Integrated Pest Management for School Gardens

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Growing Garden Educators Conference

10/11/2025

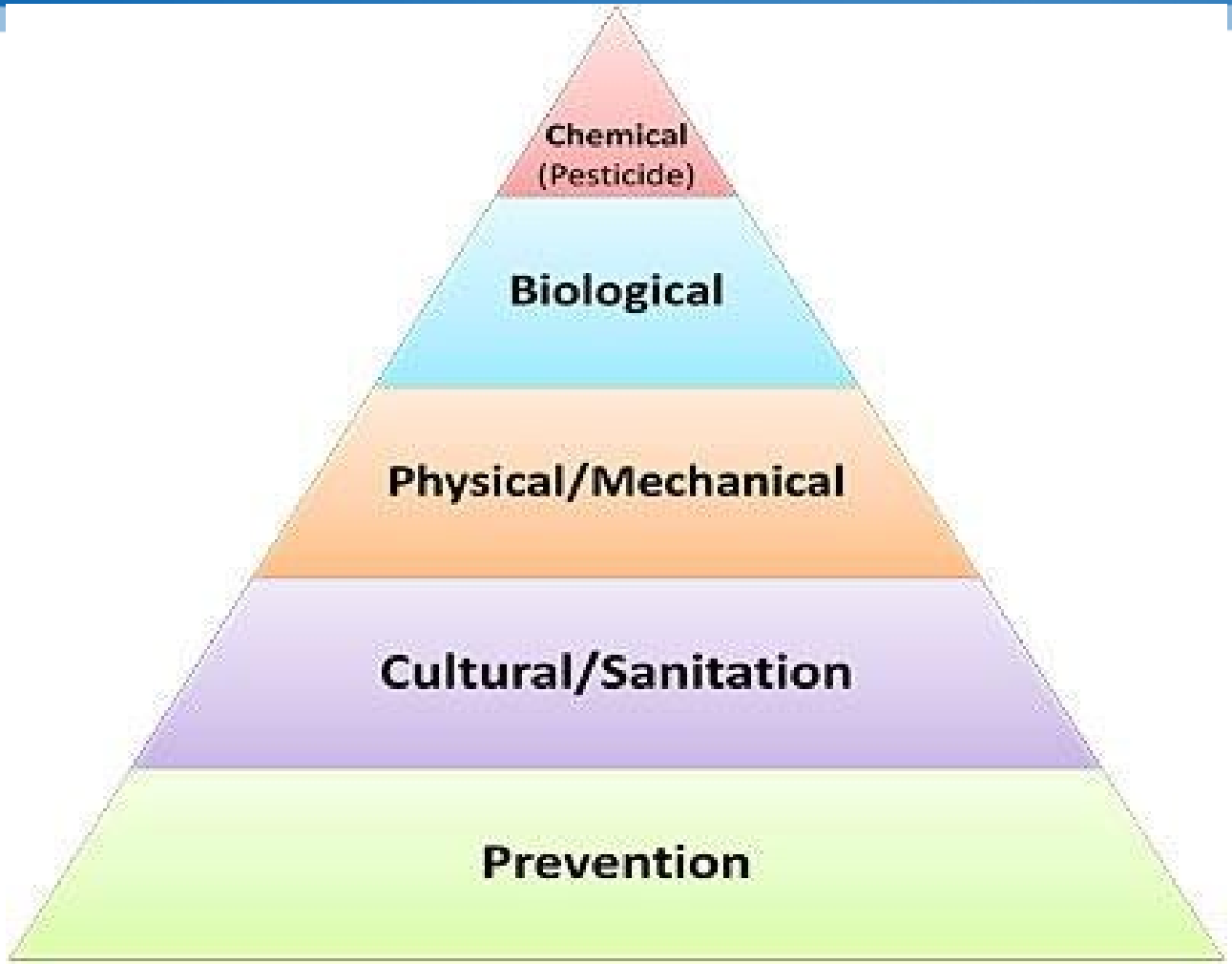
UNIVERSITY OF CALIFORNIA
Agriculture and Natural Resources
UC Master Gardener Program

MASTER GARDENER ASSOCIATION
of San Diego County

What is Integrated Pest Management (IPM)?

