



# Integrated Pest Management

# IPM



# Integrated Pest Management

- Is a method of pest control that includes cultural, physical, biological, and chemical control to control certain pest situations.



# 5 key components of IPM

- Prevent pest problems
- Identifying pests and their ecology
- Regular monitoring of plants and their pests
- Use control action thresholds
- Integrate the use of biological, chemical, cultural, and physical control methods



# Cultural Control Methods

- Crop rotation
- Cover crops
- Sanitation
- Resistant cultivars
- Condition modification
- Reproduction inhibition



# Mechanical Control Methods

- Trapping
- Disking or Field modification
- Mowing



# Physical Control Methods

- Barriers
- Fences
- Environmental Barriers



# Biological Control

- Biological control is any activity of one species that reduces the adverse effects of other species.



# Biological Control Methods

- Natural Enemies
- Predators
- Parasites
- Herbivores
- Competition
- Antibiosis



# Natural Enemies

- Natural enemies are organisms that kill, decrease the productive potential, or otherwise reduce the numbers of another organism.



# Predators

- A predator is an organism that attacks, kills and feeds on several or many other individuals (its Prey) in its lifetime.



# Parasite

- A parasite is an organism that lives and feeds in or on a larger host



# Herbivore

- Herbivores are animals that feed on plants.



# Competition

- Competition occurs when two or more organisms strive to obtain the same limited resources (such as food, water, shelter or light).



# Antibiosis

- Is the opposite of symbiosis, and it means that one organism in interaction with another organism inhibits vital activities for the sustaining of life.



# Chemical Control

- Primarily institutes the use of pesticides
- Pesticides must be used properly



# Effective Use of Pesticides

- Pest detection and monitoring
- Making pesticide use decisions
- Selecting the right pesticide
- Selective pesticides
- The selective use of pesticides
- Keeping the pesticide on target
- Follow-up monitoring



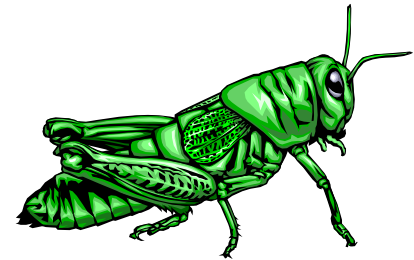
# Plant Detection & Monitoring

## ■ Correct Identification

- Pest's life stages, and seasonal changes
- Pest's habits
- Proper pesticide use, and timing of applications
- When, where, and how to apply it
- Monitoring program to assess effectiveness

# Predicting Problems Early

- Review past history, for expectations
- Conditions that favor pest build up
- Look for food & water supply issues
- Collect samples if not identified
- Carefully handle specimens
- Monitor beneficials





# Life History Information

- Where to look for nesting situations
- Pests food preferences
- Types of natural enemies occurring
- The pests seasonal occurrences or life cycle
- Plan pesticide applications accordingly

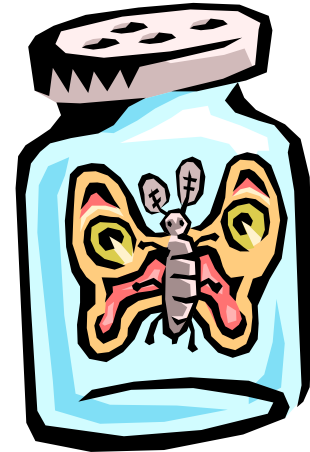


# Monitoring Program

- Provides the following information:
  - Pest densities
  - Life stages
  - Species compositions
- It also allows you to apply chemicals based upon situations and not as the “shotgun” method

# Visual Inspection

- The following are visual indicators of pests
  - Seeds
  - Weed remains from the previous season
  - Animal burrows
  - Tracks
  - Fecal droppings
  - Webbing
  - Insect or mite eggs



# Equipment Used in Monitoring

- Hand lens preference types are 10x to 16x power
- Insect net types include aerial net, beating net, aquatic net
- Beating tray used on large trees and shrubs
- Pheromone traps species specific
- Light traps useful in indoor and enclosed areas
- Animal traps types include live traps, spring traps, and sticky traps
- Pitfall traps used in landscape and nursery areas
- Other traps lure traps, color and shapes
- Pyrethrum test turf detection of cutworms, forces to soil surface
- Microscope used for close monitoring of tiny pests
- Binoculars used for bird and vertebrate pests
- Tracking powder used on the floor to monitor for crawling pests
- Containers to hold samples
- Knife strong and sharp
- Shovel always clean between uses
- Ice chest keep samples fresh
- Identification aids good ones are hard to find

# Weeds

- What species are present
  - Monitor in late fall early winter fro annuals
  - Keep a record and map of infestations
  - Look at adjacent areas for weed sources
- The stage of development
  - (seedling, flowering, post flowering)
- Whether the abundance of different species are changing from the previous year



# Herbicide Use Decision Factors

- Favorable weather conditions
- Weed species
- Growth stages of problem weeds
- Growth stage of crops involved
- Amount of damage caused by weeds
- Resistance of certain weeds to herbicides
- Soil types and conditions
- Herbicide persistence in the soil
- Economics of chemical versus mechanical control

# Nematodes

- Management has to occur before plants are in the ground.
- Take soil samples in fall for winter and spring plantings.
- Check susceptible plants for simple identification.
- Sample soil in a long continuous strip, also look for stunted or damaged plants.

