Integrated Pest Management

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Integrated Pest Management

• A strategy to prevent and suppress pests with minimum impact on human health, the environment and non-target organisms.

• Decision-making process that uses regular monitoring to decide if and when treatments are needed to control a pest, then uses a variety of tactics to keep pest numbers low.

Principles of Integrated Pest Management

• Monitor the plants
• Identify the pest organism
• Establish an acceptable injury level
• Manage using all available strategies

Monitor plants

• Look for damage on a regular basis
  – Different times of the day
  – Tools: hand lens, traps, beat sheets
  – Collect samples of damage

• Keep a record of your observations

Identify the pest organism

• Is it a pest problem or a problem caused by a non-living factor (drought, frost, chemical damage, etc.)?

• Is the pest an insect, disease, weed, etc.?

Know the pest

Once the pest is identified, learn about its life cycle and its natural enemies.

Root weevil larva
Root weevil pupa
Root weevil adult
Learn the pest's life cycle

Establish an acceptable injury level
Commercial example:
Action threshold for strawberry root weevil in mint = .92 weevil larvae/square foot

Acceptable Injury Level
For gardeners, this will differ between individuals.

Manage using all available strategies
- Cultural
- Physical
- Biological
- Chemical
  - Use the easiest, least expensive, least disruptive and least toxic ones first

Cultural Methods of Insect Control
Sound gardening practices

Resistant varieties
Crop rotation

Companion planting:
establishment of two or more plant
species in close proximity so that some
benefit is derived

- Trap cropping
- Biochemical pest suppression
- Spatial interactions
- Beneficial habitats
- Security through diversity

Intercropping with insectary plants

Encourage ecological diversity in the garden

Weeding and mulching

Sanitation
Physical Methods of Insect Control

**Barriers: Row Covers**
- Cabbage maggot
- Flea beetle

**Barriers: Sticky barrier**
- Root weevils
- Ants tending aphids

**Barriers: Plant cages and collars**

**Barriers: Copper barrier**
- Brown Garden Snail

**Handpicking**
Watering

Spider mites

Aphids

Pruning

Tent caterpillars

Trapping

Yellow sticky trap

Trapping for fungus gnats

Trapping Slugs and Snails

Trapping Insects Indoors

Codling moth pheromone trap

Apple maggot trap
Vacuuming

Boxelder Bug

Flea

Tilling

Garden symphylan

Biological Methods of Insect Control

Beneficial Organisms

- Pollinators
- Predators
- Parasitoids
- Microbials
  - Bt
  - Beneficial nematodes

Pollinators

European Honey Bee

Bumblebee

Bumblebee
Orchard Mason Bee

Syrphid fly larva

syrphid fly
Green lacewing adult

Green lacewing eggs

Green lacewing larva dining on a caterpillar
Snakefly

Two-spotted stinkbug

Brown Marmorated Stink Bug
Ambush Bug

Adult
Laër
Eggs
Pupa

Ambush Bug

554-8

84-0
Lady beetle larva

Yum! Caterpillar for lunch!

Spider Mite Destroyer
Predaceous spider mite

Violet-green swallow

Yellow Warblers

Domestic Ducks

All bat species in Oregon are insectivores

Common Garter Snake

Toad

Pacific Chorus Frog

Garter Snake
Braconid Wasp

Parasitoid wasp laying eggs in aphid

Aphid mummies

Tachinid fly

Tachinid fly and elm leaf beetle larvae

Encarsia formosa parasitizing white fly
Trichogramma laying eggs in caterpillar eggs

Trichogramma adults emerging from caterpillar eggs

Many insects in the soil are beneficial

Purchasing and Releasing Beneficials

Enhancing habitat for beneficials

- Provide diversity of plants
- Provide insectary plants with small flowers
- Provide adequate water

Springtail

Oribatid mites

Buckwheat

Fennel

Fiddleneck (Phacelia)
Beneficial microorganisms

*Bacillus thuringiensis* or Bt

*B.t. kurstaki* and caterpillars

*B.t. israelensis* and mosquitos

*B.t. san diego* and elm leaf beetle

Beneficial nematodes
Infected root weevil pupa

Infected root weevil adult

Horsehair Worm

• Very low mammalian toxicity
  • Soil must remain moist
  • Soil must be greater than 55 degrees F.