- Definition: IPM is an ecosystem-based strategy that focuses on long-term prevention of pests or their damage through a combination of techniques such as biological control, habitat manipulation, modification of cultural practices, and use of resistant varieties.

What is Integrated Pest Management (IPM)?



https://www.pesticide.org/five_steps_of_ipm

Why IPM is Important in Schools

- Protecting student health (reduced pesticide exposure)
- Creating a safe learning environment
- Encouraging biodiversity and sustainability
- Compliance with state/local school pest policies

Photo: Meredith French, MGASDC

Core Principles of IPM

1. Pest identification
2. Monitoring and assessing pest numbers and damage
3. Guidelines for when management action is needed
4. Preventing pest problems
5. Using a combination of biological, cultural, physical/mechanical and chemical management tools
6. After action is taken, assessing the effect of pest management

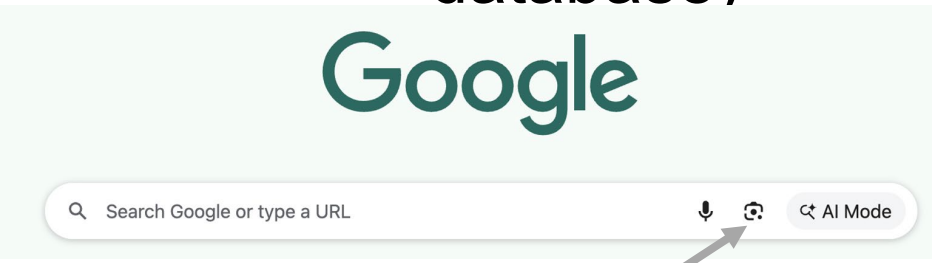
Step 1: Pest Identification

- Correct ID matters: different pests = different control methods, and different tolerance levels
- Using field guides, photos, or extension service resources
- Common school garden pests (aphids, mealybug, caterpillars, whitefly)

Photos: Jack Kelly Clark, UC IPM Program

Help with ID?

- Use your phone!
  - Google image search is a good place to start.
  - Check and double check your results at:
    - UC IPM
    - bugguide.net (Online knowledge photo gallery and forum, Iowa State University)
    - inaturalist.org (self-identification online database)



BugGuide

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Steps in Diagnosing Plant Problems

- What is the plant?
- How has it been cared for, soil type, chemical applications?
- What symptoms and signs can you see?
- Microscopic Exam?
- Do you need more tests?

Symptoms of Viral Infection

- None/Symptomless
- Mosaic or Mottle
- Leaf Spots
- Stunting/Yield Loss
- Deformation
- Death

All photos: UC IPM

Causes of Diseases - Abiotic Agents

- Abiotic factors - noninfectious source such as environmental stress, nutrient deficiency, mechanical damage, air pollution.

Photo: Penn State Extension (Odema), UC IPM (Zinc deficiency and round up damage)

Causes of Disease - Biotic Agents

- living organisms that can multiply and spread, such as viroids, viruses, bacteria, fungi, and nematodes




Tomato leaf curl

Scorch

HLB

Downy Mildew (fungi)

phytophthora; root rot

Photos: Backbonevalley Nursery (tomato), UC IPM

Is it an Insect or is it a Pathogen?

Step 2: Monitoring

- Check plants at least once a week
- Look for signs of damage: chewed leaves, sticky residue, discoloration
- Have students help with a pest log/garden journal

Step 3: Establish Thresholds

- Establish thresholds by regularly monitoring plants in a consistent and systematic manner.
- Keep good records and judge the acceptability of the fruit or vegetable in comparison with records of pest monitoring and management action.
- Experiment over time to develop thresholds appropriate for your situation. Be flexible in adjusting thresholds and adapt monitoring and management methods as appropriate.

