



Economic Threshold Levels for Common Pests

*Krishna Prasad

School of Agriculture and Environmental Sciences, Shobhit University, Meerut (U.P.)

*Corresponding Author's email: krishnaprasad20112006@gmail.com

Economic Threshold Level (ETL) is a pivotal concept in modern pest management, representing the specific population density of a pest at which the cost of pest damage equals the cost of control measures. When pest populations reach or exceed this level, timely intervention is necessary to prevent economic losses, while below this threshold, control measures are unnecessary, avoiding wasteful pesticide use. ETL is an integral component of Integrated Pest Management (IPM), as it ensures that pest control is both economically and environmentally sustainable. By applying the ETL concept, farmers can optimize resource utilization, reduce input costs, minimize environmental contamination, conserve beneficial organisms, and slow the development of pesticide resistance. This paper elaborates on the significance of ETL, its role in decision-making within IPM programs, and provides examples of threshold levels for widely occurring insect and mite pests in various crops, highlighting its practical application in sustainable agriculture.

Introduction

Agricultural crops across the globe are continuously threatened by a wide spectrum of insect and mite pests, which can cause substantial reductions in yield and quality if left unmanaged. Traditional pest control practices often relied on routine and prophylactic pesticide applications without considering the actual pest population or potential economic loss. Such indiscriminate use not only increased production costs but also contributed to environmental pollution, pesticide residues in food, and the decline of natural enemies, ultimately leading to pest resistance. The concept of Economic Threshold Level (ETL) offers a scientific and practical solution to these challenges. ETL defines the critical pest population density at which action must be taken to prevent pest-induced losses from exceeding the cost of control. Implementing ETL-based pest management allows interventions to be timely, targeted, and economically justified, avoiding unnecessary pesticide applications and conserving beneficial insects. Understanding and applying ETL is fundamental to Integrated Pest Management (IPM), which emphasizes the combined use of cultural, mechanical, biological, and chemical strategies to manage pests in an ecologically and economically sustainable manner. By adopting ETL-based decision-making, farmers can enhance crop productivity, reduce environmental impact, maintain ecological balance, and achieve long-term sustainability in agriculture. Moreover, ETL serves as a bridge between pest monitoring, forecasting, and practical field management, ensuring that pest control is both effective and cost-efficient.

ETL for Common Pests (Detailed)

Economic Threshold Levels (ETLs) vary for different pests depending on crop type, growth stage, pest biology, and environmental conditions. Below is a detailed overview of ETL for common pests in vegetable, cereal, and spice crops:

1. Aphids (*Aphis spp.*, *Myzus persicae*)

- **Crops Affected:** Vegetables (tomato, cabbage, okra), cereals (wheat, barley), coriander.

- **Nature of Damage:** Aphids suck sap from tender shoots and leaves, causing curling, yellowing, and stunted growth. Their honeydew promotes sooty mold, reducing photosynthesis. Aphids are vectors of several viral diseases.
- **ETL:** 10–20 aphids per plant at early vegetative stages; lower ETL during flowering due to risk of virus transmission.
- **Monitoring:** Regular inspection of undersides of leaves, visual scouting, and sticky traps.
- 2. **Whitefly (*Bemisia tabaci*)**
 - **Crops Affected:** Tomato, cotton, cucumber, chili.
 - **Nature of Damage:** Adults and nymphs suck sap, causing chlorosis, leaf curling, and premature leaf drop. Major vector of Tomato Leaf Curl Virus (ToLCV) and other viral pathogens.
 - **ETL:** 5 adults per leaf in vegetables; slightly higher in resistant varieties.
 - **Monitoring:** Yellow sticky traps and leaf counts; inspect early morning when adults are less active.
- 3. **Leaf Miner (*Liriomyza trifolii*, *L. sativae*)**
 - **Crops Affected:** Tomato, coriander, spinach, onion.
 - **Nature of Damage:** Larvae tunnel inside leaves forming serpentine mines, reducing photosynthetic efficiency and overall plant vigor. Severe infestation can defoliate young plants.
 - **ETL:** 30% of leaves mined; lower thresholds during early growth stages.
 - **Monitoring:** Inspect leaves weekly for mines; use yellow sticky traps to monitor adults.
- 4. **Fruit Borer (*Helicoverpa armigera*)**
 - **Crops Affected:** Tomato, chili, pulses (pigeon pea, chickpea), cotton.
 - **Nature of Damage:** Larvae bore into fruits, pods, or bolls, causing direct yield loss and contamination with excreta. Multiple generations per season increase damage risk.
 - **ETL:** 5–10% fruit infestation; lower during early fruiting stages to prevent cumulative losses.
 - **Monitoring:** Pheromone traps for male moths, weekly fruit inspection, and larval counting.
- 5. **Thrips (*Thrips tabaci*, *Frankliniella* spp.)**
 - **Crops Affected:** Onion, chili, vegetables, and some seed spices.
 - **Nature of Damage:** Thrips feed on leaf epidermis and flower buds, causing silvery patches, curling, and virus transmission (e.g., Tospoviruses).
 - **ETL:** 10–15 thrips per leaf for vegetables; 5–10 per leaf for sensitive stages like flowering.
 - **Monitoring:** Blue or white sticky traps, visual counts on tender leaves.
- 6. **Red Spider Mite (*Tetranychus urticae*)**
 - **Crops Affected:** Cotton, vegetables, ornamental plants.
 - **Nature of Damage:** Mites feed on leaf undersides, causing yellow speckling, bronzing, and web formation, eventually leading to leaf drying and defoliation.
 - **ETL:** 5–10 mites per leaf during vegetative growth; 2–3 mites per leaf during flowering/fruiting for sensitive crops.
 - **Monitoring:** Hand lens inspection of leaf undersides; check multiple plants randomly.
- 7. **Cutworm (*Agrotis* spp.)**
 - **Crops Affected:** Seedlings of tomato, maize, vegetable crops.
 - **Nature of Damage:** Caterpillars feed at night, cutting seedlings near soil surface, causing patchy gaps and delayed crop establishment.
 - **ETL:** 2–3 larvae per m² at seedling stage.
 - **Monitoring:** Soil inspection near seedlings, use of light traps or hand collection at night.
- 8. **Stem Borer (*Euzophera perticella*, *Sesamia* spp.)**
 - **Crops Affected:** Solanaceous crops (tomato, brinjal), cereals (rice, maize).
 - **Nature of Damage:** Larvae bore inside stems, causing wilting, hollow stems, and poor fruit or grain yield.

