INSECT PEST MANAGEMENT IN ORGANIC FARMING SYSTEMS

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ORGANIC PEST MANAGEMENT

- Integrated Pest Management (IPM) practices are more crucial in organic farming systems as opposed to other farming systems because producers cannot use conventional insecticides for a quick fix.
- IPM practices in other farming systems (not organic) allow the use of IPM compatible pesticides which are not necessarily “organic”. In organic farming systems one must ensure that the product is OMRI listed.
- IPM compatible insecticides refer to those which are compatible with other IPM tactics employed
  - These insecticides are usually effective but have the least toxic effects on the environment and non-target organisms.
Choose crops that have relatively few pests.
Select planting time that allows crops to avoid the insect all
together or at least avoid peak populations (e.g. plant early or
late).
As much as possible, select crop varieties that are resistant to
key pests.
Practice crop rotation
Avoid staggered planting of the same crop with successive
planting near earlier ones.
Think about position of crops in relation to other crops.
Sanitation. Destroy old crop residue soon after final harvest.
Know when to give up on a crop.
OVERVIEW OF IPM PRACTICES IN ORGANIC FARMING SYSTEMS

• Eliminate weeds before planting and control while crops are in the field; this helps to a number of insect pests including:
  • Cutworms.
  • False chinch bugs.
  • Vegetable weevils
  • Spider mites
  • Slugs
  • Crickets.

• Mechanical weed control (tilling) has other advantages:
  • Thorough tilling helps control insects that overwinter in the soil or under crop debris
  • Tilling also reduces the number of in-field fire ant mounds.
OVERVIEW OF IPM PRACTICES IN ORGANIC FARMING SYSTEMS

• Be familiar with the biology and life history of pests that are likely to occur on your crops
  • Ability to identify the pest is key.
  • Ability to identify beneficial insects is equally useful.

• Use trap crops (if possible). This may conflict with organic certification programs.
  • Collards as trap crops for diamondback moth from cabbage fields
  • Southern peas as trap crops for stink bugs to protect tomato plants.
  • Sunflowers as trap crops for leaffooted bugs from tomatoes.
OVERVIEW OF IPM PRACTICES IN ORGANIC FARMING SYSTEMS

- Use physical exclusion methods when feasible.
  - Greenhouse.
OVERVIEW OF IPM PRACTICES IN ORGANIC FARMING SYSTEMS

• Use metalized reflective plastic mulches to reduce early season infestation of pests such as thrips and aphids to seedling crops.
OVERVIEW OF IPM PRACTICES IN ORGANIC FARMING SYSTEMS

• Use physical exclusion methods when feasible.
  • Row covers
  • Greenhouses.
  • Hoop houses
OVERVIEW OF IPM PRACTICES IN ORGANIC FARMING SYSTEMS

• Use physical exclusion methods when feasible.

• Plant collars e.g. cutworm collars.
OVERVIEW OF IPM PRACTICES IN ORGANIC FARMING SYSTEMS

• Rely on naturally occurring biological control. Do not spray the type of insecticides that will destroy the biological control agents namely:
  • Predators
  • Parasites
  • Pathogens

• Grow healthy, vigorous plants.

• Monitor pest populations
  • Pheromone traps.

• Use mating disruption methods when feasible
OVERVIEW OF IPM PRACTICES IN ORGANIC FARMING SYSTEMS

- Use mechanical controls where feasible
  - Special vacuums and blowers
  - Forceful spray of water e.g. to dislodge aphids.
  - Handpicking and crushing adults and eggs

- Monitor pest populations
  - Pheromone traps.

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OVERVIEW OF IPM PRACTICES IN ORGANIC FARMING SYSTEMS

• Use “Organic” insecticides where necessary.
  • Scout regularly and start treatment early
  • Choose approved insecticides
  • Use rates that are adequate but not excessive
  – The National Organic Program rules (managed by the USDA) were established to prescribe practices that are permissible in the production of organic foods in the United States.
  – Insecticides derived from natural materials that have been researched and listed by the Organic Material Research Institute (OMRI) are those that carry the “certified organic” label.
CLASSIFICATION OF INSECTICIDES

- Insecticides are either organic or inorganic.
- By chemical definition, organic insecticides are insecticides that contain carbon.
- Inorganic insecticides do not contain carbon.
- So from a chemical point of view, most modern insecticides are organic because they contain carbon.
- Organic insecticides are either natural or synthetic.
- Conventional insecticides are mainly synthetic products.
NATURAL INSECTICIDES