Step 3: Establish Thresholds

Thresholds should be quantitative or numerical to be useful. For example, thresholds could be based on the

- average number of pests per trap each week
- percent of leaves or plants found to be damaged or infested during visual inspection
- number of pests dislodged per beat or shake sample

Step 3: Establish Thresholds

Photo 1: NapaCounty.gov; photo 2: UC IPM

Step 4: Prevention

- Choose pest-resistant plant varieties
  - look for resistance codes on plant tags and seed packets.
- Some common codes are:
  - A | Anthracnose | Fungus
  - BMV | Bean Mosaic Virus (Bean)
  - CMV | Cucumber Mosaic Virus (Cucurbitaceae)
  - DM | Downy Mildew | Water Mold
  - F | Fusarium Wilt | Fungus
  - LMV | Lettuce Mosaic Virus (Lettuce)
  - N | Roundworm | Nematode | *Meloidogyne arenaria, M. incognita, M. javanica* (Tomato)
  - PM | Powdery Mildew | Fungus
  - R | Common Rust | Fungus
  - TMV | Tobacco Mosaic Virus (Solanaceae)
  - V | Verticillium Wilt | Fungal | *Verticillium albo–atrum* and other *V. spp.* (Potato, Tomato)

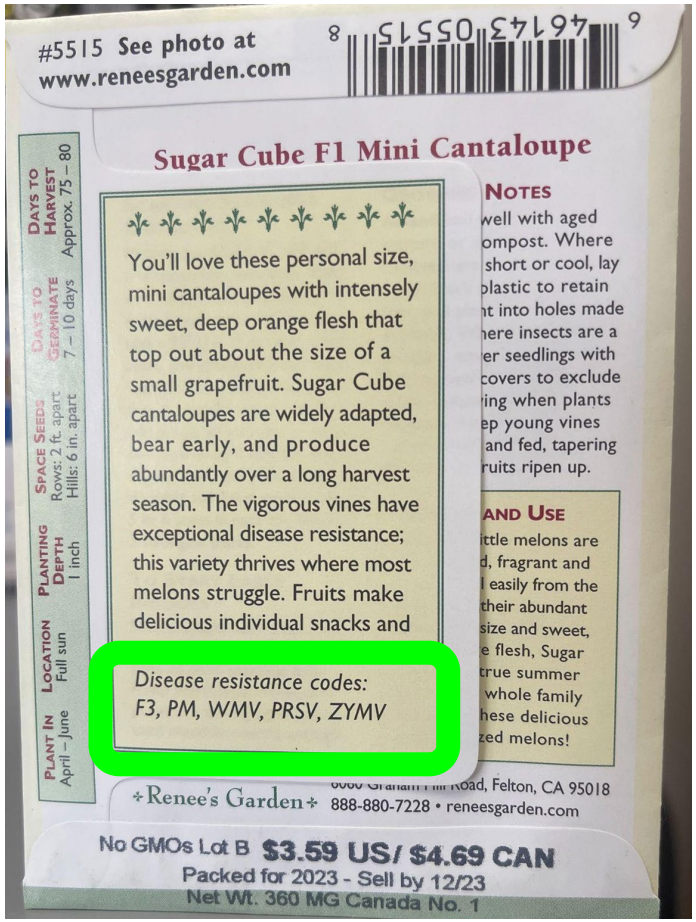

Photo: Leah Taylor

Step 4: Prevention Continued

Lady beetles, or lady bugs, and their larvae are commonly seen predators of aphids and other small insects. Shown here is the adult (left), larva (center), and cluster of eggs (right) of the convergent lady beetle.

Photo: UC IPM

Pirate bugs attack mites and any tiny insect, especially thrips.

Praying mantids eat anything they can catch, including pests and other natural enemies.

Spiders, including this crab spider, attack all types of insects.

Western predatory mites attack pest mites.

