



Integrated Pest Management



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Integrated Pest Management (IPM) is an eco-friendly approach to manage the pests by combining all the available methods to reduce pest damage and minimize risks to human health, beneficial organisms and the environment.

Steps to implement IPM

1. Identify the pest: Recognize the pest species and its impact on crops.
2. Understand pest ecology: Learn about the pest life cycle, feeding habits, and natural enemies.
3. Develop an IPM plan: Combine multiple control methods tailored to your crop and local conditions.
4. Evaluate and adapt: Continuously monitor pest levels and the effectiveness of control measures. Adjust the plan as needed.



General Principles of IPM

- Monitoring of pests: Follow regular visual inspection and use tools like pheromone and light traps [e.g. Use of pheromone traps for monitoring of gram pod borer (*Helilure*), yellow stem borer in rice (*Scirpolure*), etc.].
- Field sanitation: Removing plant debris, weeds, and other potential pest habitats to destroy alternate hosts and life stages of insects (e.g. Removal of rice stubbles to avoid spread of pink borer to succeeding wheat crop).
- Summer ploughing: To expose life stages of insects to heat and natural enemies.
- Cultivation of resistant varieties and transgenics: Plant varieties or transgenics that are resistant to certain pests.
- Proper planting method: Adjust planting time, spacing, and density to prevent conditions that favour pest development (e.g. early sowing of mustard (before mid-October) to avoid aphid incidence; 10×15 cm spacing in rice for BPH).
- Balanced use of fertilizers: To prevent pest built-up.

- Collection and destruction of life stages of insects: Egg masses (yellow stem borer in rice, fall armyworm in maize); collection and destruction of infested plant parts (deadhearts in rice, infested shoots and fruits of brinjal and okra).
- Biocontrol agents: Use of botanicals like neem based products, biopesticides such as *Metarrhizium anisopliae*, Bt, NPV and release of biocontrol agents like egg parasitoid, *Trichogramma* spp.
- Synthetic insecticides: Use pesticides only when the pest population or damage reaches the economic threshold level (ETL).

IPM in Field Crops

Cereal Stem Borers:

ETL- Yellow stem borer in rice: 10% deadhearts/ 2% white ears/

one adult or 1 egg mass/m²; **Maize stem borer:** 10% deadhearts;

Pink stem borer: 2-5% deadhearts.

- Clipping of leaf tips of seedlings at the time of transplanting to destroy the egg masses of yellow stem borer.
- Install pheromone traps @ 8 traps/ha for monitoring or 20 traps/ha for mass trapping.
- Release of egg parasitoid, *Trichogramma japonicum* @ 1,00,000 - 1,50,000/ha starting from 30 days after transplanting for 5 to 6 times in rice.
- Insecticides: Chlorantraniliprole 0.4% GR (10 kg/ha); Tetraniliprole 18.18% SC (0.5 ml/l); Isocycloseram 18.1% SC (0.6 ml/l).



Yellow stem borer



Pheromone trap

Rice Brown Plant Hopper: ETL- 5-10 hoppers/hill.

- Alternate wetting and drying in the field to reduce planthopper population.
- Metarhizium anisopliae* 1.15% WP @2.5 kg/ha.
- Insecticides: Dinotefuran 20% SG (0.3-0.4g/l); Flupyrimin 2% GR (5-7.5 kg/ha); Triflumezopyrim (0.5 ml/l).



BPH



Hopper burn

Fall armyworm in maize: ETL- (a) At early stage (3-4 weeks) 5% damage; (b) mid stage (5-7 weeks) – 10 % damage; (c) late stage (silking) 20% damage.

- Application of sand + lime in 9:1 ratio in whorls in first thirty days of sowing.
- Biopesticides: *Metarhizium anisopliae*, *Verticillium lecanii* (1 x10 cfu/g) @ 5g/l, *Bacillus thuringiensis* var. *kurstaki* @ 2g/l (or) 400g/acre.
- Insecticides: Spinetoram 11.7% SC (0.5 ml/l); Broflanilide 20% SC (0.25 ml/l).



FAW larvae



FAW larvae

Spotted pod borer: ETL- 3 larvae/plant; one web per plant

- Biopesticides: Application of Bt @1.5 kg/ha with UV retardant (tinopol @ 0.1%) at 10 days interval.
- Insecticides: Flubendiamide 20% WG (0.5 ml/l); Fluxametamide 10% EC (0.8 ml/l); Indoxacarb 14.5% SC (0.6 ml/l).

Mustard aphid: ETL- 20 to 25 aphids per plant or 10% of plants are infested.

- Conservation of natural enemies of aphids namely *Coccinella septempunctata*, *Chrysoperla carnea*, Syrphid fly, etc.
- Insecticides: Spray *Beauveria bassiana* (2 g/l); dimethoate 30% EC (1ml/l); Thiamethoxam 25% WG (0.1 g/l).



Spotted pod borer



Mustard aphid

2. IPM in Vegetable Crops

Tomato fruit borer: ETL- 1 larva per meter row length or 2% fruit damage.

- Transplant 45 day old marigold seedlings in a pattern of one row of marigold for every 16 rows of tomato and keep first and last row of marigold with HaNPV spray @ 250 LE / ha.
- Release of egg parasitoids, *Trichogramma chilonis* @ 2.5 lakhs/ha (five releases @ 50,000/ha/release).
- Insecticides: Broflanilide 300 SC (0.2 ml/l); Chlorantraniliprole 18.5% SC (0.3 ml/l); Cyantraniliprole 10.26% OD (1.8 ml/l); Fluxametamide 10% EC (0.8 ml/l).