Botanical insecticide: Neem
  • From seeds of the neem tree
  • Broad spectrum against many pests
  • Must be ingested to be toxic
  • Low mammalian toxicity
  • May require repeat applications

Chemical Methods of Insect Control: Botanicals
  • Derived from botanical sources
  • Biodegrade rapidly
  • Widely varying levels of toxicity

Horticultural Oil
  • Derived from petroleum, vegetable or fish oil
  • Smothers insects and mites
  • Works best on soft-bodied insects
  • Low mammalian toxicity
  • Avoid hottest part of day
  • Avoid drought-stressed plants
  • Use commercial products rather than homemade
**Insecticidal Soap**
- Contact insecticide smothers and desiccates insect
- Use against soft-bodied insects like aphids, thrips, whitefly, and mites
- Low mammalian toxicity
- Requires excellent coverage, repeat applications
- Biodegrades rapidly
- Effective only until it dries

**Sulfur**
- Use dust mask with dust product
- Broad spectrum miticide and fungicide
- Low mammalian toxicity
- Do not use within two weeks of an oil spray
- Some plants sensitive to sulfur

**Pheromones**
- Used for mating disruption
- Useful for codling moth management in orchards
- Limited usefulness in backyards

**Synthetic Insecticides**
- Fewer available all the time
- Widely varying toxicity
- Always read and follow label directions
- Dispose of properly

**Other options:**
- Kaolin clay
  - Naturally occurring mineral
  - Film acts as a barrier between pest and fruit
  - Irritates and repels insect feeding and egg-laying
Other options: Repellants

Right plant, right place
Choose plants well adapted to site

Select resistant varieties

Use disease-free plants and seeds

'Development': Not scab resistant

'Development': Scab resistant

'Development': Scab resistant

'Development': Scab resistant
Irrigate properly

Plant properly

Fertilize as needed

Don’t crowd plants

Control insects and weeds
- Insects can vector diseases such as plant viruses
- Weeds can harbor diseases that can be detrimental to desirable plants

Sanitation
- Remove diseased plants and plant parts
Dispose of crop refuse/compost

Sanitation
Prune out diseased wood

Use mulches

Make and use compost

Use fungicides when necessary
- Copper
- Lime sulfur
- Sulfur
- Horticultural oil
- Potassium bicarbonate
- Neem oil

Weed Management
In Oregon, weeds grow like…well, weeds.
Mulching

• Barkdust
• Wood chips
• Gravel or rock
• Cocoa or filbert shells
• Sawdust
• Newspaper or horticultural paper
• Woven fabrics
• Plastic

Hand weeding

Machine weeding

Spacing

Solarization
Cover cropping

Barriers

Herbicides
- Conventional herbicides
- Herbicidal soap
- Vinegar
- Corn gluten meal

Biological control
- Tansy flea beetle
- Cinnabar moth larvae feeding on tansy ragwort

Avoid invasive plants
- Butterfly bush
- English ivy
- Wild Clematis

Principles of Integrated Pest Management - Review
- Monitor the plants
- Identify the pest organism
- Establish an acceptable injury level
- Manage using all available strategies
Choose a Treatment Strategy

- Use easiest, least disruptive, least expensive, least toxic first
- Read the label, read the label, read the label
- If you decide to use any kind of an pesticide, spot treat only and wear protective clothing when applying

Our IPM Mission

- Oregon State University Extension Service encourages sustainable gardening practices. Problems are identified and monitored before acting. Gardeners are encouraged to consider cultural controls; then physical, biological, and chemical controls (which include insecticidal soaps, horticultural oils, botanical insecticides, organic and synthetic pesticides). Least toxic approach is always considered first.

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Soldierfly
Wild Rose Gall