

Assessment of Integrated Crop Management for Enhancing Mango Yield through Front Line demonstrations in Sangareddy District, Telangana.

Abstract

The study assessed the impact of Integrated Crop Management (ICM) practices on mango yield and profitability through frontline demonstrations conducted in Sangareddy district, Telangana, during 2020–2021 and 2021–2022. The findings revealed a total yield gap of 63.5% between potential and actual mango yields, comprising a 27.75% gap between demonstration plots and farmers practice plots and a 35.8% technological gap. High adoption rates were recorded for key practices, such as water management during flowering and fruiting (93.3%), harvesting methods (90.0%), the recommended dose of inorganic fertilizers (83.3%), cultivating legumes as intercrops (80.0%) and applying the recommended amount of farmyard manure (76.6%). Additionally, adoption rates for mango-specific sprays (70.0%) and growth regulator sprays (40.0%) increased significantly following the demonstrations.

The demonstration showed a 43.0% increase in mango yield, with demonstration plots outperforming traditional practices in both productivity and profitability. Economic analysis showed higher net returns and benefit-cost (B:C) ratios in the demonstration plots compared to farmers conventional practices. These results underscore the positive impact of ICM practices on mango productivity and profitability, emphasizing the need for adopting improved technologies to promote sustainable mango cultivation.

Introduction:

Mango (*Mangifera indica* L.), a member of the family Anacardiaceae, is commercially cultivated in over 80 countries, India leads global mango production and is popularly known as the "king of fruits" due to its rich nutritional value, delectable taste, appealing aroma, and health benefits (Banarjee, 2011). Major mango-producing states in India include Andhra Pradesh, Uttar Pradesh, Karnataka, Bihar, Gujarat, and Tamil Nadu, contributing about 46% of the global mango cultivation area and 40% of total production (Palanivel *et al.*, 2015). In India during 2022-23, Mango acreage was decreased by 0.76% to 23.32 lakh hectares (57.62 lakh acres) with 209.27 lakh tonnes production (2nd advance estimates) as compared to 207.72 lakh tonnes production from 23.50 lakh hectares (58.06 lakh acres) during the last year (<https://agmarknet.gov.in/>). In Telangana during the 2022-23 area covered under mango was 1.31 lakh ha (3.24 lakh acres). Major Mango growing districts in Telangana are

Nagarkurnool 13.86 thousand ha (34.26 thousand acres), Jagityal 13.78 thousand ha (34.05 thousand acres), Khammam 13.71 thousand ha (33.9 thousand acres), and Sangareddy 5.93 thousand ha (14.67 thousand acres). (<https://agmarknet.gov.in/>).

Enhancing crop productivity is vital for meeting the growing demand and can be achieved through advanced production techniques, high-yielding varieties, and innovative crop management practices. To address this, the District Agricultural Advisory and Transfer of Technology Centre, Sangupet, Sangareddy, under PJS AU organized frontline demonstrations in farmers' fields, showcasing improved practices to promote sustainable and high-yielding mango cultivation.

This study was conducted with the following objectives:

1. To evaluate yield gaps in mango production within the Sangareddy district.
2. To assess the adoption of integrated crop management (ICM) practices in mango production before and after implementing frontline demonstrations.
3. To examine the economic impact of mango production practices before and after the adoption of FLD.

The findings aim to highlight the effectiveness of FLDs in enhancing mango cultivation practices, bridging yield gaps, and improving farmers' economic returns.

Materials and Methods

Frontline demonstrations (FLDs) were carried out during 2020–21 and 2021–22 in Sangareddy district, Telangana, to assess the impact of Integrated Crop Management (ICM) practices and the economics of mango cultivation. The demonstrations focused on Banganpally (Beneshan) mango orchards, uniformly aged 12–15 years, across various villages in the district. To raise awareness and enhance the knowledge of mango growers, the DAATT Centre, Sangupet conducted capacity-building initiatives, including on-campus and off-campus training programs and workshops, as part of the FLD activities. Farmers were provided with critical inputs and guided to apply them according to the package of practices recommended by SKLTHU, Rajendranagar, Hyderabad.

Scientists from the DAATT Centre, Sangareddy, regularly monitored the demonstration plots at all stages of cultivation, including pruning, flowering, fruiting, harvesting, and marketing. These efforts were implemented annually in 10 selected mango orchards, ensuring effective adoption of improved practices and sustainable mango production.

Baseline data from the respondents were collected before and after the implementation of frontline demonstrations (FLDs) through personal interviews using a

structured interview schedule developed for the study. A total of 30 farmers' fields, covering 6 hectares, were selected for the demonstrations. Details of the recommended package of practices and the farmers' existing practices are presented in Table 1. The collected data were analyzed using appropriate statistical methods.

