

The background is a blue gradient with a wavy line separating a darker blue top section from a lighter blue bottom section. The text is centered in the lighter blue section.

**MASTER GARDENER
WATER QUALITY
TRAINING MODULE #5**

IPM – LEAST TOXIC PESTICIDE ALTERNATIVES

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UCCE Orange County

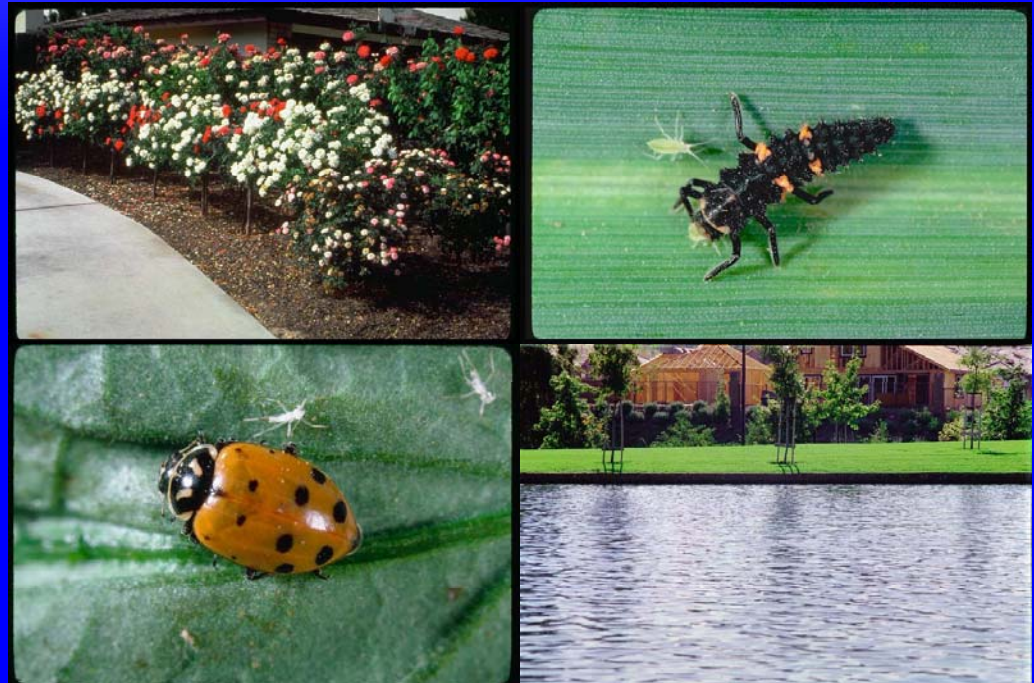
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Program Coordinator

UC Davis Plant Sciences

Introduction

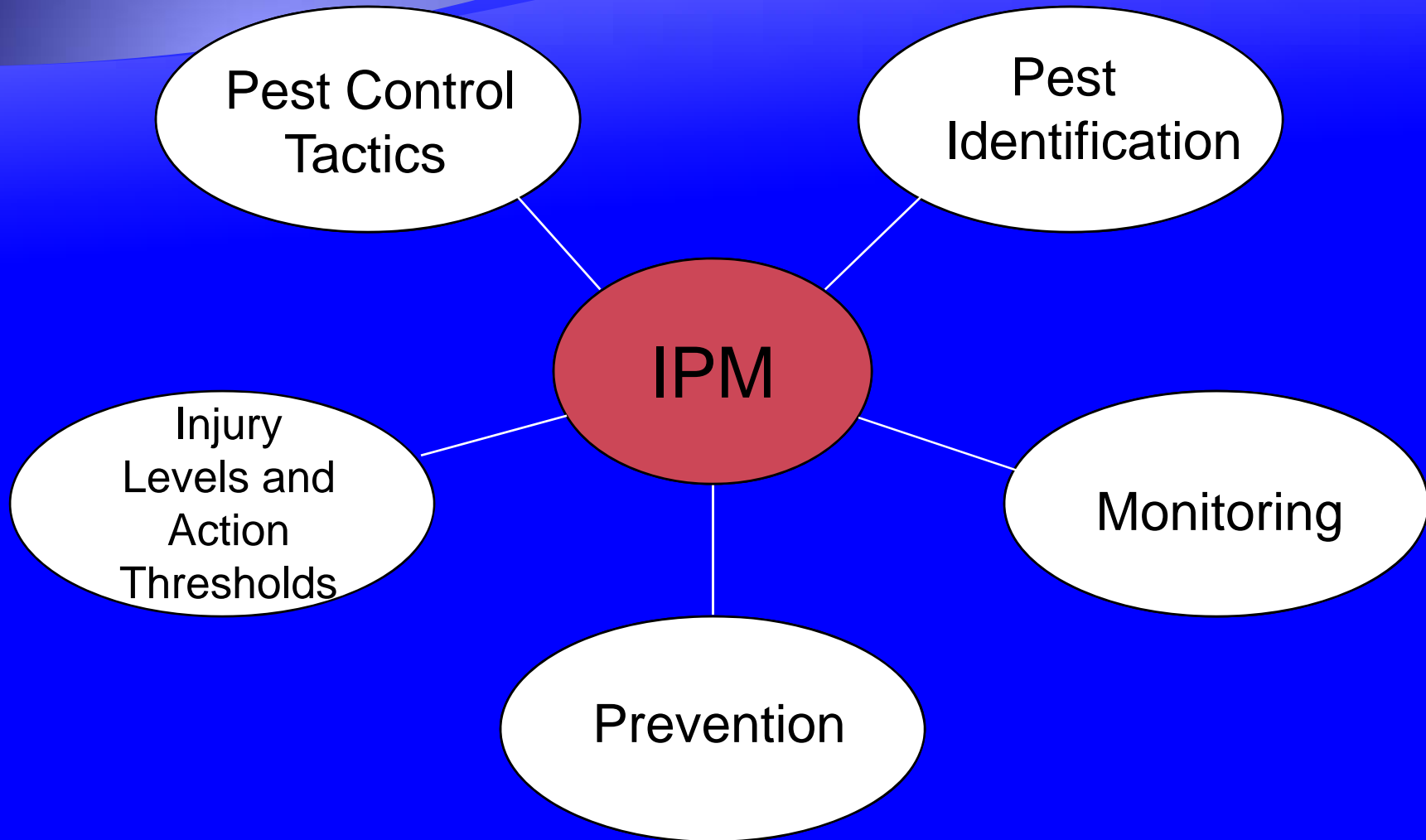
- ◆ Classic pest control versus integrated pest management
- ◆ Components of IPM
 - ◆ Role of pesticides in IPM.
- ◆ Available IPM resources



