

# What's Buggin' You?

## Integrated Pest Management

UCCE Master Gardeners of Amador County  
Maureen Angle, Doris Mosblech  
June 27, 2020



Welcome to the Amador County Master Gardeners presentation about Integrated Pest Management. This class will be presented by Master Gardeners Maureen Angle and myself, Doris Mosblech. We have several areas to cover today, so, let's get started.

## What is IPM? (Integrated Pest Management)

- **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. Pesticides are used only after monitoring indicates they are needed according to established guidelines, and treatments are made with the goal of removing only the target organism. Pest control materials are selected and applied in a manner that minimizes risks to human health, beneficial and nontarget organisms, and the environment.

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## How Does IPM Work?

- **IPM** focuses on long-term prevention of pests or their damage by managing the ecosystem
- In **IPM**, monitoring and correct pest identification help you decide whether management is needed
- **IPM** programs combine management approaches for greater effectiveness
- **IPM** is based on scientific research

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## Subjects Covered

- Mechanical & Physical & Cultural control
  - Weeds
  - Disease
  - Pests
- Biological Controls
  - List of Beneficials in Amador area
  - How to attract
- Chemical Control
  - What to use
  - How to use it

## Mechanical & Physical Control

Mechanical and physical controls kill a pest directly, block pests out, or make the environment unsuitable for it. Traps for rodents are examples of mechanical control. Physical controls include mulches for weed management, steam sterilization of the soil for disease management, or barriers such as screens to keep birds or insects out.

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## Weeds

- Mulch to Prevent
- Hand pull
- Hoeing



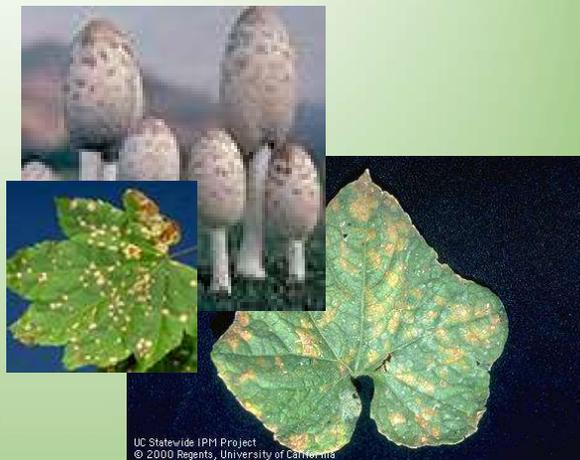
Weeds – those things growing in your garden that you REALLY don't want there! What can you do about them? These are personal preference

Mulching is a great way to prevent many weeds from growing to begin with. Pine needles and leaf litter make great mulch and using them as mulch eliminates the need to burn them so much. Also grass clippings or straw make good mulch product. All of these will ultimately decompose and add nutrients back into the soil. If you desire a more 'finished' look to your garden, wood chips or bark can be used.

The key to eliminating weeds once they've started growing is to do it early and often. If you allow the weeds to gain a foothold and to bear seed, you'll have more issues with them the following season. Hand pulling is an excellent way to specifically target the plants you wish to eliminate and then a hoe can be used on larger infestations or more mature plants. Several types of hoes are available. Make certain that the one you use is able to cut the weed off at the soil surface.

## Disease

- **Prevent Disease**
  - Reduce Stress
    - Adequate (not too much) water
  - Sterilize or solarize soil
  - Plant Resistant Varieties
- **Resolve existing disease**
  - Identify the disease (<http://ipm.ucanr.edu/>)
  - Follow Solutions guidelines



UC Statewide IPM Project  
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Many diseases can affect your garden and it's not always easy to determine what the disease might be or how to resolve it.

The best medicine, of course, is prevention. Reduce the stress the plant may be under: make certain that it is receiving adequate water (but not too much), keep the leaves dry if possible, reduce competition for nutrients by eliminating weeds make certain that it's getting the appropriate amount of sunlight. Most importantly, plant varieties that are resistant to diseases that are common in your area.