• Are produced by refining natural substances
• They are mainly botanical insecticides or mineral oils obtained by refining petroleum.
• Natural insecticides fall under three major categories:
  • Botanicals (Plant extracts)
  • Biopesticides (Pesticides derived from natural materials as animals, plants, microorganisms and certain minerals)
  • Biorationals (insect growth regulators/third generation insecticides)
Biopesticides are distinguished from conventional chemical pesticides by all or many of the following characteristics:

1) Unique mode of action
2) Narrow pest range
3) Low use volume
4) Natural occurrence
NATURAL INSECTICIDES (BIOPESTICIDES)

• Biopesticides are inherently less harmful and have fewer environmental effects than conventional pesticides.

• Unlike many conventional pesticides, biopesticides may affect only a target pest and closely related species.

• Biopesticides are often effective in small quantities and usually decompose quickly; they do not build up in the environment.
  • Helps to avoid the pollution found with some conventional pesticides.
There are three major classes of Biopesticides:

1) Microbial pesticides
2) Biochemical pesticides
3) Plant incorporated protectants (PIP)
BIOPESTICIDES
MICROBIAL INSECTICIDES

• Bacteria e.g., Bacillus thuringiensis

• Fungi e.g., Beauveria bassiana

• Viruses e.g., *Spodoptera exigua* NPV, *Helicoverpa* NPV, and *Cydia pomonella* GV.

• Microspiridian e.g., *Nosema locustae*

• Nematode e.g. *Heterorhabditis* spp.
BIOPESTICIDES

BIOCHEMICAL PESTICIDES

Have the following characteristics:

• Usually occur in nature

• Do not kill the pest outright

– There are instances where substances that are not strictly natural in occurrence are classified as biochemical pesticides e.g. Synthetic sex pheromones.

– The important thing to do before recommending or using an pesticide in certified organic farming systems is to check to ensure the pesticide is OMRI listed.
These insecticides can be grouped into:

1) Insect growth regulators
2) Attractants and repellents
3) Suffocating agents
4) Desiccants
5) Coatings
6) Pheromones
7) Systemic acquired-response inducers
BIOPESTICIDES
BIOCHEMICAL INSECTICIDES

BIORATIONALS/INSECT GROWTH REGULATORS (IGRs)

- They upset the molting process eventually causing death during the molting or disrupt metamorphosis, eventually causing death or sterility of the new adult.

- Ecdysone, juvenile Hormone and their synthetic analogs are registered as biochemical insecticides; Chitin Synthase Inhibitors (CSIs) are not registered as biochemical insecticides because of their broad-spectrum activity.
EXAMPLES OF REGISTERED INSECT GROWTH REGULATORS (IGRs)

• Methoprene for suppression of beetles, flies, mosquitoes, ants, and others on food and non-food crops, ornamentals, and livestock.

• S-Kinoprene for whiteflies, gnats, aphids, mealybugs and scale ornamentals.

• S-Hydropene for cockroaches in food-handling establishments.
ATTRACTANTS AND REPELLENTS

• Attractants attract insects to a site where they are killed and repellents repel insects from a source.

• Many of these materials are processed from plants.
EXAMPLES OF REPELLENTS

• Cedarwood- repels clothes moths.
• Citronella- repels mosquitoes, flies and fleas.
• Eucalyptus- repels mites, fleas, mosquitoes, and other insects
• Jojoba- repels clothes moths.
• Linalool- repels mosquitoes, fleas, mites, ticks, and spiders
BIOPESTICIDES
BIOCHEMICAL INSECTICIDES

EXAMPLES OF ATTRACTANTS

• Cinnamaldehyde- attract adult corn rootworms in food crops and ornamentals.
• Citronellol- attracts mites in food crops and ornamentals
• Eugenol and methyl eugenol- attracts Japanese beetles in food crops and ornamentals.
• Geraniol- attract Japanese beetles in fruits, vegetables, and ornamentals.
• Indole- attracts adult corn rootworms in fruits, vegetables and corn for feed and food.
SUFFOCATING AGENTS

Most often these are types of oils that affect various stages of soft-bodied insects such as aphids, thrips, mites, whiteflies, mealybugs, and psyllids.

