# Expanding Frontiers in Entomological Research


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# Integrated Pest Management in India

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**Salman Ahmad**

**Abstract**

Integrated Pest Management (IPM) is a vital strategy for sustainable agriculture in India, aiming to mitigate phytosanitary challenges that significantly impact crop productivity. With average yield losses due to pests estimated at 30%, and in extreme cases up to 100%, IPM offers a holistic approach combining diagnosis, informed decision-making, and both preventive and curative control methods. Despite its benefits, widespread adoption in India faces hurdles such as limited farmer awareness, inadequate research infrastructure, and preference for chemical pesticides. However, growing consumer demand for residue-free produce and government initiatives promoting biopesticides and sustainable practices are driving positive change. Innovations like AI-driven pest monitoring and enhanced extension services are poised to bolster IPM implementation, ensuring environmental sustainability and food security.

**Keywords**

Integrated Pest Management (IPM), Phytosanitary Challenges, Biopesticides, Sustainable Agriculture, AI-driven Pest Monitoring

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## Introduction

Integrated Pest Management (IPM) has become a pivotal strategy in addressing the phytosanitary challenges that significantly impact agricultural productivity in India. Given the sector's critical role in the nation's economy—providing income,

employment, raw materials, energy, fibers, and food—the implementation of effective pest management strategies is essential. Phytosanitary issues are among the primary factors limiting high yields, with average losses around 30%, and in extreme cases, reaching up to 100% (Picanço *et al*., 2007; Cerda *et al*., 2017).

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## Components of Integrated Pest Management

IPM programs are structured around three fundamental components: diagnosis, decision-making systems, and control methods (Pedigo, Rice and Krell, 2021; Picanço *et al*., 2014).

### 1. Diagnosis

Diagnosis involves identifying pests, understanding factors conducive to their proliferation, and pinpointing critical control points. Factors such as climate, natural enemies, pest biology, host plants, control methods, environment, and planting systems influence pest behaviors, including migration, colonization, development, and reproduction (Bacci *et al*., 2019; Felicio *et al*., 2019). Recognizing these elements enables the prediction of pest occurrences and the formulation of timely intervention strategies.

### 2. Decision-Making Systems

Decision-making systems encompass sampling plans and decision-making indices. Sampling plans, either conventional or sequential, determine pest and natural enemy densities to inform control decisions. Conventional plans involve fixed sample sizes and a two-stage evaluation process, while sequential plans are more dynamic, often requiring fewer samples and allowing for immediate decision-making in the field (Arcanjo *et al*., 2021; Bacci *et al*., 2007). Decision-making indices, such as the Economic Injury Level (EIL) and Economic Threshold (ET), guide whether pest control measures should be implemented based on pest population densities (Higley and Pedigo, 1996).

### 3. Control Methods

Control methods in IPM are categorized into preventive and curative strategies.

- **Preventive Methods**: These include cultural controls (e.g., crop rotation, sanitation), plant resistance, and conservation of natural enemies.
- **Curative Methods**: These involve chemical controls, augmentative biological controls, behavioral controls (e.g., pheromone traps), and genetic controls