- Free plants – inspect them for pests
- Don't import diseases to our area – plan to buy local whenever possible

If your garden does develop a disease, the first step should be to identify the problem. You can do this by going to the UCANR IPM web site. (<http://ipm.ucanr.edu/>). Once you have identified the disease, you can follow the solution recommendations on the site to resolve your problem. Alternatively, you can contact the master gardeners at (209) 223-6838 or on our web site [https://ucanr.edu/sites/Amador\\_County\\_MGs/](https://ucanr.edu/sites/Amador_County_MGs/) and click on "Ask a Master Gardener"

Gardeners should be careful about composting, don't include leaves from diseased plants

## Pests



There are all sorts of Pests that invade our garden. They eat our plants that we've worked so hard to grow healthy and productive. Dealing with them is truly a challenge.

The different types of pests that we need to deal with are:

Vertebrate – those with actual internal skeletons birds, mammals and reptiles

Invertebrate – insects, mites, mollusks and nematodes

We can't go into everything that can be mechanically done to control these pests but we can cover some major areas.

## Prevent

- Barriers
- Inhospitable Environment

Once again – one of the most effective methods of controlling pests in your garden is to prevent them coming in at all. Some products that could help with that are:

Barriers – preventing the pests from entering your garden to begin with can help

Some examples of barriers and things to scare pests away are:

# Fencing



## Barrier

Fencing to keep deer, turkeys and other large pests out of the garden

## Gopher Baskets



### Barrier

Gopher baskets to protect plants from digging rodents such as gophers, ground squirrels, moles

## Hardware Cloth in raised beds



### Barrier

Hardware Cloth in raised beds to protect against digging rodents – gophers, moles, voles, etc.

## Petroleum jelly



### Barrier

Petroleum Jelly to stop crawling insects (ants)

Around small trees, on hanging chains (humming bird feeders), around the tops of pots

## Tanglefoot Insect Barrier



### Barrier

Tanglefoot insect barrier – protect larger trees from insects crawling up the trunk of the tree

## Bird netting



### Barrier

Bird Netting to protect tender fruits from birds

Tulle can be a better solution– It is easier on the birds – use green  
it's washable

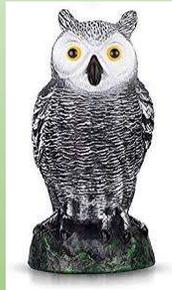
## Reflective tape for birds



Inhospitable Environment

Reflective tape for birds

# Scarecrows



Inhospitable Environment

Scarecrows

## Motion activated sprinkler



Inhospitable Environment

Motion activated sprinkler (if you want to get REALLY elegant)

## Prevent

Plant what they don't like

<https://www.cnps.org/gardening/deer-resistant-native-plants-5588>

Plant what they don't like – if your plants are poisonous or inedible for the pest, have thorns and unpleasant textures to the leaves, pests are more likely to leave them alone  
A great resource for finding deer-resistant native plants is on the California natives web site <https://www.cnps.org/gardening/deer-resistant-native-plants-5588>  
Other resources include your local nurseryman or the Master Gardeners

## Eliminate

- Pick them off
- Knock them off
- Trap them



Once pests are in your garden, you'll need to find some way of eliminating them.

- You can pick them off the plant and dispose of them – if they are large enough to handle and slow enough to catch
- You can knock them off your plants with a strong spray of water (this is a time when getting the leaves wet isn't a bad thing)
- You can trap them and dispose of them – this is a somewhat complicated process since it may involve killing the pest and local ordinances will dictate proper disposal.
  - If you trap/kill – you have to dispose of it (on your property)
  - Smaller bodies can be put in the trash
  - Larger may be disposed of at the dump for a fee (check)

## Biological Controls - Beneficials

- List of Beneficials w/  
larvae



You can also use predators who naturally occur in the environment to assist you in controlling your pest population.