Advantages and Disadvantages of a Pesticide-Based Program Versus an IPM-Based Pest Control Program.

| <u>Pesticide Based Pest Control</u> | | <u>IPM Based Pest Control</u> | |
|---|--|--|---|
| <u>Advantages</u> | <u>Disadvantages</u> | <u>Advantages</u> | <u>Disadvantages</u> |
| Quick suppression of pests. | Loss of natural controls. | Long-term control. | Training is required to identify pests and natural enemies. |
| Spraying is quick and easy | Not long-term. | Safer to the environment. | Must have knowledge of pesticides and their effects on other organisms. |
| Not much preparation or follow-up needed. | More pesticides in environment. | Pesticides can be used (only used as last resort). | Must maintain a record-keeping system. |
| | Contamination of waterbodies from runoff. | Reduces disruption of natural enemies. | Must scout regularly. |
| | Pesticide safety for applicators, public, animals. | Reduces contamination from runoff. | Labor is required for monitoring. |
| | Often get outbreaks of other pests. | Less exposure to pesticides. | |
| | | Can be proactive in pest control actions. | |

Components of an IPM Program



Key Terms

- ◆ Integrated Pest Management
 - ◆ a strategy to prevent and suppress pest problems with minimum adverse impacts on human health, the environment, and nontarget organisms.

Prevention

- Vital component of IPM program.
- Importance of landscape design.
 - Choice of plant species.
- Planting Practices
- Maintenance Practices
 - Irrigation
 - Fertilization
 - Cleanliness
 - Building maintenance



Pest Identification



- Essential for choosing the correct pest control tactic(s).
- Verify the cause of the damage.
- Eliminate abiotic factors as the cause.

Pest Identification

**DO NOT HESITATE TO
SEEK HELP FOR
IDENTIFICATION OF
PESTS!**



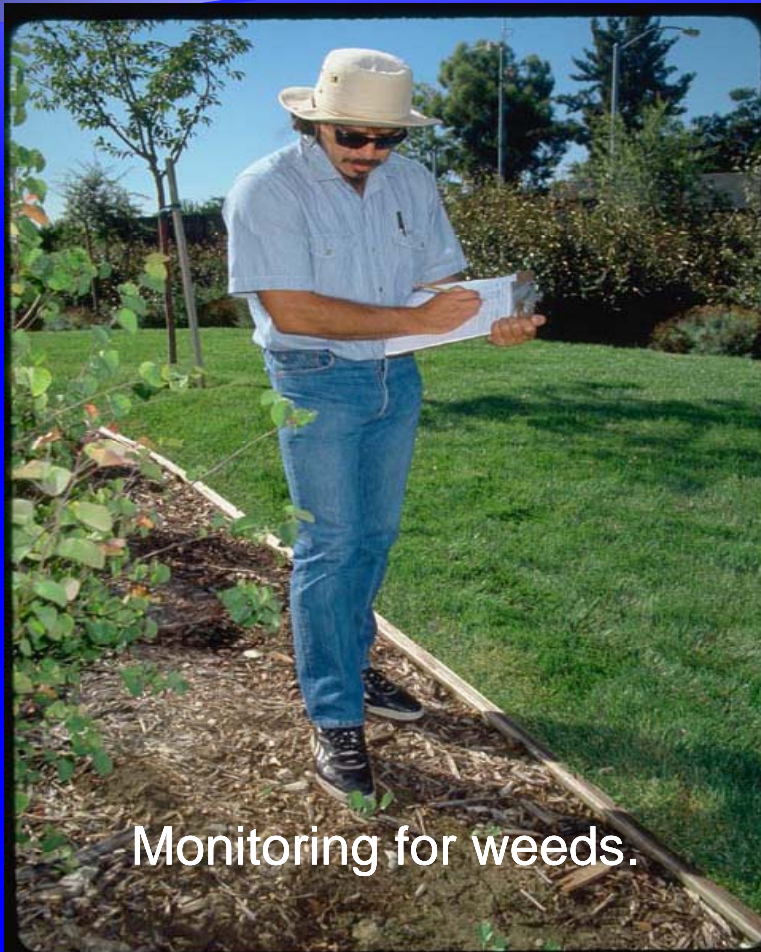
**COOPERATIVE EXTENSION
UNIVERSITY OF CALIFORNIA**