- **ETL:** 5–10% infested plants at early vegetative stage; lower for high-value vegetables.
- **Monitoring:** Stem dissection, visual inspection, light or pheromone traps for adult moths.

Key Notes on ETL Application:

1. ETLs are **crop- and stage-specific**; thresholds are lower during flowering and fruiting.
2. **Regular scouting and monitoring** are essential to accurately determine when ETL is reached.
3. **ETL integrates with IPM**, ensuring interventions (biological or chemical) occur only when needed, reducing costs and environmental harm.

Conclusion

Economic Threshold Level (ETL) is a cornerstone of sustainable pest management, providing a scientific basis for making timely and economically justified interventions. By integrating ETL into pest monitoring and decision-making, farmers can prevent unnecessary pesticide applications, reduce input costs, and avoid environmental contamination. ETL-based management ensures that control measures are implemented only when pest populations are likely to cause significant economic losses, thereby protecting beneficial insects, natural predators, and overall agroecosystem health.

The adoption of ETL within Integrated Pest Management (IPM) frameworks promotes rational, targeted, and environmentally sustainable pest control. It helps in balancing crop protection with ecological conservation and long-term productivity. Regular field scouting, accurate pest identification, and understanding crop-specific thresholds are essential for the effective application of ETL. Furthermore, ETL facilitates informed decision-making, enabling farmers to adjust management strategies according to pest biology, crop stage, and environmental conditions. Overall, ETL-based IPM enhances crop yield and quality, minimizes economic losses, reduces reliance on chemical pesticides, and contributes to sustainable agriculture by fostering ecological balance and long-term farm profitability.

References

1. FAO. (2018). *Integrated Pest Management: Principles and Practice*. Food and Agriculture Organization of the United Nations, Rome, Italy.
2. CABI. (2020). *Crop Protection Compendium: Insect and Mite Pests of Crops*. CABI International, Wallingford, UK.
3. Rajendran, R., & Sundarababu, R. (2004). *Integrated Pest Management in Vegetable and Spice Crops*. Tamil Nadu Agricultural University, Coimbatore, India.
4. Sharma, H.C. (2010). *Host Plant Resistance to Insects in Crops*. Springer, India.
5. Pradhan, S. (1983). *Insect Pests of Crops*. National Book Trust, New Delhi, India.
6. Singh, P., & Kumar, A. (2015). *Economic Threshold Levels and Pest Management in Vegetable Crops*. *Journal of Entomology and Zoology Studies*, 3(6), 145–153.
7. Raina, R., & Bhatnagar, V. (2012). *Role of Economic Threshold Levels in Integrated Pest Management of Seed Spices*. *Indian Journal of Entomology*, 74(2), 125–137.
8. Tripathi, A.K., & Upadhyay, S. (2018). *Pesticide Reduction Strategies through ETL-Based IPM Approaches in Horticultural Crops*. *Journal of Applied Entomology*, 142(7), 621–634.
9. ICAR-National Research Centre on Seed Spices (NRCSS). (2022). *Integrated Pest Management Guidelines for Coriander and Other Seed Spices*. ICAR Publications, Ajmer, India.