A list of 'natural enemies' is available on the UCANR IPM web site.

Some of the predators that are common to our area are:

How to attract beneficials:

The best way to do this is to create a diverse landscape that is predominately native (and/or Mediterranean), and by avoiding pesticides. Such a landscape and sustainable practices will provide what the good bugs need (like all wildlife): food, water, shelter, places to start their young and an environment free of toxins.

Some favorite plants:

- Native buckwheats
- Coffee berry
- California lilac
- Coyote brush
- Elderberry
- Manzanita
- Salvias

- Penstemons
- Many herbs

Good places to find recommended plants are the California Native Plant Society [www.cnps.org](http://www.cnps.org) and UCCE at [www.ucanr.edu](http://www.ucanr.edu). Additionally the UC Davis Arboretum often sells California native plants at their fund raising events.

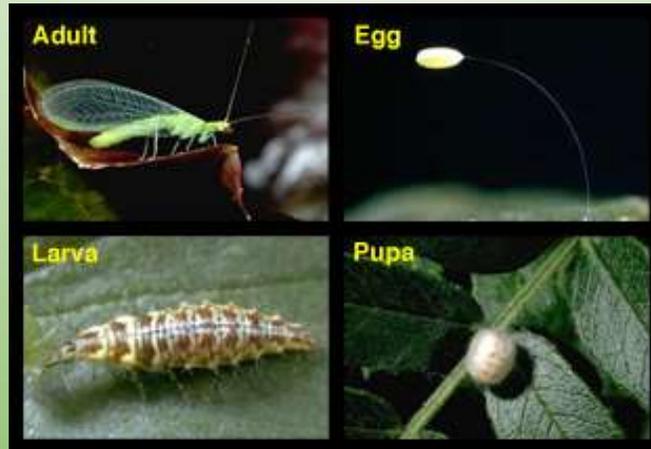
## Convergent lady beetle



Lady bugs (convergent lady beetles)

– prefer to eat aphids but sometime whiteflies and other soft-bodied insects

## Green lacewings



Green lacewings

– larvae feed on mites and aphids

## Syrphid, flower, or hover flies



Syrphid (flower or hover) fly  
- larvae eat mostly aphids

## Damsel bugs



- Damsel bugs  
– enjoy a wide variety of small insects

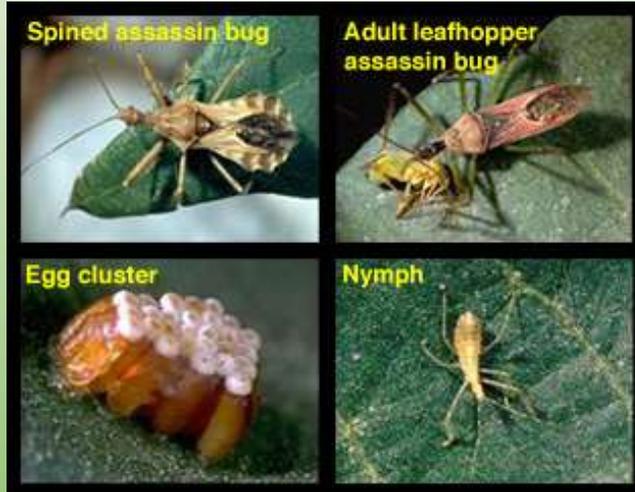
## Predaceous ground beetles



Predaceous ground beetles

– stalk soil-dwelling insects such as cutworms and root maggots

# Assassin bugs



Assassin bugs  
– attack almost any insect

# Predatory Wasps



Predatory wasps  
– prey on aphids, caterpillars and other insects

# Spiders



Most spiders  
– attack all types of insects

# Praying Mantids



Praying Mantid

– eats everything – including other beneficial insects

## Lizards, Frogs, Toads & Snakes



Although some **lizards eat** plants, most **lizards** feed on insects. In **California**, the most common types feed on beetles, ants, wasps, aphids, grasshoppers, and spiders

Invertebrates, such as insects, **are** the most common food items of adult **frogs**. Larger **frogs** frequently **eat** vertebrates, such as Pacific tree **frogs** and **California** mice.

