initiation starts at September-October months and harvesting was done at February-April months. The analysis of yield data was done using Microsoft Excel 2021 version.

3. RESULTS AND DISCUSSION

3.1 Yield Attributes and Yield

The data on flower, fruit and yield characters presented in Table 1 showed that higher number of flowers, fruits and higher fruit setting (%), fruit weight and yield/plant from the INM practices during both the years as well as on pooled data. The pooled data analysis result showed that, INM practices recorded (62 fruits) 3.34% more fruits than farmers practice (60 fruits). INM practices showed much influence in increasing fruit setting percentage (78.54%), average fruit weight (258.13g) and average yield/plant (16.0 kg) over the framers practice (Table 1). The average fruit weight is one of the important yield contributing parameter of pomegranate which ultimately determines the total yield of the crop. The increase in fruit number and fruit weight has resulted in increase in yield/plant of tree. The INM practices in pomegranate have recorded 6.45% and 9.7% higher average yield per plant over farmers practice in the year 2022-23 and 2023-24, respectively. Similar results of improvement of yield attributing characters due to adoption of INM practice was also reported by Gajbhiye *et al.* [10] and kumar *et al.* [11]. INM practice showed significant effect on yield of pomegranate during both the years. The fruit yield was significantly increased in INM practice due to application of inorganic fertilizers along with organic inputs and biofertilizers in the year 2022-23 and 2023-24 over that of the farmer's practice of crop having only chemical fertilization (Table 2). Pooled analysis over 2 years data also confirmed the superiority of the INM treatment over the farmers practice with regard to the pomegranate productivity. The pomegranate yield recorded under INM treatment was 11.38 t/ha in 2022-23, 18.9 t/ha in 2023-24 and 15.14 t/ha when pooled over the years. This was about 11.56% higher in 2022-23 and 10.52% higher in 2023-24 over farmers practice. The increase in yield in INM practice can be attributable to more fruits per plant and increased fruit weight. From the pooled data INM produced 10.67% additional yield as compared to farmers practice of inorganic nutrient management. The results clearly showed the need of integrated use of inorganic source of nutrients along organic sources for greater biomass production that ultimately helped in increasing the pomegranate productivity. Kumari *et al.* [12] and Gajbhiye *et al.* [10] also reported wide differences in yield and fruit quality among the different INM practices in pomegranate.

3.2 Economics

Economic indicators *i.e.* cost of cultivation, gross returns, net returns and B:C ratio of demonstrated INM practices were presented in Table 3. The cost of cultivation was higher in INM practice over the farmers practice during both the years and on mean data. Farmers adopting INM practices (Rs. 2,57,875/-) recorded 13.3% additional cost than farmers practice over the pooled data (Rs.2,27,550/-). Year-to-year variability in cultivation costs can be explained by differences in the local social and economic

Table 1. Yield attributes of pomegranate as influenced by INM practices

Parameter	2022-23		2023-24		Pooled	
	INM	Farmers Practice	INM	Farmers Practice	INM	Farmers Practice
No of flowers/Plant	74.12	73.05	84.12	83.05	79.12	78.05
No of fruits/Plant	57.22	55.46	67.22	65.46	62.22	60.46
Fruit set (%)	77.19	75.92	79.9	78.8	78.545	77.36
Fruit Weight (g)	253.63	245.85	262.63	245.85	258.13	245.85
Yield /Plant (Kg)	14.52	13.64	17.65	16.09	16.085	14.865

Table 2. Yield of pomegranate as influenced by INM practices

Year	Demonstrations	Mean Yield (t/ha)	Stranded Deviation	t-value	p-value
2022-23	INM	11.38	0.72	2.97**	0.008
	Farmers Practice	10.20	0.84		
2023-24	INM	18.9	1.03	3.94**	0.000
	Farmers Practice	17.16	0.92		
Pooled	INM	15.14	0.811	3.55**	0.002
	Farmers Practice	13.68	0.87		

Table 3. Economics of pomegranate production as influenced by INM practices

Economic Parameter	2022-23		2023-24		Pooled	
	INM	Farmers Practice	INM	Farmers Practice	INM	Farmers Practice
Cost of Cultivation (Rs)	220350	201600	295400	253500	257875	227550
Gross Returns (Rs)	1138100	918250	1890000	1539000	1514050	1228625
Net Returns (Rs)	917750	716650	1594600	1285500	1256175	1001075
B:C Ratio	5.16	4.55	6.39	6.07	5.87	5.40

