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Impact of front line demonstration on integrated management of brinjal shoot and fruit borer (*Leucinodes orbonalis* Guenee) in Nizamabad district, Telangana state

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Abstract

Front line demonstrations (FLDs) were organized in farmers' fields by Krishi Vigyan Kendra (KVK), Rudrur during the *Yasangi* (Rabi) seasons of 2022–23 and 2023–24 in Nizamabad district, Telangana state. The demonstrations evaluated an Integrated Pest Management (IPM) module against conventional farmers' practices (check) for managing the brinjal shoot and fruit borer (*Leucinodes orbonalis* Guenee). Pooled data across two years revealed that IPM demonstration plots recorded significantly lower shoot damage (12.85%) and fruit damage (20.30%) compared to farmers' practice (27.85% and 43.60%, respectively), achieving a mean damage reduction of 53.87% for shoots and 53.46% for fruits. The IPM module recorded a higher marketable fruit yield (325.70 q ha⁻¹) compared to the check (296.00 q ha⁻¹), representing an average yield increase of 10.03%. The average cost of cultivation was reduced in demonstration plots (Rs. 209,140 ha⁻¹) relative to check plots (Rs. 237,010 ha⁻¹) due to judicious pesticide usage. Consequently, higher net returns (Rs. 311,980 ha ha⁻¹) and an enhanced Benefit-Cost (B:C) ratio of 2.49:1 were obtained under the IPM module, compared to Rs. 235,790 ha⁻¹ and 1.99:1 in farmers' practice. The technology gap, extension gap, and technology index were enumerated as 274.30 q ha⁻¹, 29.70 q ha⁻¹, and 45.72%, respectively.

Keywords: Brinjal, front line demonstration, integrated pest management, shoot and fruit borer

1. Introduction

Brinjal (*Solanum melongena* L.), belonging to the Solanaceae family, is a major vegetable crop cultivated extensively across India. However, its production is severely hindered by insect pests, primarily the brinjal shoot and fruit borer (BSFB), *Leucinodes orbonalis* Guen. (Anon., 2018). BSFB larvae bore into young shoots and fruits, leading to extensive fruit damage and yield losses ranging from 20.7% to over 85% (Satpathy *et al.*, 2005) [8]. The crop is additionally attacked by sucking pests like aphids, leafhoppers, whiteflies, and thrips (Nayak *et al.*, 2016) [5].

To control these pests, farmers frequently rely on intensive chemical insecticide sprays. This practice increases production costs, leads to pesticide residue accumulation, creates secondary pest outbreaks, and causes environmental pollution. Integrated Pest Management (IPM) offers an eco-friendly and economically viable alternative by combining cultural, biological, and chemical control methods (Alam *et al.*, 2006; Patra *et al.*, 2016) [1, 6]. Front Line Demonstrations (FLDs) organized by Krishi Vigyan Kendras (KVKs) serve as an effective extension tool to demonstrate IPM modules, educate growers, and bridge the gap between potential and actual farm yields. This paper assesses the impact of IPM FLDs conducted by KVK Rudrur on pest incidence, crop yield, and economic parameters in Nizamabad district.

2. Materials and Methods

Front Line Demonstrations (FLDs) on the IPM strategy module for brinjal shoot and fruit borer were conducted in adopted villages by Krishi Vigyan Kendra, Rudrur during *Yasangi* 2022–23 and 2023–24 in Nizamabad district, Telangana state.

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The IPM demonstration package comprised:

- Need based soil drenching with COC @ 3 g/l of water in nursery against damping off.
- Apply 3G granules @ 10g/4 m² to control sucking pests in nursery.
- Installing yellow sticky traps @ 4/acre to control whitefly incidence.
- Installing pheromone traps @ 20-40/acre for monitoring and mass trapping of brinjal shoot and fruit borer moths.
- Clipping and destroying of damaged shoots from time to time in initial stages.
- Spraying of Azadirachtin of 1500 ppm @ 5 ml/l of water to kill the egg masses of borers.
- Spraying of need based chemicals against shoot and fruit borer: Chlorantraniliprole 18.5 SC @ 0.3 ml/l or Emamectin benzoate 5 SG @ 0.4 g/l of water can be sprayed upon crossing ETL thresholds.
- Spraying of need based chemicals against whitefly/aphids: Fenpropathrin 30 EC @ 0.5 ml/l of water can be sprayed upon crossing ETL thresholds.

An adjacent plot maintained under conventional farmers' practices (indiscriminate, calendar-based chemical insecticide sprays like Chlorpyrifos, Profenofos, Lambda-cyhalothrin, and Emamectin benzoate) served as the control check.