**UC STATEWIDE IPM
PROGRAM**

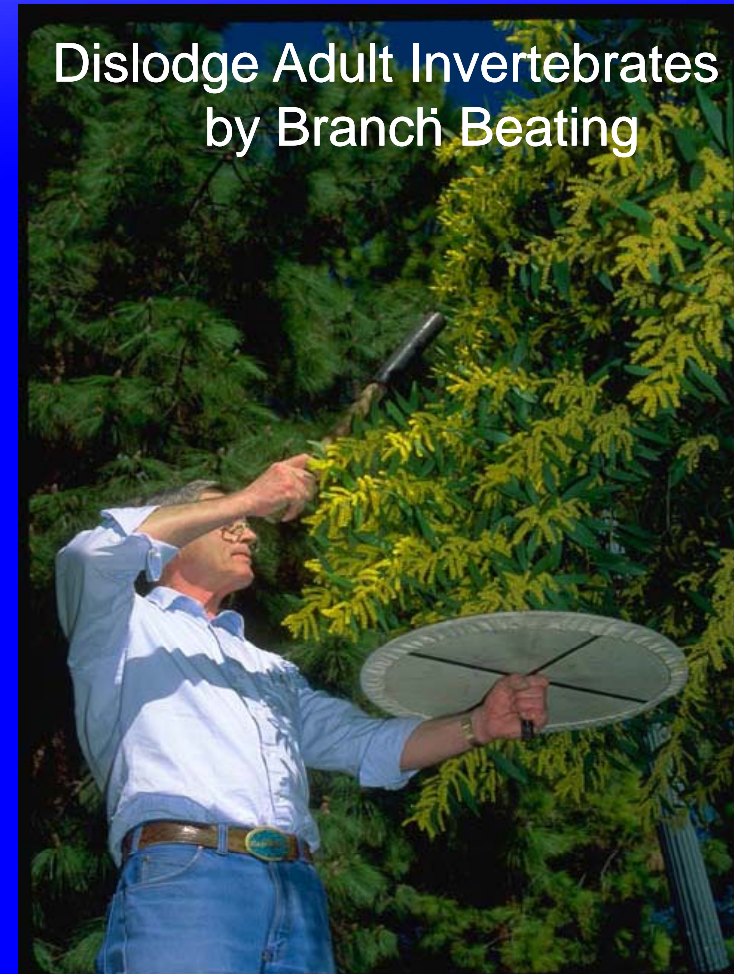
COUNTY AGRICULTURAL COMMISSIONER



Monitoring



Monitoring for weeds.



Dislodge Adult Invertebrates
by Branch Beating

Scouting

- Keep records of:
 - Pest problems,
 - Population trends,
 - Success of suppression techniques.
- Provides a method of anticipating seasonal infestations.
- Provide this info to homeowners in HOA newsletters