conditions. The higher cost of production in INM practice might be due to the fact that chemical fertilisers contain more nutrients per unit weight of product than organic fertiliser. To reach the same soil nutrient levels as a unit weight of chemical fertiliser, many units of organic fertiliser are necessary, making the use of organic inputs more expensive than inorganic. Similar observation of higher cost of production by use of organic inputs was also observed by Mondal *et al.* [7] and Mallikarjun *et al.* [13]. The gross return calculated was presented in the Table 3 and it was noticed that INM practice registered higher gross returns during the second year as compared to first year, which might be attributed due to high yield during second year of study. The average gross returns from the pooled data recorded was Rs. 15,14,050/ha as compared to Rs. 12,28,625 in farmers practice. The IINM practice registered an increase of 23.23 % gross returns over farmers practice. The pooled data on net returns also showed the superiority of INM practices over farmers practice. It was also noticed that net returns recorded under INM practices (Rs.12,56,175/-) was 25.4% higher than farmers practice (Rs.10,01,075/-). Economic analysis of the yield performance revealed that benefit cost ratio of demonstration plots was observed to be higher than control plot i.e., farmer practice. The effect of organic nutrient applied in INM practice, revealed an average benefit cost ratio of 5.87 in demonstrated INM plots compared to 5.40 in farmers plots. Similar outcomes of increased economic benefit by adopting INM practices was also reported by Mondal et al. [7] and Kumar *et al.* [14].

4. CONCLUSION

From the findings of the study, the performance of pomegranate under INM practice demonstrated a greater disparity in yield attributes and yield than farmer practice. Pomegranate yield improvement with INM was achieved by the combined effects of inorganic and organic nutrient sources that worked systematically to deliver nutrients throughout the

crop growth period, boosting production, increasing input usage efficiency and economic gain. It can be concluded that, under current circumstances, adopting INM practices in pomegranate cultivation could result in a higher economic benefit than farmers' practices, encouraging more farmers to adopt INM practices not only in pomegranate but also in other major fruit crops in Ananthapur district of Andhra Pradesh.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Meena CL, Meena RK, Sarolia DK, Dashora LK, Singh D. Effect of integrated nutrient management on fruit quality of pomegranate cv. Ganesh. Journal of Agriculture and Ecology. 2018;15(5): 67-75.
2. Kirankumar KH, Shivakumara BS, Madaiah D, Sarvjna BS. Effect of integrated nutrient management on economics of pomegranate cv. Bhagwa under central dry zone of Karnataka. The Pharma Innovation Journal. 2022; SP-11(6): 1616-1619.
3. APEDA (Agricultural and Processed Food Products Export Development Authority) APEDA facilitates export of first trial shipment of fresh pomegranate to USA via air. 2023.

   Available:https://www.pib.gov.in/PressReleasePage.aspx?PRID=1946623]
4. Kumar KH, Shivakumara BS, Salimath SB, Maheshgowda BM. Effect of integrated nutrient management on growth and yield parameters of pomegranate cv. Bhagwa under Central Dry Zone of Karnataka. International Journal of Current Microbiology and Applied Sciences. 2019;8(2):1340-1344.
5. Maity A, Kashyap P. Integrated Nutrient Management for Sustainable Pomegranate Production.In: Roy SS, Kashyap P and Tarun A editors. Natural Resource Management in Horticultural Crops. 2022:31-47
6. Sharma BD, Jatav MK, Balai RC, Meena A. Integrated nutrient management for horticultural crops in arid region. In Dryland Horticulture. 2021;25:29-61.
7. Mondal S, Mallikarjun M, Ghosh M, Ghosh DC, Timsina J. Effect of integrated nutrient management on growth and productivity of hybrid rice. Journal of Agriculture Science and Technology. 2015: 297-308.
8. Mondal S, Mallikarjun M, Ghosh M, Ghosh DC, Timsina J. Influence of integrated nutrient management (INM) on nutrient use efficiency, soil fertility and productivity of hybrid rice. Archives of Agronomy and Soil Science. 2016;62(11): 1521-1529.
9. Mallikarjun M, Maity SK. Effect of integrated nutrient management on soil biological properties in kharif rice. International Journal of Current Microbiology and Applied Sciences. 2018; 7 (11):1531-1537.
10. Gajbhiye BR, Gourkhede PH, Kachave TR. Yield, Quality, Disease Resistance and Plant Nutrition of Pomegranate (*Punica Granatum* L.) Influenced by Integrated Nutrient Management. Agricultural Mechanization in Asia. 2022; 53:(06).
11. kumar KH, Shivakumara BS, Suresha DE, Madaiah D, Sarvjna BS. Effect of integrated nutrient management on quality and biochemical parameters of pomegranate cv. Bhagwa under central dry zone of Karnataka. International Journal of Chemical Studies. 2018;6(1): 05-06.
12. Kumari S, Baloda S, Mor R, JAKHAR S, JAT M, KUMAR S. Response of nutrient supplementation through INM on yield and quality parameters of pomegranate (*Punica granatum*). The Indian Journal of Agricultural Sciences. 2023;93(10):1091-1096.
13. Mallikarjun M, Kumari CR, Sireesha E, Naik KB, Yugandhar V, Harini M. Effect of organic, natural and inorganic farming practices on growth, yield and economics of paddy. International Journal of Research in Agronomy. 2024; 7(3): 572-575
14. Kumar A, Sharma DD, Sharma DP, Shylla B, Singh U, Verma P, Mushtaq M, Parihar NS, Wani OA, Casini R, Almutairi KF. Integrated Nutrient Management as a Low Cost and

Eco-Friendly Strategy for Sustainable Fruit Production in Apricot (*Prunus armeniaca* L.). International Journal of Fruit Science. 2024;24(1):18-32.

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