





Overview of Pesticides for Master Gardeners

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Topics covered in this presentation



- Types of pesticides
- Pesticide toxicity and impacts
- The pesticide label
- Less toxic pesticides
- Information resources

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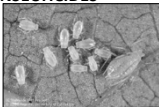


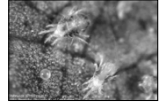
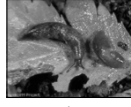
What are Pesticides?


- Substances that control, suppress, prevent or repel pests
- May be used against all types of pests

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Pesticide Types by Pest


HERBICIDES  WEEDS	INSECTICIDES  INSECTS	RODENTICIDES  VERTEBRATES
FUNGICIDES  FUNGI/PLANT PATHOGENS	ACARICIDES or MITICIDES  MITES	MOLLUSCICIDES  SLUGS and SNAILS




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Pesticide Selectivity—can help protect the environment, people and nontarget plants


- A **broad-spectrum** pesticide kills a wide range of organisms
- A **selective** pesticide kills only organisms in a related group.



Bifenthrin kills all types of insects including ants, grubs, aphids, caterpillars, bees as well as fish and nontargets.







Bacillus thuringiensis (Bt.k) kills only caterpillars feeding on leaves or buds of sprayed plants. Beneficials, bees and wildlife not affected.



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Pesticide selectivity— Herbicides

Selective  <p>FLUAZIFOP: Kills grasses but not broadleaves.</p>	 <p>2,4-D, MCPP: Kill broadleaves not grass.</p>	Non-Selective  <p>Glyphosate: Kills broadleaves AND grasses.</p>
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Herbicides: Preemergent or Postemergent?

PREEMERGENT

Apply before weed seeds germinate.

POSTEMERGENT

Apply after weeds germinate.

Apply them when they will be effective.

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Contact vs. Systemic Herbicides (postemergent only)

CONTACT HERBICIDE

Contact herbicides usually kill only the green parts of the plant where the spray touches the plant. Contact herbicides will kill young plants fairly quickly. They may not kill older plants or the roots.

Contact examples:
pelargonic acid (Scythe)
Clove oil (Burnout)

SYSTEMIC HERBICIDE

Systemic herbicides are taken up by green plant parts or through roots and are transported to the growing tips of roots and shoots. It may take several days for a systemic herbicide to kill a plant.

Systemic examples:
Glyphosate (Roundup), 2,4-D, fluzafop

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Contact (nonsystemic) vs Systemic Insecticides

NONSYSTEMIC INSECTICIDE

Apply to all areas or plant parts where insects are present.

Example: Most insecticides

SYSTEMIC INSECTICIDE

Apply to soil for plant uptake.

Example: Imidacloprid

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Pesticide toxicity

- **TOXICITY** is the ability of a pesticide to injure a living organism.
- **ALL** pesticides are toxic to some organisms.
- **DOSE:** More toxic pesticides cause harm at lower doses than less toxic pesticides.

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Pesticides can move and cause harm to the environment

Pesticides drift in air.

Sprinkler or rain water washes pesticides down drains.

Drift in air

soil

mud/sediment movement

Runoff into creeks, streams or oceans

Pesticides move in water or stick to soil particles and wash down drains.

May injure bees, beneficials, wildlife, desirable plants, pets, people


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Read the Pesticide Label!!

- Product and brand identification
- Active ingredients
- Directions for use
- Precautionary statements
 - Hazards to Humans, Domestic animals and the Environment
- First aid instructions
- Note to physicians
- Storage and Disposal

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Don't confuse the trade name and the active ingredient name



Look closely for

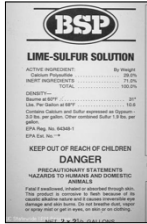
- Active ingredients
- Signal word
- EPA registration number

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Signal Words indicate acute toxicity

SIGNAL WORD	Toxicity	Approx Human lethal dosage
DANGER-POISON	Highly toxic	Taste to a teaspoon
DANGER	Highly hazardous	Pesticide-specific
WARNING	Moderately toxic	1 teaspoon-1 oz
CAUTION	Low toxicity	1 oz to relatively nontoxic

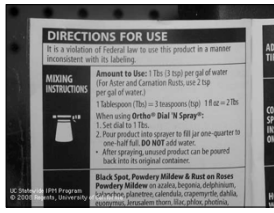
A few very low toxicity pesticides have no signal word



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Directions for use


- How to mix up product
- What plants or sites you can use it on
- What pests it controls
- Special restrictions