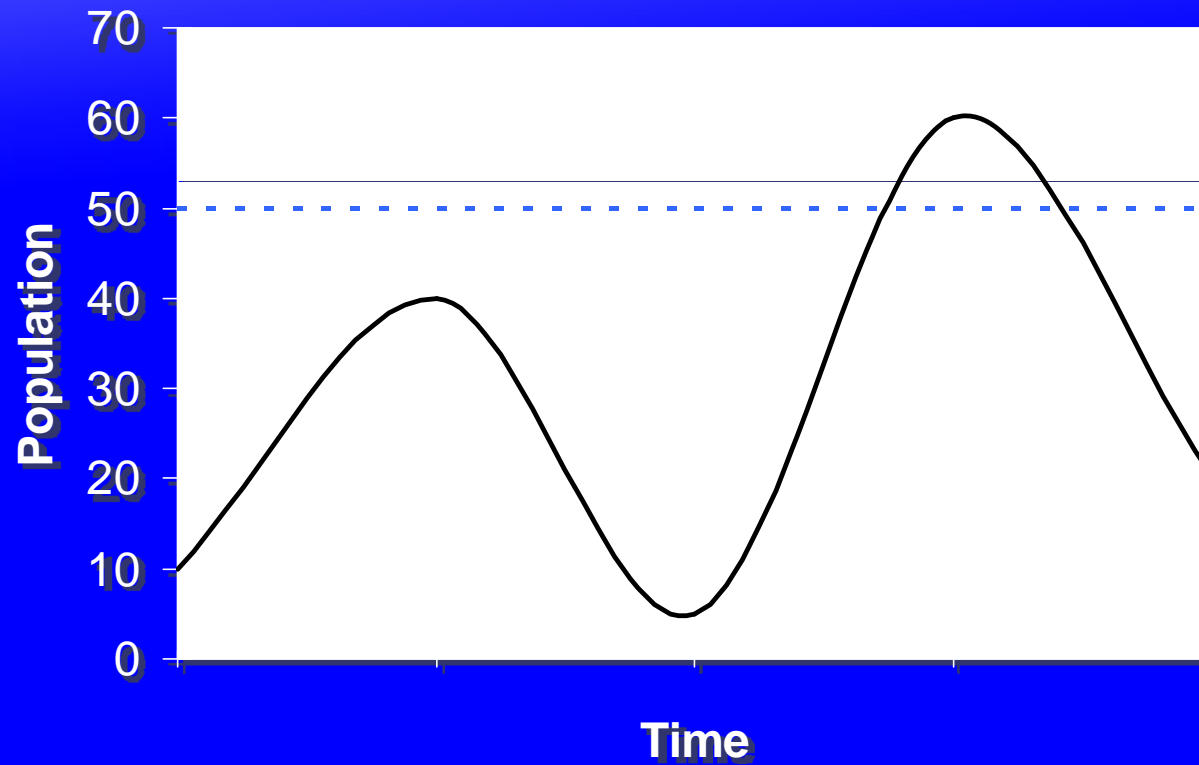
Action Thresholds



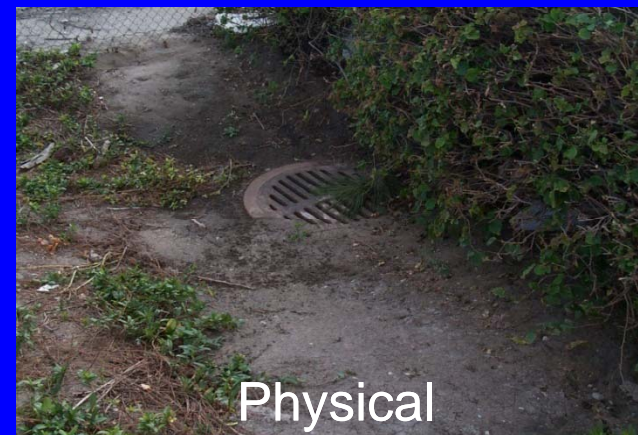
Heavy Infestation



Action Thresholds



Pest Control Tactics



Cultural



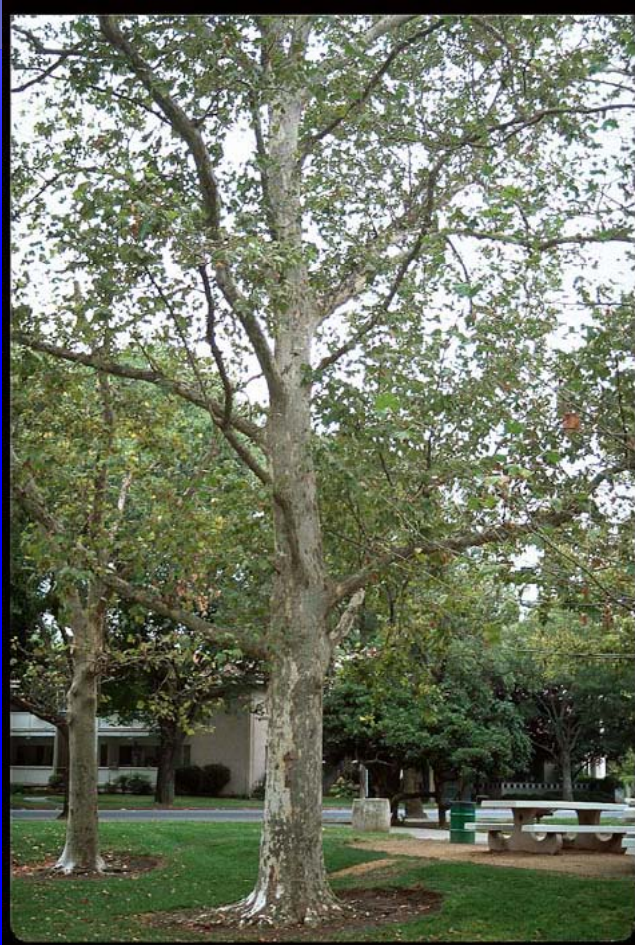
- Landscape design
- Prune properly
- Meet irrigation requirements
- Fertilize appropriately

Mechanical

- Barriers
 - Seal openings into buildings.
- Machinery
- Pruning of infested plant material.
- Mulching



Physical



- Pruning to open canopy
- Protect from sun
- Proper drainage



Biological

- Use of beneficial organisms.
 - Predators
 - Herbivores
 - Parasites
 - Pathogens
- Classical, conservation, or augmentation.
- Sensitive to pesticides.