Encourage beneficial insects, and know how to ID all life stages

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Step 4: Prevention Continued

- Maintain healthy soil and proper watering
- Keep gardens weed-free and debris-free

University of Sydney

Step 5: Control Methods

Cultural controls – Crop rotation, plant spacing

Mechanical controls – Handpicking, barriers, traps

Biological controls – Ladybugs, lacewings

Chemical controls – Only if necessary, lowest toxicity, follow rules

Photos: TheSpruce.com; Leah Taylor, UC IPM

Step 5: Cultural Control

Cultural controls – Crop rotation, plant spacing, don't overwater, don't over fertilize, proper pruning.

Sanitation, sanitation, sanitation.

Put the right plant, in the right place!

Photos: TheSpruce.com

Step 5: Mechanical Control

Mechanical controls – Handpicking, barriers, traps, high pressure hose (water wand), insect vacuums.

Photos: Leah Taylor, UC IPM

Step 5: Biological Control

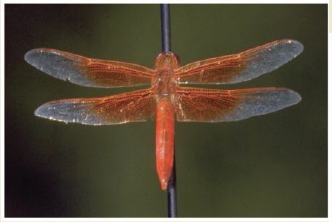


Green lacewing adults (left) feed on nectar and pollen, with only certain species also eating insects. Their **larvae** (center) feed on mites and soft-bodied insects, especially aphids. **Eggs** (right) are laid on slender stalks in groups or individually.


Predaceous ground beetle adults (left) hunt soil-dwelling insects such as cutworms and root maggots. Some also feed on snails and slugs. Their **larvae** (right) live on soil and in litter, feeding on almost any invertebrate.

Assassin bugs attack mostly small to medium-sized insects.

Damsel bugs feed on a wide variety of small insects.



Dragonflies eat other flying insects such as moths, midges, and mosquitoes, capturing them in mid-air.


Syrphid fly (flower fly, hover fly) adults (left) eat pollen and nectar. Their **larvae** (right) mostly eat aphids but also other soft-bodied insects like psyllids.

Predatory wasps, such as this paper wasp, prey on caterpillars and other insects.

Sixspotted thrips mostly feed on mites.

Soldier beetle adults mostly eat aphids. Their larvae are soil-dwelling and often feed on small insects.

Photo: UC IPM

Step 5: Biological Control Cont.

Parasites and Parasitoids

A parasite is an organism that lives and feeds in or on a host. Unlike true parasites (fleas and ticks for example), parasitoids kill their hosts. Nearly all insect pests have at least one parasitoid that attacks them. Most parasitoids are wasps or flies and are often very small.

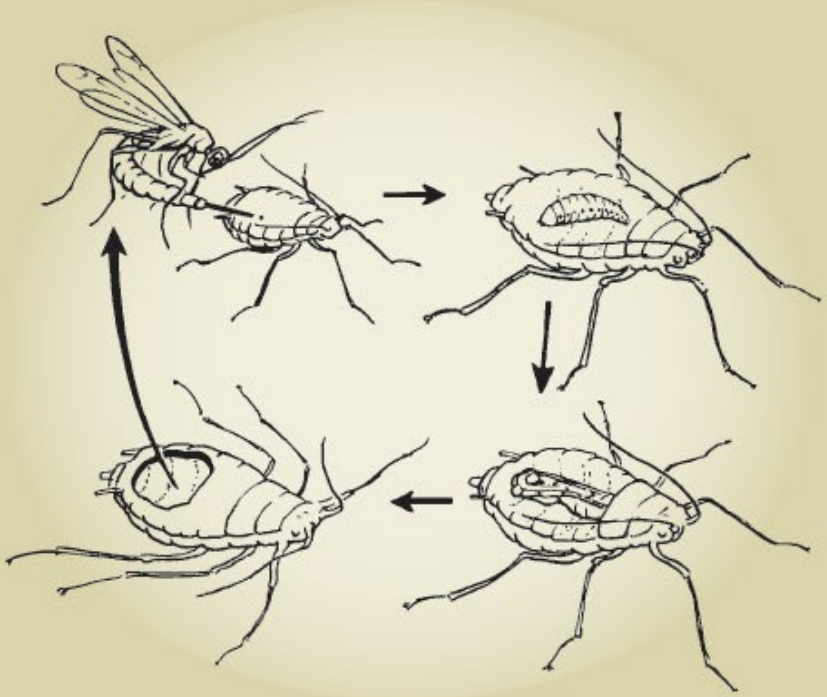
Stink bug egg parasitoid
Some parasitoids attack insect eggs, such as this *Trissolcus* wasp.