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Registrations and terminology

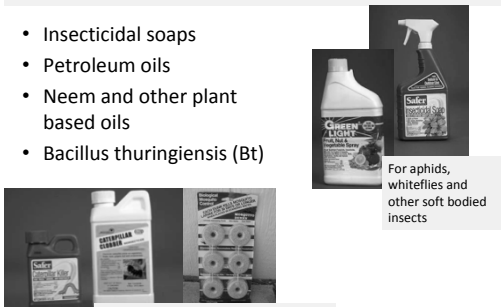
- Most pesticides are registered by the U.S. EPA and CA Department of Pesticide Regulation.
- Some food or natural oil products are **exempt** from registration ("25b" products). They don't carry EPA registration numbers.
- Organically acceptable** pesticides are derived from natural products such as plants or minerals (including petroleum oil), are not chemically processed. Some *but not all* have the OMRI logo.
- Less Toxic Pesticides:** (*not an official term*)—have less negative impact on people and nontargets



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What are some less toxic insecticides?

- Insecticidal soaps
- Petroleum oils
- Neem and other plant based oils
- Bacillus thuringiensis (Bt)



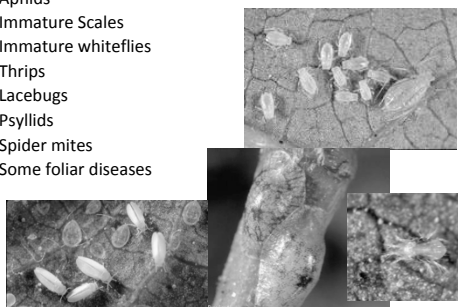
For aphids, whiteflies and other soft bodied insects

B.t. k--For caterpillars; B.t. l--mosquitoes

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Soaps and Oils

- Aphids
- Immature Scales
- Immature whiteflies
- Thrips
- Lacebugs
- Psyllids
- Spider mites
- Some foliar diseases



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Soaps vs Oils

- Oils smother pests/disrupt respiration
- Soap mode of action uncertain but likely disrupt respiratory function, cuticle and cell membranes
- Good coverage essential for both
- Soaps used primarily for herbaceous plants or small shrubs
- Oils used for woody plants
- Oils somewhat more effective, especially on scales
- Oils frequently used as dormant treatments




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Petroleum versus plant derived oils

- Petroleum: superior oil, supreme oil, narrow range oil, horticultural oil
- Plant-based: neem oil, jojoba oil, canola oil, cottonseed and others

Generally same mode of action but neem oils have Anti-feedant and growth regulating activity.

Have fungicidal activity too




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Plant essential oils and other “25b” products

- Most are derived from food plants
- Considered nontoxic to people
- Don’t require federal or state registration
- Can be effective on **soft-bodied insects and mites**. Some have fungicidal or herbicidal activity
- Act as other oils do, but may also have other modes of action
- Some act as repellents
- Very short residual

- Examples
 - Cinnamon
 - Citric acid
 - Citronella
 - Clove
 - Cottonseed
 - Garlic
 - Lauryl sulfate
 - Lemongrass
 - Mint
 - Peppermint
 - Rosemary
 - Sesame
 - Thyme



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Microbial Insecticides— derived from insect pathogens

Bt: *Bacillus thuringiensis kurstaki*

- For control of leaf or bud-feeding caterpillars (Lepidoptera only)
- Caterpillar must eat material—excellent coverage essential
- Small caterpillars most effectively controlled
- Breaks down rapidly. May need to reapply
- Non toxic to beneficials, humans and wildlife

Another microbial, *Cydia pomonella granulovirus* (Cyd-X), is a virus disease of codling moth


B.t. israelensis is effective against mosquitoes & fungus gnats



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Other lower toxicity insecticides

- **Spinosad**— chewing insects and thrips. A natural fermentation product.
- Botanical or plant-derived insecticides—**pyrethrin** and **azadirachtin** (neem extract)
- All these materials are generally organically acceptable, breakdown rapidly in the environment and have less impact on beneficials, people and wildlife than conventional insecticides.