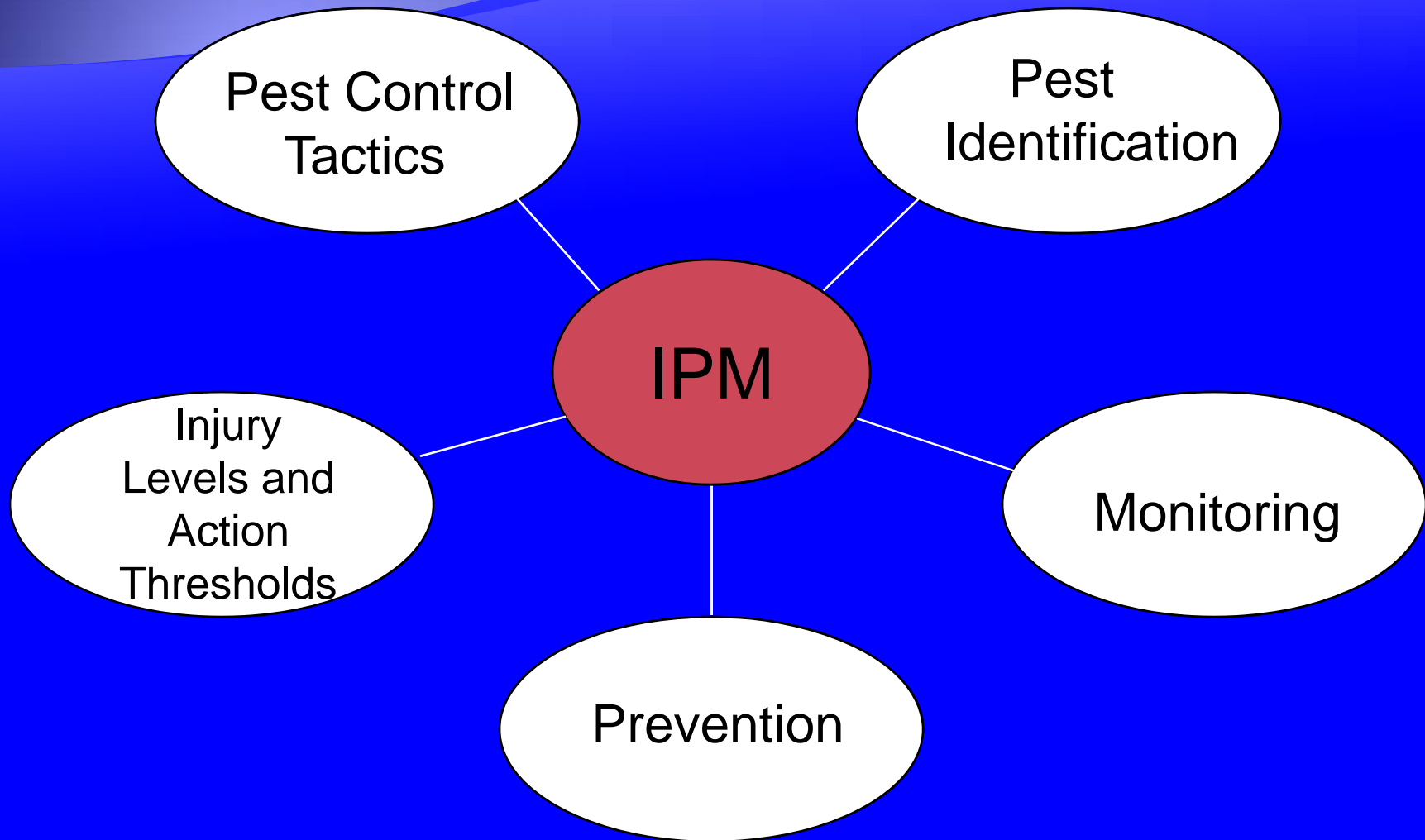


Chemical



- Used to control, prevent, or repel pests
- Avoid broad-spectrum, persistent pesticides
- Consider all available alternatives before using a pesticide
- Always follow the label directions

Putting the Components Together



Putting the Components Together

- ◆ IPM reduces pesticide inputs = reducing the potential risk of polluting waterbodies.
 - ◆ Example: prevention, proper pest identification, and proper choice of control tactics.
- ◆ Choose IPM methods that are effective and are least likely to have adverse effects on the environment (i.e. water quality).

Search

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- ◆ [Peach Year-Round IPM Program released](#)
- ◆ [In the News added](#)
- ◆ [UC Exotic/Invasive Pests and Diseases Research Program request for new proposals](#)
- ◆ [New edition, IPM for Potatoes in the Western U.S.](#)

Solve your pest management problems with UC's best information, personalize it with interactive tools, or find out about pest management research and extension projects.