Parasitized scales on twig
The blackish scale insects on the twig at left are discolored because they have been parasitized, and wasp larvae are developing within.

Caterpillar parasitoid
Caterpillar parasitoids include the *Hyposoter exiguae* wasp.

Photo: UC IPM

Aphid parasitoid life cycle



The adult female wasp lays an egg inside an aphid; the egg hatches into a larva that feeds on the aphid from the inside. After killing the aphid, the wasp larva pupates then emerges as an adult wasp.

Mummy and healthy aphid
Parasitized aphids die and turn into crusty "mummies" that can be black or beige. The hole in the mummy at left indicates a parasitoid has emerged. The aphid in the middle is healthy.

Photo: UC IPM

More on Chemical Control

- What is a Pesticide?

<u>The word “Pesticide” comes from:</u>

“Pestis” which means “plague” or “pest”

“-cide” which meaning “to kill” or “to cut down”

Pesticide = A thing that kills pests

So… what is a “Pest”?

Pests also include organisms that impact human or animal health.

Pests may transmit disease or may be just a nuisance.

Pests are living organisms that damage or interfere with desirable plants or damage homes or other structures.

Photo: Leah Taylor

A Pest can be a…

All photos: UC IPM

Plant (weed)

Vertebrate (bird, rodent, or other mammal)

Invertebrate (insect, tick, mite, or snail)

Nematode (microscopic wireworm)

Pathogen (bacteria, virus, or fungus) that causes disease

Other unwanted organism that may harm water quality, animal life, or other parts of the ecosystem

Pesticide Definition:

This includes a wide range of materials, such as insecticides, herbicides, fungicides, rodenticides, and other pesticides, even dish soap.

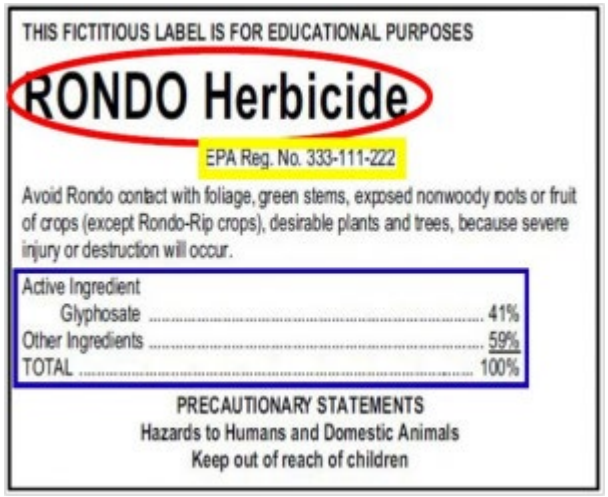
If a substance is intended to, or used to, manage pests, it's considered a pesticide.

A pesticide is any substance or mixture used to control, prevent, kill, suppress, or repel pests.

Reading a Pesticide Label:

Reading the pesticide label is critical before using a pesticide in the garden.

Pesticide labels contain important information that should be read, understood, and followed before applying a pesticide.


THIS FICTITIOUS LABEL IS FOR EDUCATIONAL PURPOSES

RONDO Herbicide

EPA Reg. No. 333-111-222

Avoid Rondo contact with foliage, green stems, exposed nonwoody roots or fruit of crops (except Rondo-Rip crops), desirable plants and trees, because severe injury or destruction will occur.

Active Ingredient	
Glyphosate	41%
Other Ingredients	59%
TOTAL	100%

PRECAUTIONARY STATEMENTS
Hazards to Humans and Domestic Animals
Keep out of reach of children

https://pesticidestewardship.org/homeowner/how-to-read-the-label/

Pesticide labels include the

- trade name,
- active ingredients,
- signal word,
- instructions for use, disposal, and safety.

