# Overview of Pesticides
for Master Gardeners

1

## Topics covered in this presentation

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

2

## What are Pesticides?

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

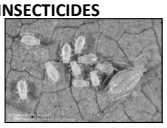
3

## Pesticide Types by Pest

**HERBICIDES**

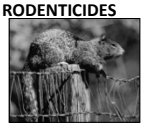
WEEDS

**INSECTICIDES**



INSECTS

**RODENTICIDES**

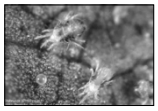


VERTEBRATES

**FUNGICIDES**

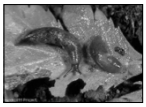
FUNGI/PLANT PATHOGENS

**ACARICIDES** or **MITICIDES**



MITES

**MOLLUSCICIDES**



SLUGS and SNAILS

4

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

- A ***broad-spectrum*** pesticide kills a wide range of organisms

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

- A ***selective*** pesticide kills only organisms in a related group.


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

5

## Pesticide selectivity– Herbicides

Selective | Non-Selective

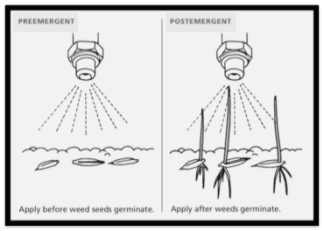

**FLUAZIFOP: Kills grasses but not broadleaves.**


**2,4-D, MCPP: Kill broadleaves not grass.**


**Glyphosate: Kills broadleaves AND grasses.**

6

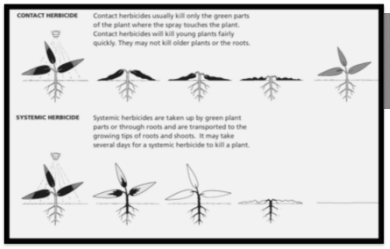
## Herbicides: Preemergent or Postemergent?




Apply them when they will be effective.

7

## Contact vs. Systemic Herbicides (postemergent only)

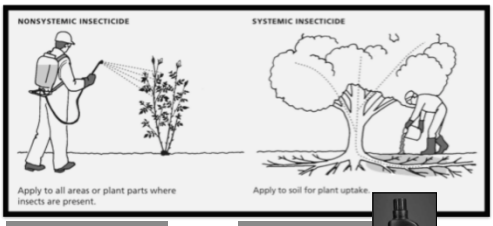



Contact examples: pelargonic acid (Scythe) Clove oil (Burnout)

Sytemic examples: Glyphosate (Roundup), 2-4-D, fluazifop

8

## Contact (nonsystemic) vs Systemic Insecticides



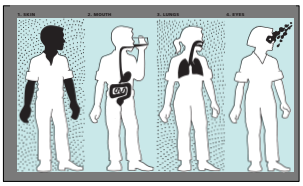

Example: Most insecticides

Example: Imidacloprid

9

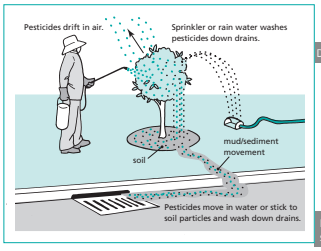
## Pesticide toxicity

- **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.



10

## Pesticides can move and cause harm to the environment




Drift in air

Runoff into creeks, streams or oceans

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

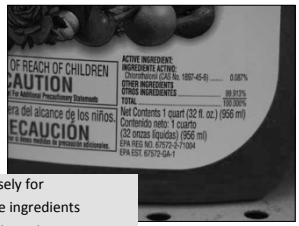
11

## 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


12


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

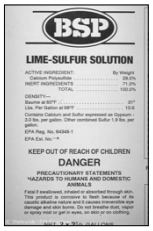



Look closely for
- Active ingredients
- Signal word
- EPA registration number

13

## 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 |

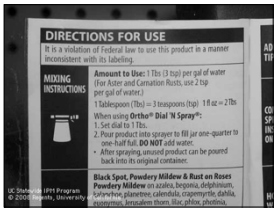



A few very low toxicity pesticides have no signal word

14

## Directions for use

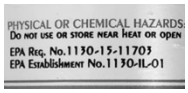
- How to mix up product
- What plants or sites you can use it on
- What pests it controls
- Special restrictions




15

## 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




OMRI

16

## What are some less toxic insecticides?

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

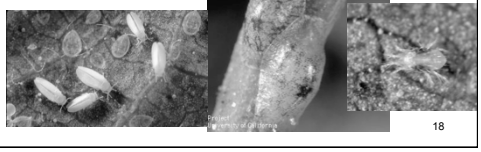

For aphids, whiteflies and other soft bodied insects

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

17

## Soaps and Oils

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



18

## 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


19

## 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

20

## 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


21

## 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

22

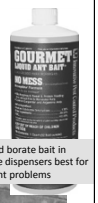
## Other lower toxicity insecticides

- **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.


23

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

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




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

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

24

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

## 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*

25

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

| Insecticide | Contact Toxicity (immediate killing) | Persistence of Toxic Residue* |
|---|---|---|
| *Bacillus thuringiensis* | 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

26

## Toxicity to Bees

| High Toxicity | Moderate Toxicity | No or very low Toxicity |
|---|---|---|
| organophosphates | spinosad | *Bacillus thuringiensis* |
| 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.

27

## 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

28

## 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

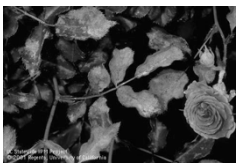
Corn gluten meal--used as preemergent—UC research does not back up efficacy

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

29

## Fungicides: powdery mildew & other foliar diseases

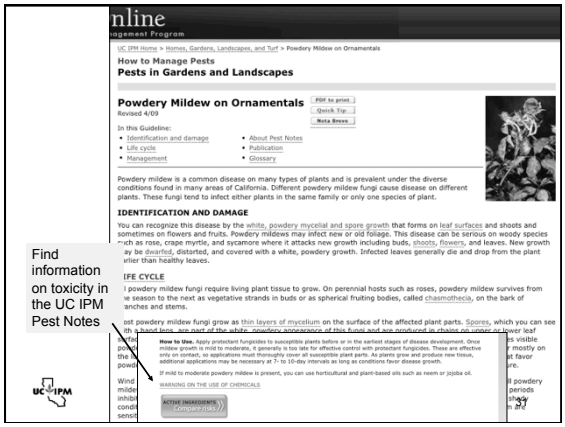
- Neem and other oils*
- Sulfur formulated with soap (NOT DUST)
- Biologicals: *Bacillus subtilis*
- Potassium bicarbonate

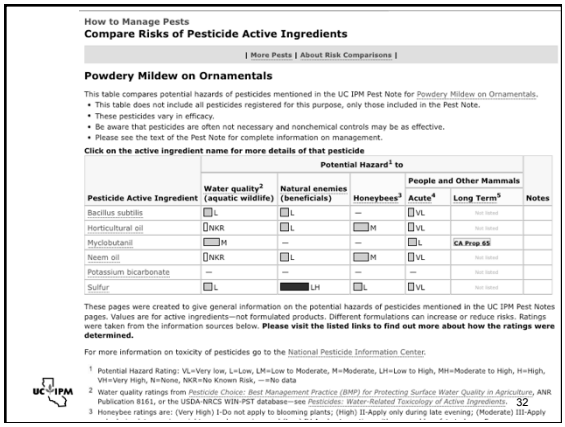


Copper fungicides are organic; but are used primarily in the dormant season for peach leaf curl & scab—not PM or other foliar diseases.

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

30




## 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**


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

34