- ▶ [About UC IPM](#)
- ▶ [2005 Annual Report](#)

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homes, structures, people, and pets (including Pest Notes)
agriculture and floriculture (Pest Management Guidelines)



Use tools to help make decisions
weather data and products
degree-days
interactive tools and models

Educational resources



Publications and other materials
Workshops and events
Educational programs
Pesticide safety, training, and use

Research and IPM



Grants programs
Results of funded projects
Research tools and databases: [California pesticide use summaries](#)

Statewide IPM Program, Agriculture and Natural Resources, University of California
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[Administration](#)

For noncommercial purposes only, any Web site may link directly to this page. FOR ALL OTHER USES or more information, read [Legal Notices](#). Unfortunately, we cannot provide individual solutions to specific pest problems. See [How to manage pests](#), or in the U.S., contact your [local Cooperative Extension office](#) for assistance. / revised: March 22, 2006. [Contact webmaster](#). Mailing address: Statewide IPM Program, University of California, One Shields Ave., Davis, CA, 95616-8821.

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[Pests of landscapes, gardens, turf](#)

Pests of homes, structures, people, and pets: Pest Notes and more—University of California's official guidelines for pest monitoring techniques, pesticides, and nonpesticide alternatives for managing pests around the home. | [More](#) | [Acknowledgments](#) | [Index to pests](#) | [PDFs to print](#) | [Quick Tips](#) | [Recent updates](#) | [en español](#) |

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How to Manage Pests

Pests of Homes, Structures, People, and Pets

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Cockroaches

Published 11/99

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In this Guideline:

- ◆ [Problems associated with cockroaches](#)
- ◆ [Management](#)
- ◆ [Identification](#)
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There are five species of cockroaches in California that can become pests: German cockroach, brownbanded cockroach, oriental cockroach, smokybrown cockroach, and American cockroach. Of these, the one that has the greatest potential of becoming persistent and troublesome is the German cockroach, which prefers indoor locations. Oriental and American cockroaches occasionally pose problems in moist, humid areas.

PROBLEMS ASSOCIATED WITH COCKROACHES

Cockroaches may become pests in homes, restaurants, hospitals, warehouses, offices, and virtually any structure that has food preparation or storage areas. They contaminate food and eating utensils, destroy fabric and paper products, and impart stains and unpleasant odors to surfaces they contact.

Cockroaches (especially the American cockroach, which comes into contact with human excrement in sewers or with pet droppings) may transmit bacteria that cause food poisoning (*Salmonella* spp. and *Shigella* spp.). German cockroaches are believed to be capable of transmitting disease-causing organisms such as *Staphylococcus* spp., *Streptococcus* spp., hepatitis virus, and coliform bacteria. They also have been implicated in the spread of typhoid and dysentery. Some people, especially those with asthma, are sensitive to the allergens produced by these cockroaches. However, a major concern with cockroaches is that people are repulsed when they find cockroaches in their homes and kitchens.

IDENTIFICATION

Cockroaches are medium-sized to large insects in the order Dictyoptera (formerly Orthoptera). They are broad, flattened insects with long antennae and a prominent pronotum. Some people confuse them with beetles, but adult cockroaches have membranous wings and lack the thick, hardened forewings or elytra of beetles. They are nocturnal and run rapidly when disturbed. Immature cockroaches (nymphs) look like adults, but are smaller and do not have wings.

Of the five common pest species, German and brownbanded cockroaches inhabit buildings, whereas the oriental, smokybrown, and American cockroaches usually live outdoors, only occasionally invading buildings. It is important to [correctly identify the species](#) involved in a cockroach infestation so that the most effective control method(s) for the species involved is chosen.

German Cockroach

The [German cockroach](#), *Blattella germanica*, is the most common indoor species, especially in multiple-family dwellings. They prefer food preparation areas, kitchens, and bathrooms because they favor warm (70° to 75°F), humid areas that are close to food and water. Severe infestations may spread to other parts of buildings. This species reproduces the fastest of the common pest cockroaches: a single female and her offspring can produce over 30,000 individuals in a year, but many succumb to cannibalism and other population pressures. Egg laying occurs more frequently during warm weather. The [female carries around a light tan egg case](#) (about 1/4 inch long) until 1 to 2 days before it hatches, when she drops it. Sometimes the egg case hatches while it is still being carried by the female. Each egg case contains about 30 young, and a female may produce a new egg case every few weeks.

Brownbanded Cockroach

The [brownbanded cockroach](#), *Supella longipalpa*, is not as common as the German cockroach in California and accounts for only about 1% of all indoor infestations. This species seeks out areas that are very warm most of the time, preferring temperatures of about 80°F, about 5° to 10°F warmer than what German cockroaches prefer. Favorite locations include near the warm electrical components of appliances such as radios, televisions, and refrigerators. Brownbanded cockroaches prefer starchy food (e.g., glue on stamps and envelopes), are often found in offices and other places where paper is stored, and are more common in apartments or homes that are not air conditioned. They also infest animal-rearing facilities, kitchens, and hospitals. Adult males sometimes fly when disturbed, but females do not fly. Females glue light brown egg cases, which are about 1/4 inch long, to ceilings, beneath furniture, or in closets or other dark places where eggs incubate for several weeks before hatching. Each female and her offspring are capable of producing over 600 cockroaches in one year.