Yields from the demonstration plots were recorded under the close supervision of scientists from the DAATT Centre, Sangupet, across various locations in the district. Additionally, information on actual yields achieved by farmers under their traditional management practices was gathered for comparison.

The following yield gaps were calculated:

1. **Technological gap (Yield Gap-I):** The difference between the potential yield and the yield from the demonstration plots.
2. **Extension gap (Yield Gap-II):** The difference between the demonstration plot yield and the yield achieved by farmers under their practices.
3. **Total yield gap:** The difference between the potential yield and the actual yield achieved by farmers.

These analyses provided insights into the impact of FLDs in reducing yield gaps and improving mango cultivation practices.

Results and Discussion

Yield gap in mango production

The yield gaps in mango production, as presented in Table 2, highlight significant differences between potential, demonstrated, and actual yields. The potential yield of mango was found to be 120.00 q/ha, while the demonstrated yield obtained through frontline demonstrations was slightly lower at 115.70 q/ha. However, the actual yield achieved by farmers using their own resources and management practices was significantly lower, at 82.40 q/ha. The technological gap (yield gap-I), which represents the difference between the potential yield and the demonstrated yield, was 43.0 q/ha, accounting for a 35.8% reduction from the maximum attainable yield. The extension gap (yield gap-II), or the difference between the demonstrated yield and the actual yield, was 33.3 q/ha, indicating a 27.75% reduction compared to the demonstrated plots. Overall, a substantial total yield gap of 76.3 q/ha was observed, representing a 63.5% shortfall in achieving the potential yield.

These findings align with the results reported by Amandeep Kaur *et al.* (2013) and Biplab and Tanmay (2010). The large total yield gap can be attributed to environmental differences between research stations, extension workers, and farmers' fields, as well as the non-adoption of recommended production technologies, as noted by Mishra *et al.* (2007) and Kiran (2003).

Addressing this gap requires effective coordination between researchers, extension workers, and farmers. These results are consistent with the findings of Hiremath and Hilli (2012) and Jadav and Solanki (2009).

The adoption level of package of practices in ICM of mango

The adoption levels of recommended practices in Integrated Crop Management (ICM) for mango, as presented in Table 3, revealed that most respondents implemented practices such as water management (93.3%), harvesting methods (90.0%), recommended doses of inorganic fertilizers (83.3%), intercropping with legumes (80.0%), and application of the recommended quantity of farmyard manure (76.6%). These high adoption rates can be attributed to the simplicity of these practices compared to more complex technologies. Similar observations were reported by Singh *et al.* (2014), Changadeya *et al.* (2012), and Jadav *et al.* (2009).

Notably, the adoption percentages increased more significantly for practices like spraying mango special (70.0%) and spraying growth regulators (40.67%). However, practices such as intercropping with legumes, water management, and the application of farmyard manure showed relatively smaller increases in adoption rates after frontline demonstrations. According to Mehta *et al.* (2012), this lower increase in adoption may contribute to a significant reduction in yield. These findings align with those reported by Alagukannan *et al.* (2015) and Aski *et al.* (2010)

Impact of ICM on Mango Yield

the impact of Integrated Crop Management (ICM) on mango yield through frontline demonstrations is summarized in Table 4. The data indicates a significant increase in mango yield, with a 25.50% improvement per hectare in the FLD plots. The yield of mango showed a notable difference before and after the implementation of the FLD, highlighting the wider adoption of the demonstrated technologies by farmers. These findings are consistent with the research conducted by Meena *et al.* (2015) and Patel *et al.* (2014).

Economic Analysis of Mango Production:

The economic impact of demonstrated production practices for mango was analyzed by calculating the total cost of cultivation, gross return, net return, and benefit-cost ratio (BCR) before and after the implementation of frontline demonstrations (FLD). The data presented in Table 5 shows that mango yield increased from 82.4 q/ha before FLD to 115.7 q/ha after FLD. Farmers sold mangoes at an average rate of ₹ 2880 per quintal, and profitability was calculated based on this rate (Balaji *et al.*, 2013).

The results revealed net returns of ₹ 93,785/ha before FLD, which increased significantly to ₹ 1,52,681/ha after FLD. The benefit-cost ratio also improved, rising from 1.6 before FLD to 2.0 after FLD. This clearly indicates that the BCR of mango production was higher after FLD, which can be attributed to the higher adoption of recommended practices for mango production and effective extension contact between FLD farmers, scientists, and extension workers. These findings are consistent with those reported by Patel *et al.* (2014) and Shinde (2011).