# Pathogens

- Monitor pathogens by observing plant symptoms or damage.
  - Do symptoms occur only in scattered plants?
  - Are symptoms concentrated in parts of the field?
  - Are symptoms generally distributed?
- Monitor for the presence of insects or other vectors that can transmit certain pathogens.
- Collect samples and send for I.D. if necessary.

# Arthropods

- Visual monitoring of plant foliage with a lens.
- Using a sweep net on certain plants is optional but be careful of tender plants.
- Beating trays are used on shrubs and trees.
- Use economic thresholds for control decisions.
- Light traps attract night flying insects.
- Sticky traps are used in conjunction with pheromones, or simply colored sticky traps. Also some sticky traps are used on floors to identify crawling insects.
- Use phenology models to accurately predict egg hatches. [www.ipm.ucdavis.edu](http://www.ipm.ucdavis.edu)



# Vertebrate Pests

- Monitor for evidence of their presence.
  - Burrows, feces, tracks, traps



# Making Pesticide Use Decisions

- Health codes require control
- Persons tolerance levels
- Action thresholds
- Environmental conditions
- Suppression indicators are
  - Inoculum sources
  - Favorable conditions for development
  - History of disease infection



# Factors Influencing Pesticide Use

- Potential for air pollution and groundwater contamination.
- Protecting endangered species
- Handler, packer, processor restrictions
- Handler training costs
- Requirements to protect workers
- Compatibility of REI and PHI
- Limitations imposed by plant-back restrictions.



# Selecting the Right Pesticide

- Pesticide label books
- Farm advisors and Ag commissioners
- PCA's
- UC publications, treatment guides, PMG's
- [www.ipm.ucdavis.edu/PMG](http://www.ipm.ucdavis.edu/PMG)

# Pesticide Persistence

- Affects residues, off-target movement, and longevity of AI
- Persistence is it's half life
- WP have a longer persistence than EC's
- pH if high, breaks down chemicals quickly
- Porous surfaces increase persistence
- Soil microorganisms break down chemicals

# Cost and Efficacy of Pesticides

- Cost of product does not equal efficacy
- Cost per lb. AI /cost per unit area treated
- Weather conditions affect efficacy
- Pest susceptibility
- Damage to natural enemies
- Compromises are often made and personal experience often needs to be valued.



# Other Factors to Consider

- Ease of use and compatibility with other materials.
- Effects on beneficial insects and natural enemies.
- Restricted- entry intervals and harvest limitations.

# Selective Pesticides

- Refers to a range of organisms affected by a pesticide. Controlled by factors:
  - The penetration rate through an organism's outer body covering (or the cuticle of plant tissue)
  - The speed at which the toxicant is excreted by organisms
  - How the toxicant binds to tissues of different organisms



# The Selective Use of Pesticides

- Application timing
- Application techniques
- Dosage levels
- Types of formulations
- Adjuvants
- Ability to keep the pesticide on target



# Important Application Techniques

- Equipment operation
- Preventing gaps or overlaps
- Spot treatments
- Band Treatments
- Treating alternate rows or blocks
- Low-volume applications
- Pesticide dosage level
- Type of formulation used
- Adjuvants



# Keep the Pesticide on Target

- Skill of the operator
- Application equipment used
- Droplet size of the spray being used
- Operating pressure of the sprayer
- Physical properties of the pesticide formulation
- General weather conditions
- Unique local weather conditions (microclimates)

# Follow-Up Monitoring

## ■ Amount of pesticide used:

1. Calculated amount required for job: \_\_\_\_\_
2. Actual amount used: \_\_\_\_\_
3. Variation – divide (1) by (2) then multiply by 100. Subtract answer from 100 (this should be between +10 and -10) \_\_\_\_\_

## ■ Coverage:

1. Uniform \_\_\_\_\_, or uneven \_\_\_\_\_
2. Runoff? \_\_\_\_\_, Penetration into all areas? \_\_\_\_\_

## ■ Effectiveness:

1. Target pests controlled or reduced below economic injury level? \_\_\_
2. Condition of natural enemies: \_\_\_\_\_, Secondary pest outbreak? \_\_\_

## ■ Problems:

1. Spotting of plants? \_\_\_\_\_, Injury to plants? \_\_\_\_\_, Other? \_\_\_\_\_



# Definitions



# Allelopathy

- The ability of a plant species to produce substances that are toxic to certain other plants.



