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## Integrated crop management enhances productivity and profitability in African Marigold (*Tagetes erecta* L.)

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### Abstract

Frontline demonstrations on African marigold (*Tagetes erecta* L.) were conducted during Kharif 2022–23 and 2023–24 to evaluate the effectiveness of Integrated Crop Management (ICM) practices. ICM significantly enhanced growth parameters and recorded a higher mean yield ( $61 \text{ q ha}^{-1}$ ) compared with farmers' practice ( $54 \text{ q ha}^{-1}$ ), resulting in a 12.96% yield advantage. Net returns (Rs. 1,97,180  $\text{ha}^{-1}$ ) and the benefit–cost ratio (3.4) were also higher under ICM. The technological gap, extension gap, and technology index were  $39 \text{ q ha}^{-1}$ ,  $7 \text{ q ha}^{-1}$ , and 38–40%, respectively. The study confirms that ICM practices substantially improve productivity and profitability in marigold cultivation.

**Keywords:** ICM, African marigold, frontline demonstrations, yield gap, economics, technology index

### Introduction

Marigold (*Tagetes* spp.), a commercially important flower crop belonging to the family Asteraceae, is widely cultivated in India for its ornamental and cultural value. Its short duration, low-cost cultivation, and consistent market demand make it a profitable option for small and marginal farmers (Singh *et al.*, 2018) [8]. Demand surges during festivals and ceremonies further strengthen its income potential (Rao & Reddy, 2020) [5].

Despite its economic relevance, marigold productivity in many regions remains low due to inadequate crop management, imbalanced fertilization, poor nursery techniques, and limited adoption of recommended plant protection practices. Integrated Crop Management (ICM) offers a holistic strategy to improve crop performance by integrating scientific nursery raising, proper spacing, balanced nutrition, pinching, IPM, and weed management.

The present study evaluates the impact of ICM on growth, yield, and profitability of marigold under farmers' field conditions in Mancherial and Kumuram Bheem Asifabad districts.

### Materials and Methods

#### Study Area and Duration

The study was conducted during Kharif 2022–23 and 2023–24 in Mancherial and Kumuram Bheem Asifabad districts of Telangana under the technical guidance of Krishi Vigyan Kendra (KVK), Mancherial.

#### Demonstration Setup

A total of ten frontline demonstrations (FLDs) covering 4 ha were implemented to assess ICM practices. Demonstration plots included:

- Hybrid seedlings raised in pro-trays
- Transplanting on ridges and furrows at  $60 \times 45 \text{ cm}$
- Recommended NPK and FYM application
- Timely pinching
- Weed management
- Integrated pest management (IPM)

Farmers' practice (FP) included flatbed nurseries or direct sowing, no pinching, imbalanced fertilization, manual weeding, and chemical control of pests.

### Capacity Building

KVK conducted on-campus and off-campus trainings, workshops, and field visits. Uniform 30-day-old seedlings were supplied to all demonstration farmers.

### Data Recording

Data were recorded on plant height, primary branches, flowers per plant, flower diameter, thrips incidence, yield, cost of cultivation, and economic returns.

### Statistical Analysis

Data were analyzed as per Sheoran *et al.* (1998) [17].

### Yield Gap and Technology Index

Values were computed following Singh and Sharma (2017) [19].

## Results and Discussion

### Growth and Quality Parameters

ICM practices significantly improved growth attributes compared to farmers' practice (Table 1). Demonstration plots recorded greater plant height (117.4 cm), more flowers per plant

(40), more branches (4.8), and larger flower diameter (6.78 cm). Thrips incidence was lower (5.58%) in ICM plots than farmers' practice (8.9%), reflecting effective pest management. The improvement in growth and flower quality can be attributed to uniform seedlings, balanced nutrition, pinching, and IPM.

### Yield and Yield Gaps

Mean demonstration yield was 61 q ha<sup>-1</sup>, compared to 54 q ha<sup>-1</sup> under farmers' practice. Yield increased by 12.96% over FP. The technology gap was 39 q ha<sup>-1</sup>, while extension gap was 7 q ha<sup>-1</sup> (Table 2 & 2.1). The technology index (38–40%) indicates moderate feasibility under field conditions. The total yield gap (46 q ha<sup>-1</sup>) could be due to environmental variability and partial technology adoption, consistent with findings of Mishra *et al.* (2007) [12].