The adoption of Integrated Crop Management (ICM) practices in mango cultivation through frontline demonstrations (FLD) led to significant changes in farmers' practices. Most farmers became aware of the recommended package of practices for mango production after the FLD was conducted on their fields. A noticeable increase in the adoption percentage was observed for key practices, such as spraying mango special and growth regulators, after the FLD compared to before its implementation. The yield of mango, along with net returns and the benefit-cost (B:C) ratio, showed substantial improvements in the FLD plots compared to traditional farmer practices.

The positive impact of ICM in mango production was evident from the increased adoption of demonstrated technologies even after the FLD program. This highlights the effectiveness of frontline demonstrations in promoting advanced practices. Applying this concept more broadly, including to progressive farmers, can facilitate the rapid and widespread dissemination of recommended practices across the farming community

Table 1 Demonstrated package of practices and farmers' practices for ICM in mango

Sl. No	Technologies	Frontline demonstration (Demonstrated package)	Farmers practices (Local check)
1	Pruning and canopy management	Removed the dried, infested and dense canopy after harvesting of previous mango fruits.	Improper pruning
2	Recommended quantity of farm yard manure application	Applied 25 kg per tree per year	Applied 2-3 bucket or basket per tree per year
3	Recommended dose of fertilizer application	730 g N + 180 g P ₂ O ₅ + 680 g K ₂ O per tree per year (50 % NPK after harvesting and remaining 50 % NPK	Applied one time 17:17:17 NPK + 20:20:0 NPK mixed

		applied at Oct-Nov.) based on soil sample analysis report	chemical fertilizer (Approx. 500 g/tree/year)
4	Water management	Drip irrigation	Flood/channel irrigation
5	Growing legumes as intercropping	Grown green gram as intercrop for additional income and also improved the soil fertility	Growing green manure crops 3 years intervals.
6	Spraying with Mango special (micronutrient	Sprayed IIHR Mango special at 75 g in 15 litre of water with one lemon juice and one shampoo sachet(Rs.1/) during Sept. Oct. Nov. & December month	sprayed micronutrients at improper time and dosage
7	Spaying of growth regulators for reduce flower and fruit drops	Sprayed 20 ppm NAA for reduce flower and fruit drops	Sprayed pesticides in place to growth regulators
8	Plant protection measures to control pest and diseases	1) Mango hopper management: Sprayed Imidacloprid @ 0.3 ml/L of water. 2) Fruit fly management: used pheromone traps 10 No./ha. 3) Powdery mildew management: Sprayed Hexaconazole 5 EC @ 2 ml/L of water 4) Anthracnose: Sprayed Carbendazim @ 1.5 g/L of water.	Not followed, irrespective of disease and pest, used plant protection chemical combined together with growth regulator without knowing compatibility of chemicals and not identified pest and disease for spraying.
9	Harvesting method	Used UAS Bengaluru improved mango harvester	Manual harvesting causing damaging to fruits.

Table.2 Yield gap identified in mango production

Particulars	Yield q/ha	Percentage gap
Potential yield q/ha	120	--
Demonstration Yield q/ha	115.7	--
Farmer practice	82.4	--
Technology gap (yield gap I)	43	35.8
Extension Gap (Yield gap II)	33.3	27.75
Total Yield gap	76.3	63.5

Table.3 The adoption level of package of practices in ICM of mango

(n=30)

S>no.	Package of practices Adoption	Adoption (Before FLD)		Adoption (After FLD)		Increased in adoption Technologies	
		No	Per cent	No	Per cent	No	Per cent
1	Pruning and canopy management	06	20	18	60	12	40
2	Recommended quantity of farm yard manure application	14	46.6	23	76.6	09	30
3	Recommended dose of inorganic fertilizer application	15	50	25	83.3	10	33.3
4	Water management	17	56.6	28	93.3	11	36.6
5	Growing legumes as	13	43.3	24	80	11	36.6

	intercropping						
6	Spraying with Mango special (micronutrient)	8	26.6	21	70	14	46.6
7	Spaying of growth regulators	08	26.6	12	40	4	13.3
8	Plant protection measures to control pest and diseases	10	33.3	23	76.6	13	43.3
9	Harvesting method by harvester	12	40	27	90	15	50

Table.4 : Yield of mango before and after frontline demonstration n=30

Average yield of mango (q/ha)		Percent increase in yield
Before FLD (Farmer Practice)	After FLD (Demonstrated Field)	
82.4 q/ha	115.7q/ha	33.3

Table.5 Economics of mango production before and after frontline demonstration

S.no.	Particular	Before FLD	After FLD
1	Cost of cultivation (Rs/ha)	144940	180892
2	Yield of mango (q/ha)	82.4	115.7
3	Gross Return (Rs/ha)	237369.6	364416
4	Net Return (Rs/ha)	93785	152681
5	B:C ratio	1.6	2.0

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