- They cause suffocation by blocking the respiratory system.
- Some breakdown the cuticle of the mite/insect.
- May penetrate body tissues, causing them to degrade.
- Oils derived from all sources may alter the behavior of insects and mites and may cause them to avoid laying eggs or disrupt their feeding.
- Oils are also widely used to control the egg stage of various mites and insects by preventing the normal exchange of gases through the egg surface or interfering with egg development.
EXAMPLES OF SUFFOCATING AGENTS

- Mineral Oil (registered by the EPA as a suffocating agent).
  - Marketed as Summit Horticultural Spray Oil ®

- Soybean oil (also registered as a suffocating oil).
  - It is used against light-bodied insects on fruits trees, nut trees, evergreens, and woody shrubs e.g., Golden Pest Spray Oil®
DESSICANTS

- Insecticides that have desiccating effect
- Act by disrupting the waxy outer layer of the cuticle and causing water loss resulting in the eventual death of the pest.

Examples include:
- Avachem® Sucrose octanoate and
- Avachem® Sorbitol octanoate
COATINGS

Agents in this category form a nontoxic physical barrier between an insect pest and a leaf surface.

Examples include:
- **Kaolin (e.g., Surround WP®)**
  - Is a natural clay that does not react with other materials and is insoluble in water.
- **Jojoba oil (e.g., Detur ®)**.
  - Is a vegetable oil obtained from the jojoba bean
  - Use in the control of whiteflies.
PHEROMONES

- Volatile chemical attractants that are involved in mate finding in insects particularly moths and beetles.
- Usually male-attracting sex pheromones.
- Synthetic versions of pheromones used effectively in insect pest management programs to:
  - Sample insect populations for surveillance
  - Confuse males, thus reducing fertility
  - Attract and kill males also reducing fertility
- Synthetic pheromones have been developed for Codling moth, oriental fruit moth, peach twig borer, pink bollworm, Japanese beetle etc.
PYRETHRUM

• It is by far the most widely used botanical.

• Is extracted from flower petals of the Chrysanthemum species grown in Kenya, Ecuador, and other countries.

• Pyrethrum is available as a spray concentrate or dust for use on fruit trees, ornamentals, vegetables, and flowers.

• This insecticide breaks down very easily in the presence of sunlight.

• Pyrethrum-treated fruits and other edibles have shorter post-harvest intervals (PHI) compared to conventional insecticides.
D-LIMONENE

- Extracted from citrus peels, constituting about 98% percent orange peel oil by weight.
- Limonene is used against external parasites of pets such as fleas, lice, mites, ticks.
- It has negligible toxicity to warm-blooded animals.
- D-limonene acts on the sensory nerves of the insect’s peripheral nervous system, causing death.
ROtenone (No longer recommended/used)

• Used to be the second most used botanical.
• It is extracted from the roots of legumes, *Derris species* grown in Malaysia and East Indies and *Lonhocarpus species* grown in South America.
• Has been applied as an insecticide since 1848
• Has been applied as a fish poison by South Americans at least since 1649.
• Its use has been discontinued due to toxicity to fish and other aquatic organisms.
RYANIA

• Is extracted from the stem and roots of Ryania speciosa, a shrub grown in Trinidad.
• The active ingredient is an Alkaloid, but has lower toxicity to humans compared to Nicotine.
• Ryania has been used most widely against caterpillars on fruit trees, particularly codling moth, *Cydia pomonella* on apples.
• Ryania is effective against insects such as the European corn borer, Ostrinia nubilalis, on corn and many other insects in home gardens and fruit trees.
• Renapyr ® is a synthetic version of ryania.
SABADILLA

• Is extracted from the seed of *Schloenocaulon officinale*

• Active ingredient is an alkaloid

• Sabadilla has low toxicity to humans but is known to cause eye irritation and sneezing in some individuals.

• It is effective against most garden pests except aphids and mites.
RECAP: EXAMPLES OF “ORGANIC” INSECTICIDES

- Spinosad
- *Bacillus thuringiensis* (Bt)
- Beauveria bassiana
- Viruses
- Parasitic nematodes
- Azadirachtin
- Neem Oil
- Pyrethrins
- Garlic spray
- Vegetable oils and Fish oils
- Insecticidal soaps
- Iron phosphate
- Sulfur
- Kaolin clay
UNSURE ABOUT WHETHER A PRODUCT IS REGISTERED FOR CERTIFIED ORGANIC PRODUCTION?

CHECK THE OMRI WEBSITE

www.omri.org
REFERENCES


3. Integrated Pest Management Resources. Mississippi State University.

   www.ipmnews.msu.edu/vegetable/vegetable/tabid/151/articleType/ArticleView/articleId/222/categoryId/113/Row-covers-for-frost-protection-and-earliness-in-vegetable-production.aspx