Reading a Pesticide Label: Active Ingredient

- The active ingredient is the material that kills or otherwise affects the target pest.
- Active ingredients are required to be listed on a pesticide label.
- Inert (or “other”) ingredients are added to the formulation to help the active ingredient work better but may not appear on the label.
- Inert ingredients aren’t required to be listed unless they’re hazardous.

Reading a Pesticide Label: Trade Name

- The trade name is the brand name the manufacturer gives to the product, such as Sluggo or Sevin Insect Killer.
- Trade names of individual products often change and don't reliably indicate the ingredients. Always check the label before purchase to be certain it is the pesticide you want

Common name (Example trade name)	Mode of Action[1]	Selectivity[2] (affected groups)	Predatory Mites[3]	General Predators[4]
abamectin (Agri-Mek)	6	moderate (mites, leafminers)	H	L

Reading a Pesticide Label: Signal Words

- Signal words indicate the short-term (acute) toxicity of the product to humans and other mammals. They are based on the overall oral, dermal, or inhalation toxicity and skin or eye irritation of the pesticide's active and inert ingredients.
- Signal words are CAUTION, WARNING, or DANGER (in order of increasing toxicity).
- Pesticide labels must list the appropriate signal word, although products with very low acute toxicity may not have a signal word.

Reading a Pesticide Label:

To read the whole label, you may need to peel open the attached packet.

- Directions for use: how and where the product can be used, target pests, and how much should be used.
- Precautionary statements: physical and chemical hazards, personal protective equipment requirements, and toxicity to honeybees, fish, birds, and other wildlife.
- Storage and disposal: storage requirements and how to safely dispose of empty pesticide containers. Pesticides should always be kept in their original containers.
- First aid instructions: specific directions on what to do in case of pesticide exposure.

What Happens if you Don't Follow the Label?

- Plants may be injured (pesticide burn or drift).
- Product may not effectively manage the pest.
- Nontarget organisms may be harmed
  - (humans, wildlife, pollinators).
- Soil, air, or water may become polluted.

Photo: UC IPM

Special Safety Considerations in School

No student handling of pesticides

Notification requirements for parents/staff

Storage and disposal regulations

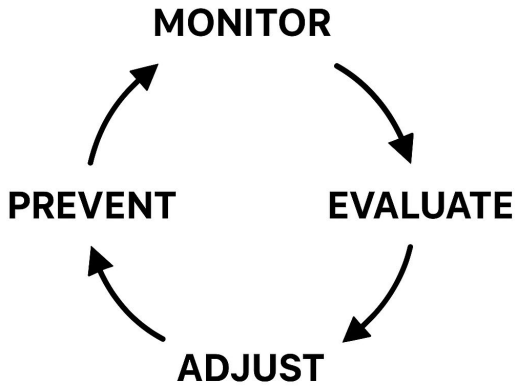
Use only approved, school-compliant products

- California Healthy Schools Act
- California Pesticide Information Portal

Know when to call a professional

Step 6: CHECK AND CHECK AGAIN

- Monitor pest levels after treatment
- Compare results to your thresholds
- Record observations and outcomes
- Adjust methods if problems persist
- Reassess prevention practices



Involving Students in IPM

- Observation & monitoring activities
- Bug ID projects and “pest detectives”
- Plant health journals
- Garden clean-up days

Photo: Leah Taylor

Benefits Beyond Pest Control

Photo: Leta Bender, MGASDC

- Hands-on science learning
- Environmental stewardship
- Encouraging problem-solving skills
- Healthier, more productive gardens

Local and Online Resources

County Cooperative Extension Office

University IPM programs (UC IPM, etc.)

School garden consultant

Online pest ID guides

Summary

IPM = Prevent, Monitor, Identify, Control, Assess

Keep kids safe while protecting the garden

Simple steps, and consistency, can make a big difference

Questions?

- Have you faced any challenges?

- Can you share solutions with each other?

Contact me!

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858-822-6910

Help@MasterGardenerSD.org