Oriental Cockroach

The [oriental cockroach](#), *Blatta orientalis*, is sometimes referred to as a waterbug or waterbeetle. It lives in dark, damp places like indoor and outdoor drains, water control boxes, woodpiles, basements, garages, trash cans, and damp areas under houses. It is most likely to occur in single-family dwellings that are surrounded by vegetation. It is also common in ivy, ground cover, and outside locations where people feed pets. They prefer cooler temperatures than the other species do, and populations of this species often build to large numbers in masonry enclosures such as water meter boxes. At night, oriental cockroaches may migrate into buildings in search of food. They usually remain on the ground floor of buildings and move more slowly than the other species. Oriental cockroaches do not fly and are unable to climb smooth vertical surfaces; consequently they are commonly found trapped in porcelain

Boric acid powder does not decompose and is effective for as long as it is left in place, if it remains dry. Formulated as an insecticide, boric acid dusts usually contain about 1% of an additive that prevents the powder from caking and improves dusting properties. If it gets wet and then dries and cakes, it loses its electrostatic charge and will not be picked up readily by the cockroach. If this occurs, reapply powder to these areas.

Baits. Baits are formulated as pastes, gels, granules, and dusts. The most popular use of baits in homes is within bait stations, which are small plastic or cardboard units that contain an attractive food base along with an insecticide. Bait gels are placed in small dabs in cracks and crevices where cockroaches will find it. The advantage of bait stations is that insecticides can be confined to a small area rather than being dispersed and they are relatively child resistant. Baits in plastic containers also remain effective for many months whereas the bait gels dehydrate in about 3 days when left in the open air. But while they are fresh, bait gels are very effective when placed in locations where they will be found by cockroaches. To remain effective, however, the gels need to be reapplied frequently.

Most insecticides used in baits are slow acting; cockroaches quickly learn to avoid fast-acting ones. Consequently an effective bait program does not give immediate results, but may take 7 days or longer. Baits can be quite effective for long-term control of cockroaches unless the cockroaches have other food sources available to them.

Baits do not control all cockroaches equally. Female cockroaches with egg cases do very little feeding and avoid open spaces; consequently they are less likely to be immediately affected by a bait.

Commercial baits available (see Table 1) contain abamectin, boric acid, fipronil, hydramethylnon, or sulfuramid mixed with a food base. Sulfuramid is not as effective as the other materials because it is somewhat volatile and there has been some development of resistance to it.

TABLE 1. Baits Currently Available for Use in Homes.

| Active ingredient | Brand name | Formulation | Where to get product |
|---------------------------|----------------------------|--------------|---------------------------------------|
| abamectin | Avert | gel, powder | pest control company |
| abamectin plus hydroprene | Raid Max Plus Egg Stoppers | bait station | retail stores |
| boric acid | Stapleton's Magentic | paste | Blue Diamond Phone: (800) 237-5705 |
| | Niban and others | granules | pest control company |
| fipronil | Maxforce | bait station | pest control supply store |
| | Maxforce | gel | pest control supply store |
| hydramethylnon | Combat | bait station | retail stores |
| | Combat | granules | retail stores |
| | Maxforce | gel | pest control supply store |
| | Siege | gel | pest control company |

As with sticky traps, baits do not attract cockroaches so place them near hiding spaces or where roaches are likely to encounter them when foraging. When placed next to a sticky trap that contains an attractant pheromone, bait consumption by the roaches is reported to increase. Bait stations can also be placed next to fecal specks and droppings of cockroaches, which contain a natural aggregation pheromone. Look for these fecal specks and droppings under kitchen counters, behind kitchen drawers, and in the back of cabinets.

Insect Growth Regulators. The insect growth regulator (IGR) hydroprene prevents immature cockroaches from becoming sexually mature. It also has the added advantage of stimulating cockroaches to feed. When placed next to a bait it can increase bait consumption. Under normal circumstances an adult female cockroach carrying an egg case doesn't feed much, but exposure to an IGR will induce her to feed.

Sprays and Aerosols. Applying low-residual insecticides to get a quick knockdown of cockroaches in an infested area can provide immediate relief from a cockroach infestation but generally does not give long-term control. Common home use insecticides include combinations of pyrethrin and piperonyl butoxide or pyrethroids such as cyfluthrin, cypermethrin, and permethrin. The safest application method for home users is the crack-and-crevice spray used in combination with sanitation and exclusion. Avoid the use of insecticide aerosol sprays, bombs, or foggers, as these will just disperse the cockroaches and may actually increase problems.

The faster the knockdown activity of an insecticide, the quicker cockroaches learn to avoid it. Cockroaches are repelled by deposits of residual insecticides such as synergized pyrethrins and emulsifiable concentrate formulations of pyrethroids such as cyfluthrin, cypermethrin, and permethrin. Wettable powder formulations are generally less repellent and more effective on a wide range of surfaces; however, they may be unsightly.

It should be noted that many cockroach populations, especially the German cockroach, have developed resistance (or tolerance) to many insecticides used for their control. Resistance has been documented with allethrin, chlorpyrifos, cyfluthrin, cypermethrin, fenvalerate, and others. Do not expect instant results from an insecticide spray application, but if the cockroaches seem to be unaffected the following day, a different material or strategy may be required.