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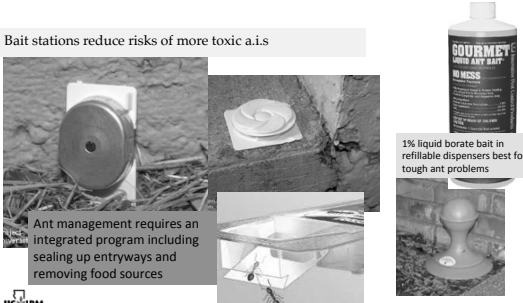
Ant baits: borate-based products, fipronil, hydromethylnon, abamectin*

Bait stations reduce risks of more toxic a.i.s

Ant management requires an integrated program including sealing up entryways and removing food sources

1% liquid borate bait in refillable dispensers best for tough ant problems



*Bait type products with propoxur or indoxacarb aren't very effective because they are too fast-acting



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Common home use insecticide products NOT qualifying as less toxic

- **Organophosphates** (*malathion, acephate, disulfoton*)
- **Carbaryl** (*Sevin*)
- **Pyrethroids** (*bifenthrin, permethrin, cyfluthrin, cypermethrin, esfenvalerate, lambda-cyhalothrin*)
- **Neonicotinoids:** *imidacloprid, dinotefuran*






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Selectivity for Insecticides: Avoid products with Negative Impacts on Natural Enemies & Bees

Insecticide	Contact Toxicity (immediate killing)	Persistence of Toxic Residue*
<i>Bacillus thuringiensis</i>	No contact	No persistence
Oils/Soaps	Moderate contact	No persistence
Botanicals (pyrethrins/azadirachtin)	Moderate to High contact	Short persistence
Spinosad	Moderate contact	Intermediate persistence
Organophosphates/Carbamates/Pyrethroids	High contact	Intermediate to long persistence
Imidacloprid: Foliar spray	Variable: Most natural enemies affected	Intermediate persistence
Imidacloprid: Soil applied or root/trunk-injected	Bees, predatory beetles and nectar-feeding parasites	Long persistence

* Persistence is the length of time a pesticide remains toxic. Intermediate = toxic for several days to weeks; Long = toxic for months






Toxicity to Bees

High Toxicity	Moderate Toxicity	No or very low Toxicity
organophosphates	spinosad	<i>Bacillus thuringiensis</i>
Carbamates (carbaryl)	diatomaceous earth	soaps
Pyrethroids	azadirachtin	most plant based and horticultural oils
Neonicotinoids	Some oils	
Pyrethrin (when formulated with PBO)		

Protect bees by never applying any pesticides while plants are in bloom and bees are visiting.

- Some high tox pesticides leave residues that are toxic for days or weeks.
- Moderate tox pesticides usually break down within a day.
- Systemic insecticides applied before bloom may move into flowers weeks later when they bloom.







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Iron Phosphate snail & slug bait

- Breaks down into harmless materials
- Nontoxic to pets, humans and wildlife
- Avoid metaldehyde to protect pets, people & the environment

Some products now adding spinosad for earwigs

New products containing Sodium Ferric EDTA appearing on shelves


Herbicides Used in Organic systems

- **Plant-based oils** (clove, eugenol, lemongrass) Greenmatch EX, Matran 2
- **Pelargonic acid** (Scythe)
- **Herbicidal soap**
- **20% Vinegar/Acetic Acid** (Weed Pharm)

- These products are effective only on young plants, primarily broadleaves.
- Not effective on perennials or plants with substantial roots
- Nonselective—can damage desirable plants
- Useful for cracks and crevices, edges.
- Acetic acid can be dangerous

Corn gluten meal--used as preemergent—UC research does not back up efficacy

Iron HEDTA—selective broadleaf herbicide for lawns—not organic—low toxicity





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Fungicides: powdery mildew & other foliar diseases

- **Neem and other oils***
- **Sulfur formulated with soap (NOT DUST)**
- **Biologicals: *Bacillus subtilis***
- **Potassium bicarbonate**

Copper fungicides are organic; but are used primarily in the dormant season for peach leaf curl & scab—not PM or other foliar diseases.

*Oils are the most effective against foliar diseases and are the only ones that have eradicant activity.

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Find information on toxicity in the UC IPM Pest Notes

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Integrated Pest Management Program

UC IPM Home > Home, Gardens, Landscapes, and Turf > Powdery Mildew on Ornamentals

How to Manage Pests

Pests in Gardens and Landscapes

Powdery Mildew on Ornamentals [PDF to print] [Check title] [New items]

Revised 4/09

In this GuideLine:

- Identification and damage
- Life cycle
- Management
- About Pest Notes
- Publication
- Glossary

Powdery mildew is a common disease on many types of plants and is prevalent under the diverse conditions found in many areas of California. Different powdery mildew fungi cause disease on different plants. These fungi tend to infect either plants in the same family or only one species of plant.

