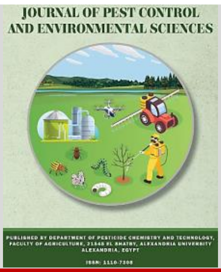
Available online at https://jpess.journals.ekb.eg/

Journal of Pest Control and Environmental Sciences (JPCES)

Volume 25 (2025) 18–21




Short Communication

# Analysis of the impact of integrated agricultural practices management on the dynamics of biological enemies and ecological diversity

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**ABSTRACT**

Integrated agricultural practices management enhances biological enemy populations and ecological diversity by reducing chemical inputs and promoting sustainable farming techniques. This approach supports natural pest control, improves ecosystem balance, and fosters biodiversity, contributing to resilient and sustainable agroecosystems.

**Keywords:** Integrated Agricultural Practices; Biological enemies; Ecological diversity.

## 1. Introduction

### 1.1. Integrated agricultural practices management (IAPM)

IAPM refers to the harmonized use of various farming techniques aimed at achieving sustainable agricultural production with minimal environmental impact. IAPM integrates crop rotation, soil health management, and biological control to maintain ecological balance and enhance crop productivity (Kumar et al., 2024; Smith et al., 2022). Its primary objective is to promote sustainable farming by reducing chemical inputs, conserving natural resources, and supporting ecosystem services (Jones et al., 2023). Biological control, a key component of IAPM, utilizes natural enemies of pests to regulate pest populations, reducing reliance on synthetic pesticides and preserving biodiversity (Lee et al., 2021).

### 1.2. IAPM and the power of natural enemies

Biological enemies in agroecosystems include predators, parasitoids, and beneficial insects, which play crucial roles in pest regulation (Ratto et al., 2022). Predators directly consume pests, while parasitoids lay eggs in or on pests, leading to their death. Beneficial insects contribute to maintaining ecological balance by suppressing pest populations naturally (Deguine et al., 2020). These natural enemies are essential for sustainable pest management as they reduce the need for chemical pesticides, minimizing environmental harm and supporting biodiversity (Ratto et al., 2022; Deguine et al., 2020). Enhancing their habitats and diversity strengthens biological control effectiveness in agroecosystems.

IAPM fosters the abundance and diversity of natural enemies by reducing chemical pesticide use and promoting habitat diversity, which supports predator and parasitoid populations (Zhou et al., 2024). Reduced pesticide application minimizes harm to beneficial insects, allowing them to regulate pest populations effectively (Bottrell et al., 2018). Successful case studies under IAPM demonstrate enhanced pest suppression and improved crop health through conservation biological control and targeted biopesticide use (Stenberg et al., 2017). These practices lead to sustainable pest management, preserving ecosystem balance and reducing pesticide resistance risks (Zhou et al., 2024; Bottrell et al., 2018).

IAPM positively influences ecological balance and biodiversity by promoting diversified cropping systems, habitat management, and cultural practices, which enhance ecosystem diversity and resilience

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Received 6 November 2025; Received in revised form 17 November 2025; Accepted 18 November 2025. Available online 18 November 2025.

(Zhao et al., 2024). Such diversification supports varied microhabitats and resource availability, benefiting multiple species and improving ecological functions (Scherr et al., 2007). Modern IPM techniques, including biopesticides and precision agriculture, further contribute by minimizing chemical input and reducing environmental disturbances, thereby conserving beneficial organisms and ecological processes (Islam et al., 2022). Together, these integrated approaches sustain biodiversity and ecosystem services essential for sustainable agriculture (Zhao et al., 2024; Scherr et al., 2007; Islam et al., 2022).

### 1.3. Challenges and opportunities in adopting IAPM

Challenges in adopting IAPM include high initial costs, limited access to credit, and inadequate extension services, particularly among smallholder farmers (Mnukwa et al., 2025). Additional barriers are labor demands, land tenure insecurity, and poor market linkages (Amadu et al., 2020). However, opportunities to enhance ecosystem services and agricultural resilience arise from integrated policy frameworks, improved financial mechanisms, and strengthened institutional support (Lipper et al., 2014). Promoting knowledge dissemination, facilitating input access, and securing land rights are critical for widespread IAPM adoption, enabling sustainable intensification that benefits both productivity and environmental health (Mnukwa et al., 2025; Amadu et al., 2020).

## 2. Conclusion

Integrated Agricultural Practices Management (IAPM) benefits biological enemies and biodiversity by enhancing ecosystem services and reducing chemical inputs, thus promoting sustainable food production (Berger et al., 2025). It supports ecological balance, resilience, and multifunctionality of agroecosystems. The future of integrated management lies in combining biodiversity conservation with agricultural productivity to ensure food security under changing climate conditions.

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