Tomato fruit borer

Shoot and fruit borer in brinjal: ETL- 5% infestation.

- Install pheromone traps @ 4-5/acre for monitoring and 10/acre for mass trapping.
- *Bacillus thuringiensis* serovar *kurstaki* 5.0% WP (1g/l).
- Insecticides: Emamectin benzoate 5% SG (0.4 ml/l; Fluxametamide 10% EC (0.8 ml/l); Chlorantraniliprole 18.5% SC (0.4 ml/l); Cyantraniliprole 10.26% OD (1.8 ml/l).



Shoot and fruit borer

Diamond back moth in crucifers: ETL- 2 larvae/ plant.

- Installation of pheromone traps @ 4/ha for monitoring, 10/ha for mass trapping of adult insects.
- Release of larval parasitoid *Cotesia plutellae* @20000/ha from 20 days after planting.
- Application of *Bacillus thuringiensis* var. *galleriae* 1.3% flowable concentrate @ 2 g/l of water; *Verticillium lecanii* 5.0% SC (1 ml/l).
- Insecticides: Broflanilide 20% SC (0.4 ml/l); Chlorantraniliprole 18.5% SC (0.1 ml/l); Chlorfenapyr 10% SC (1.5 ml/l); Chlorfluazuron 5.4% EC (3 ml/l).



Diamond back moth

Sucking pests viz., leafhopper, white fly, thrips, aphids etc in vegetable crops

- Set up yellow/blue/ sticky traps for monitoring and mass trapping of thrips, white fly, aphids, leafhopper @ 10-20 traps per acre.
- Insecticides: Thaimethoxam 25% WG (0.4 g/l); flonicamid 50 WG (0.4 g/l); Fluxametamide 10% EC (0.8 ml/l).



Whitefly

Leafhopper

IPM for Storage Pests

- Clean storage units, bins, and bags before storage of grains.
- Dry grains to the recommended moisture level (10%) to prevent fungal growth and pest infestations.
- Store grains in airtight containers or hermetically sealed bags to prevent pest entry.
- Treat the stacks, walls ceilings and floor of godown with deltamethrin 2.5 % WP @36 g/l for 30 m² area.
- Fumigation with aluminium phosphide 15% (12g tablet) @1 tablet/ton or 600 g/100m³ for whole cereals and seeds and 900 g/100m³ for millets, pulses, dry fruits, nuts, spices, oil seeds and milled products.
- Storage structure should be properly sealed to ensure airtight condition for optimum concentration for 5-7 days.



Codia cossella



Ceratocapsus cephalonica



Tribolium castaneum



Strophosoma oryzae



Hegdodera granarium

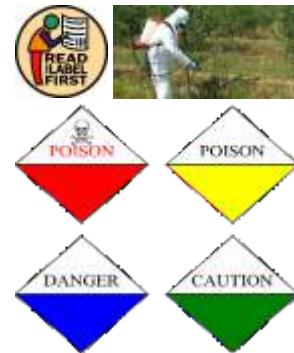


Hegdodera aterrima

Safe use of pesticides

- Always purchase pesticides from a registered dealer.

- Carefully read the label.
- Store the pesticides away from house premises and protected with direct sunlight and rain.
- Store the pesticides in its original containers.
- Wear protective clothing while spraying.
- Spray in the evening hours to avoid exposure of insecticides to pollinators.
- Always adhere to recommended dose and dilutions.
- Do not eat, drink, and smoke during spraying.
- Take bath after spraying.
- All empty containers must be safely disposed.



Commercialized Pest Management Technologies

PUSA MeFly KIT

- Cost-effective, user-friendly, eco-friendly
- Materials in the kit
- o Plastic containers (5)
- o Pretreated wooden blocks (15)
- o Wire for hanging (5)
- o Instruction manual
- Solution to manage fruit fly menace in a wide range of fruit crops like mango, guava, papaya, citrus, etc.
- Reusable design
- Promotes sustainable agriculture by reducing dependence on chemical pesticides



PUSA QFly KIT

- Cost-effective, user-friendly, eco-friendly
- Materials in the kit
- o Plastic containers (5)
- o Pretreated wooden blocks (15)
- o Wire for hanging (5)
- o Instruction manual
- Solution to manage melon fly menace in a wide range of cucurbit vegetables like bitter gourd, muskmelon, snap melon, snake gourd, cucumber, pumpkin, watermelon, etc.



Pusa Whitefly Attractant

- Cost effective, user friendly, eco-friendly
- Used along with yellow sticky traps for monitoring and mass trapping
- This attractant lure increases the trap catch efficiency by 50-300%
- Recommended for use in field/horticultural crops



Authors:

Rajna S, SM Nebapure, PR Shashank and MK Dhillon

Compiled and Edited:

Rajeev Singh, M.S. Nain, Pratibha Joshi, Nafees Ahmad, Satyaprakash and Rahul Singh

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For more information, please contact

Head, Division of Entomology

ICAR-Indian Agricultural Research Institute,
New Delhi-110012, Contact: 011-25842482, #4644
E-mail: head_ento@iari.res.in

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