IDENTIFICATION AND DAMAGE

You can recognize this disease by the white, powdery mycelium and spore growth that forms on leaf surfaces and shoots and sometimes on flowers and fruits. Powdery mildews may infect new or old foliage. This disease can be serious on woody species such as rose, crabapple, myrtle, and sycamore where it attacks new growth including buds, shoots, flowers, and leaves. New growth may be distorted, distorted, and covered with a white, powdery growth. Infected leaves generally die and drop from the plant prior than healthy leaves.

IFE CYCLE

Powdery mildew fungi require living plant tissue to grow. On perennial hosts such as roses, powdery mildew survives from one season to the next as vegetative strands in buds or as spherical resting bodies, called *chiasmogones*, on the bark of twigs and stems.

Most powdery mildew fungi grow as thin layers of mycelium on the surface of the affected plant parts. Spores, which you can see with a hand lens, are released from the *chiasmogones* and spread to new susceptible plant parts.

How to Manage

Apply protective fungicides to susceptible plants before or in the earliest stages of disease development. Once lesions appear, it is difficult to control, but generally, it is too late for effective control with protective fungicides. These are effective only on contact, so applications must thoroughly cover all susceptible plant parts. As plants grow and produce new tissue, additional applications may be necessary at 7- to 10-day intervals as long as conditions favor disease growth.

If mild to moderate powdery mildew is present, you can use horticultural and plant-based oils such as neem or jojoba oil.

WARNING: ON THE USE OF CHEMICALS

ACTIVE INGREDIENTS: [unreadable]

powdery mildew

pest

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How to Manage Pests

Compare Risks of Pesticide Active Ingredients

[More Pests | About Risk Comparisons]

Powdery Mildew on Ornamentals

This table compares potential hazards of pesticides mentioned in the UC IPM Pest Note for Powdery Mildew on Ornamentals.

- This table does not include all pesticides registered for this purpose, only those included in the Pest Note.
- These pesticides vary in efficacy.
- Be aware that pesticides are often not necessary and nonchemical controls may be as effective.
- Please see the text of the Pest Note for complete information on management.

Click on the active ingredient name for more details of that pesticide

Pesticide Active Ingredient	Potential Hazard ¹ to					Notes
	Water quality ² (aquatic wildlife)	Natural enemies (beneficials)	Honeybees ³	Acute ⁴	Long Term ⁵	
Bacillus subtilis	[L]	[L]	—	[VL]		See label
Horticultural oil	[NKR]	[L]	[M]	[VL]		See label
Myclobutanil	[M]	—	—	[L]		CA Prop 65
Neem oil	[NKR]	[L]	[M]	[VL]		See label
Potassium bicarbonate	—	—	—	—		See label
Sulfur	[L]	[LH]	[L]	[VL]		See label

These pages were created to give general information on the potential hazards of pesticides mentioned in the UC IPM Pest Notes pages. Values are for active ingredients—not formulated products. Different formulations can increase or reduce risks. Ratings were taken from the information sources below. Please visit the listed links to find out more about how the ratings were determined.

For more information on toxicity of pesticides go to the National Pesticide Information Center.

¹ Potential Hazard Rating: VL=Very low, L=Low, LM=Low to Moderate, M=Moderate, LH=Low to High, MH=Moderate to High, H=High, VH=Very High, N=None, NKR=No Known Risk, —=No data

² Water quality ratings from Pesticide Choice: Best Management Practice (BMP) for Protecting Surface Water Quality in Agriculture, ANR Publication 8161, or the USDA-NRCS WIN-PST database—see Pesticides: Water-Related Toxicology of Active Ingredients. 32


³ Honeybee ratings are: (Very High) 1-Do not apply to blooming plants; (High) 2-Apply only during late evening; (Moderate) 3-Apply

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Sources of Pesticide Environmental and Health Impact Information on the Web

- National Pesticide Information Center: <http://npic.orst.edu>
- UC IPM Web site: <http://www.ipm.ucdavis.edu/RETAIL/pesticide.info.html>
- Pesticide Action Pesticide Database: <http://www.pesticideinfo.org/>

For information on what pesticides to use against specific home and garden pests, go to www.ipm.ucdavis.edu/retail



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This presentation was created by the University of California Statewide Integrated Pest Management Program

Visit the UC IPM Web site at www.ipm.ucdavis.edu



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