# Bacterium

- A single celled, microscopic, plantlike organism that does not produce chlorophyll.
- Most bacteria obtain their nitrogen and energy from organic matter.
- Some bacteria cause plant or animal diseases.



# Broad-spectrum & selective pesticides

- Broad spectrum is a pesticide that is toxic to many different species.
- Selective pesticides are toxic to a target pest and won't harm other plants or organisms.

# Canker

- A dead and discolored, often sunken area (lesion) on the stem, branch, or twig of a plant.



# Cotyledons

- Leaves formed within the seed and present on seedlings immediately after germination. They generally appear different from the leaves of the mature plant.

# Crown

- The point at or just below the soil surface where the main stem (trunk) and roots join.

# Degree-Day

- A unit combining temperature and time used in monitoring growth and development of organisms.



# Dormant

- To become inactive during winter or periods of cold.
- Dormant sprays are applied when the trees are in this condition.



# Frass

- Solid Fecal material produced by insects.

# Fungus

- A multicellular lower plant lacking chlorophyll, such as mold, mildew, smut, or rust. The body consists of filamentous strands called Mycellium, and reproduces by way of spores.
- Fungicide is a pesticide used to control the fungus or fungi.

# Gall

- A localized swelling or outgrowth of plant tissue often formed in response to the action of a pathogen or other pest.

# Girdled

- Having a ring of dead or damaged tissue around the stem or root; girdling usually kills the plant.



# Host

- A plant or animal that provides sustenance for other organisms.



# Instar

- The period between molts in larvae of insects. Most larvae pass through several instars.



# Larva

- The immature form of insects that develop through the process of complete metamorphosis including egg, several larval stages, pupa, and adult.

# Ligule

- In many grasses, a short membranous projection on the inner side of the leaf blade at the junction where the leaf blade and leaf sheath meet.



# Molt

- The periodic formation of a new cuticle or outer skin in insects and other arthropods, followed by the shedding of old skin before entering another stage of growth.



# Mycorrhizae

- Beneficial associations between plant roots and fungi.

# Nymphs

- Immature forms of insects that go through gradual metamorphosis with no pupal stage; also the immature forms of mites after the first larval stage.

# Organic vs Inorganic

- Organic is a material whose molecules contain primarily Carbon and Hydrogen atoms. Meaning without the use of synthetic fertilizers or pesticides.
- Inorganic contains no carbon. Generally indicates materials that are of mineral origin.

# Perennial vs Annual

- A plant that lives longer than two years, and some may live indefinitely. (Perennial)
- A plant that normally completes its life cycle of seed germination, vegetative growth, reproduction, and death in a single year. (Annual)

# Pesticide

- Any substance or mixture intended for preventing, destroying, repelling, killing, or mitigating problems caused by insects, rodents, weeds, nematodes, fungi, or other pests; and any other substance or mixture intended for use as a plant growth regulator, defoliant, or desiccant.



# Pheromone

- A chemical produced by an animal to attract other animals of the same species.



# Photosynthesis

- The process by which plants convert sunlight into energy.

# Pupa

- The non-feeding, usually immobile stage between larva and adult stages in insects that undergo complete metamorphosis.

# Rhizome, Stolon and Tuber

- Rhizome is a horizontal underground stem, especially one that forms roots at the nodes to produce new plants.
- Stolon is an aboveground runner or rooting structure found in some plants.
- A tuber is a much enlarged fleshy underground stem.



# Sclerotium

- A firm compact mass of mycelium that serves as a dormant stage for some fungi.

# Solarization

- The practice of heating up the soil to levels lethal to pests through application of clear plastic to the soil surface for 4 to 6 weeks during warm, sunny weather.

# Spore

- A reproductive structure produced by some plants and microorganisms that is resistant to environmental influences.



# Systemic, Pre-emergent & Post-emergent

- Systemic means to be taken up into the plant tissue and translocate throughout to control weeds.
- Pre-emergents are applied to the soil and interfere with the germination of weeds.
- Post-emergents are applied after germination and kill on contact.



# Virus

- A submicroscopic particle that can reproduce only within the living cells of other organisms; some are capable of producing disease symptoms.

# Scientific Nomenclature (convergent lady beetle)

- Kingdom: Animalia (animals)

Class: Insecta (insects)

Order: Coleoptera (beetles)

Family: Coccinellidae (lady  
beetles)

Genus: Hippodamia

Species: Convergens