### Economics

ICM plots achieved higher net returns (Rs. 1,97,180 ha<sup>-1</sup>) compared to FP (Rs. 1,42,828 ha<sup>-1</sup>). Cost of cultivation was comparatively lower under ICM (Rs. 67,520 ha<sup>-1</sup>) owing to efficient input use. The B:C ratio was higher under ICM (3.4) than FP (2.5). Per-day net returns were also greater in ICM (Rs. 2,190 ha<sup>-1</sup>), confirming better profitability (Table 3). Improved yields, reduced pest incidence, and higher flower quality contributed to enhanced economic returns.

**Table 1:** Technical observations on growth and quality parameters (2022–23 & 2023–24)

| Sl. No  | Plant height Demo | Plant height Check | Primary branches Demo | Primary branches Check | Flowers Demo | Flowers Check | Flower diameter Demo | Flower diameter Check | Thrips Demo | Thrips Check |
|---------|-------------------|--------------------|-----------------------|------------------------|--------------|---------------|----------------------|-----------------------|-------------|--------------|
| 1       | 118               | 97.0               | 5                     | 4                      | 40           | 27            | 6.7                  | 5.3                   | 5.5         | 9.0          |
| 2       | 115.5             | 93.0               | 4                     | 3                      | 38           | 28            | 6.7                  | 5.2                   | 6.5         | 10           |
| 3       | 120.5             | 95.0               | 5                     | 3                      | 41           | 25            | 6.8                  | 4.9                   | 5           | 8.5          |
| 4       | 107.4             | 96.3               | 5                     | 4                      | 42           | 26            | 6.8                  | 5.7                   | 5.5         | 9.5          |
| 5       | 125.6             | 94.5               | 5                     | 3                      | 39           | 25            | 6.9                  | 5.0                   | 5.4         | 7.5          |
| Average | 117.4             | 95.16              | 4.8                   | 3.4                    | 40           | 26.2          | 6.78                 | 5.22                  | 5.58        | 8.9          |

**Table 2:** Yield gap analysis during 2022–23 and 2023–24

| Year    | No. of farmers | Demo Yield | Check Yield | Increase% | Technological gap | Extension gap | Tech Index |
|---------|----------------|------------|-------------|-----------|-------------------|---------------|------------|
| 2022-23 | 5              | 60         | 55          | 9%        | 40                | 5             | 40         |
| 2023-24 | 5              | 62         | 53.5        | 15.4%     | 38                | 8.5           | 38         |
| Mean    | 10             | 61         | 54          | 12.96%    | 39                | 7             | 39         |

**Table 2.1:** Consolidated yield gap in marigold production

| Particulars         | Yield | Percentage gap |
|---------------------|-------|----------------|
| Potential yield     | --    | --             |
| Demonstration yield | 61    | --             |
| Actual yield (FP)   | 54    | --             |
| Technological gap   | 39    | 39             |
| Extension gap       | 7     | 7              |
| Total yield gap     | 46    | 46             |
| Technology Index    | 39.11 | --             |

**Table 3:** Impact of ICM demonstration on yield and economics of marigold

| Year    | No. farmers | Cost Demo | Cost Check | Net returns Demo | Net returns Check | B:C Demo | B:C Check | Per day NR Demo/Check |
|---------|-------------|-----------|------------|------------------|-------------------|----------|-----------|-----------------------|
| 2022-23 | 5           | 68370     | 70090      | 189030           | 138810            | 3.7      | 2.9       | 2100.3 / 1542.3       |
| 2023-24 | 5           | 66670     | 70354      | 205330           | 146846            | 3.1      | 2.1       | 2281.4 / 1631.6       |
| Mean    | 10          | 67520     | 70222      | 197180           | 142828            | 3.4      | 2.5       | 2190.8 / 1586.9       |

## Conclusion

Integrated Crop Management significantly enhanced growth, yield, and profitability of African marigold under field conditions. Higher flower yield, improved quality, reduced pest incidence, and superior economic returns demonstrate the strong potential of ICM for large-scale adoption among marigold

growers. The findings support wider dissemination of ICM modules to boost floriculture-based income in Telangana.

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