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Cockroaches



For more information, see our [Pest Note on Cockroaches](#) or contact your local [Cooperative Extension office](#).

Cockroaches thrive in warm environments that provide food, water, and shelter. Roaches hide in cracks, crawl spaces, and other dark places during the day and come out at night to feed. Pesticide sprays alone will not control roaches and are not usually required. Baits provide better control. You must integrate several strategies to make your home a less roach-friendly environment. Thoroughness is essential for effective control.

Identify your cockroach species first:

- Effective management options vary according to species.
- Cockroach traps provide an easy way to catch roaches for identification.
- Control practices for outdoor invaders (American, oriental roaches) and indoor residents (brownbanded and German roaches) differ.
- For help with identification go to [UC Statewide IPM Program Pest Notes](#).

Remove food and water sources:

- Even tiny crumbs or liquids in cracks provide good food sources.
- Store food in sealed containers.
- Keep trash in containers with tight lids.
- Eliminate plumbing leaks.
- Vacuum cracks and crevices and clean floors and counters daily.

Remove roach hiding places:

- Seal cracks and other openings to prevent invaders from the outside.
- Seal cracks in false bottoms of cupboards and other indoor hiding places.
- Seal or clean up other areas where you find roaches or their egg cases hiding.
- Remove old newspapers, boxes and other clutter in kitchens and bathrooms.
- The oriental cockroach hides outdoors under ivy and other shelter. Check to see if you have this roach and remove outdoor hiding places or bait.

Use traps to identify and track cockroach populations:

- Cockroach traps are available in hardware stores.
- Place traps on the floor around edges of walls, in cupboards and other places where you think roaches are foraging. Place bait stations at locations where you trap roaches.
- Check traps daily.
- Sticky traps with pheromones may provide some control of German cockroaches.

Using chemicals to control cockroaches:

- Avoid use of foggers, bombs or aerosol sprays— they just disperse populations
- Boric acid powder blown into cracks, crevices, hollow walls, under refrigerators, or other undisturbed hiding places is very effective (allow seven days or more for an effect to be seen)
- Bait stations containing boric acid, abamectin, fipronil, or hydramethylnon placed near hiding places can be effective if other food sources are removed (allow seven days or more for an effect to be seen). Replace stations as needed as long as roaches are being caught.
- Insecticide sprays alone do not give long-term control. They are not necessary if other methods such as baits and boric acid powder are combined along with cleanup and removal of hiding places.
- Contact a professional pest control operator for very serious infestations, but be sure they use an integrated program as described above.



German cockroach adult



German cockroach nymph

Be sure to read product labels carefully and follow all instructions on proper use, storage, and disposal of pesticides.

What you use in your garden affects our creeks, lakes, and rivers!

Alternatives to Broad Spectrum Pesticide Applications

- Wash pests off plants with strong stream of H₂O
- Contain pesticides in bait stations
- Habitat modifications
- Least-toxic pesticides

Habitat Modifications

- Caulking
- Seal food and food wastes
- Increase light and ventilation
- Clean up food or liquid spills as soon as possible



Promotion of Beneficial Insects

- Eliminate use of broad spectrum pesticides
- Provide essential food and water
 - Plant a diversity of plant species
 - Include native and Mediterranean plants as sources of pollen and nectar

Beneficial Insects



Characteristics of Least-Toxic Pesticides

- Effective against target pest
- Low acute and chronic mammalian toxicity
- Degrade rapidly
- Kill a narrow range of target pests
- Little or no impact on nontarget organisms

Types of Least-Toxic Pesticides

- Pheromones and other attractants
- Insect growth regulators
- Repellents
- Desiccating dusts
- Soaps and oils
- Some botanical pesticides



Drawbacks Utilizing Least-Toxic Pesticides

- Often more expensive
- May not be effective when populations are exceedingly high
- May work slower than traditional pesticides
- May be difficult to find products



Product Examples

Ant Control

- Broad spectrum pesticides
 - Barrier around perimeter of home
 - Short-term control
- Granular Bait
 - Ants forage and consume bait
 - Carrier attracts ants
- Bait Station
 - Ants attracted to bait
 - Pesticide protected from environment



Liquid/Gel Ant Control

- Active ingredients
 - Boric acid
 - Fipronil
 - Cleaning products (inside quick control)
- Examples
 - Terro® Liquid Ant Baits
 - Maxforce ® Gel
 - KT AntPro ®
 - Windex ®, 409 ®, etc...

Placement of Bait Stations

- Install one on each side of structure
- Place near source of water – air conditioner, hose bib, etc...
- Shady and moist locations – North side
 - Avoid full sun locations
- Near trails of ants
 - DO NOT PUT DIRECTLY OVER OR NEXT TO NESTS!
 - > 5 feet away is best
- Avoid areas with runoff such as near downspouts.

Sure-Fire Ways to Ensure Least Toxic Pesticides are Ineffective

◆ Key Factors

- Quick versus slow control
- Providing consistent food source
- Excessive watering
- Lack of pesticide a.i. rotation
- Failure to implement more sanitary practices in home and yard
- Failure to control 'honeydew' producing insects