Observations on shoot damage (%), fruit damage (%), total yield (q ha⁻¹), cost of cultivation (Rs. ha⁻¹), gross returns (Rs. ha⁻¹), net

returns (Rs. ha⁻¹), and benefit-cost (B:C) ratios were recorded. Extension indicators were calculated using standard formulas suggested by Samui *et al.* (2000) [7].

$$\text{Shoot damage (\%)} = \left\{ \frac{\text{No. of shoots drooped}}{\text{Total no. of shoots}} \right\} \times 100$$

$$\text{Fruit damage (\%)} = \left\{ \frac{\text{No. of fruits with bore holes}}{\text{Total no. of fruits}} \right\} \times 100$$

$$\text{Per cent increase in yield} = \left\{ \frac{\text{Demonstration yield} - \text{Farmers practice yield}}{\text{Farmers practice yield}} \right\} \times 100$$

$$\text{Technology Gap} = \text{Pi (Potential Yield)} - \text{Di (Demonstration Yield)}$$

$$\text{Extension Gap} = \text{Di (Demonstration Yield)} - \text{Fi (Farmers yield)}$$

$$\text{Technology index} = \left\{ \frac{\text{Potential Yield} - \text{Demonstration yield}}{\text{potential yield}} \right\} \times 100$$

3. Results and Discussion

3.1. Effect of IPM Module on Shoot and Fruit Borer Incidence

Table 1: Effect of IPM Module on Shoot and Fruit Borer Incidence

Year	Shoot Damage%		Reduced damage over check%	Fruit Damage%		Reduced damage over check%
	Check	Demo		Check	Demo	
2022-23	28.60	13.30	53.50	44.30	21.00	52.60
2023-24	27.10	12.40	54.24	42.90	19.60	54.31
Average	27.85	12.85	53.87	43.60	20.30	53.46

During Yasangi 2022–23, shoot damage in demonstration plots was 13.30% compared to 28.60% in the check plot, representing a 53.50% reduction. Fruit damage was recorded at 21.00% in the demo plot versus 44.30% in the check plot (52.60% reduction).

During Yasangi 2023–24, demonstration plots recorded 12.40% shoot damage and 19.60% fruit damage compared to 27.10% shoot damage and 42.90% fruit damage in check plots. This corresponds to a 54.24% reduction in shoot damage and a 54.31% reduction in fruit damage. Pooled mean values across both

seasons revealed average shoot damage of 12.85% in demonstration plots versus 27.85% in check plots, and average fruit damage of 20.30% in demonstration plots versus 43.60% in check plots. These findings conform with Satpathy *et al.* (2005) [8] and Nayak *et al.* (2016) [5], who reported that bio-intensive IPM modules significantly reduce borer infestations compared to schedule-based chemical sprays.

3.2. Impact on Yield and Extension Indicators

Year	Yield (q ha ⁻¹)			% Increase in yield	Technology gap (q ha ⁻¹)	Extension gap (q ha ⁻¹)	Technology index (%)
	Potential	Non IPM	IPM				
2022-23	480.00	295.00	325.00	+10.17	155.00	30.00	32.29
2023-24	480.00	297.00	326.40	+9.90	153.60	29.40	32.00
Average	480.00	296.00	325.70	+10.03	154.30	29.70	32.15

Marketable fruit yield in IPM demonstration plots reached (325.00 q ha⁻¹) in 2022–23 and (326.40 q ha⁻¹) in 2023–24, achieving productivity enhancements of 10.17% and 9.90% over farmers' practices (295.00 q ha⁻¹ and 297.00 q ha⁻¹ respectively). These findings are in conformity with the works of Singh and Bisen (2020) [11] and Chaitanya *et al.*, (2020) [3].

The pooled extension gap was (29.70 q ha⁻¹), emphasizing the yield loss occurring at the field level due to non-adoption of recommended IPM interventions. The technology gap averaged 154.30 q ha⁻¹, reflecting local environmental constraints, soil heterogeneity, and crop management factors (Chaitanya *et al.*, 2020) [3]. The technology index averaged 32.15%, demonstrating the field feasibility of the demonstrated technology in Nizamabad district.

3.3. Economic Analysis

The average cost of cultivation in demonstration plots was Rs. 2,09,140 ha⁻¹ (2,09,500 ha⁻¹ in 2022–23 and 2,08,780 ha⁻¹ in 2023–24), which was lower than farmers' practice Rs. 2,37,010 ha⁻¹. This cost reduction was primarily driven by replacing frequent synthetic chemical sprays with cost-effective pheromone traps, biopesticides, and need-based sprays. These findings were in line with the research of Senthil kumar *et al.* (2018) [9] and Shankar *et al.* (2022) [10].

4. Conclusion

Front Line Demonstrations conducted by KVK Rudrur confirmed the efficiency and economic superiority of the IPM module against *Leucinodes orbonalis* in Nizamabad district. Adoption of

the IPM package reduced shoot damage by 53.87% and fruit damage by 53.46%, while cutting cultivation costs by Rs. 27,870 ha⁻¹. Productivity increased by 10.03%, yielding an additional net profit of Rs. 76,190 ha⁻¹ and raising the B:C ratio to 2.49:1. Widespread extension activities and farmer training programs are recommended to accelerate horizontal adoption across the region.

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