Toads feed on a wide variety of insects and invertebrates. Its diet includes grasshoppers, beetles, flies, and mosquitos.

**California** king **snakes are** frogs, birds, lizards, wee turtles and mice. They frequently even chow down on fellow **snakes**, specifically rattlesnakes

## Biological Controls - Beneficials

- How to attract beneficials



### How to attract beneficials:

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# Chemical (Pesticide) Control

## What are Pesticides?

- Substances that control, suppress, prevent or repel pests.



## Is it Organic ?

- ❖ *HS Chemistry* vs Organic garden products 2020
- ❖ *HS Chem* = compounds which contain at least 1 atom of Carbon bonded to other elements, i.e. Sugar,  $C_6H_{12}O_6$  , Carbon Dioxide,  $CO_2$
- ❖ Organic garden products 2020 = products made from **naturally derived materials** (plant, mineral, petroleum) with no added synthetic substances (man-made compounds)
- ❖ **OMRI** is an independent nonprofit that verifies organic input products that are used to produce organic food and fibers.
- ❖ USDA operates the **National Organic Program** which regulates and certifies commercial growers, producers, and products as organic.
  - \*Organic does not always mean less-toxic.



## 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.



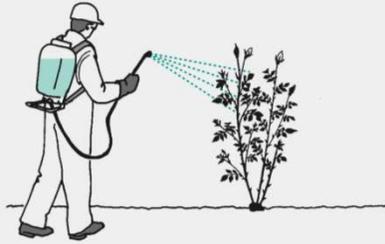
Bifenthrin kills all types of insects including ants, grubs, aphids, caterpillars, bees, as well as fish and nontargets.



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

## Contact (nonsystemic) vs Systemic Insecticides

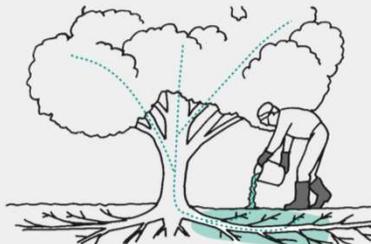
### NONSYSTEMIC INSECTICIDE



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

Example: Most insecticides

### SYSTEMIC INSECTICIDE



Apply to soil for plant uptake.

Example: Imidacloprid



## Pesticide Types by Pest

### HERBICIDES



WEEDS/PLANTS

### INSECTICIDES



INSECTS

### RODENTICIDES



RODENTS

### FUNGICIDES



FUNGI/PLANT PATHOGENS

### ACARICIDES or MITICIDES



MITES

### MOLLUSCICIDES



SLUGS and SNAILS

38

Pesticides used to control weeds are called Herbicides. Examples include glyphosate or Roundup, 2,4-D, benefin and trifluralin.

Pesticides used to control fungi and other plant pathogens are called Fungicides. Examples include sulfur, copper, chlorothalonil, and certain fungicidal soaps and oils.

Pesticides applied to control insects are called Insecticides. There are many insecticides available for use in landscapes. Some of the most common active ingredients are listed here including imidacloprid, carbaryl, malathion, pyrethrin, permethrin, bifenthrin, and insecticidal oils and soaps.

Many insecticides also control mites but pesticides specially formulated to manage mites are called acaricides or miticides.

To manage rats, mice, ground squirrels, gophers or other rodents are products called Rodenticides. Many of these products are quite toxic to pets or wildlife and should be placed in bait boxes or out of reach. Examples include strychnine, warfarin, diphacinone, chlorophacinone and zinc phosphate.

Pesticides applied to control slugs and snails are called Molluscicides. Metaldehyde and iron phosphate are common active ingredients in molluscicide products.



## Pesticide types by pest



WEEDS



HERBICIDES

Examples:

Trifluralin



FUNGI/PLANT PATHOGENS



FUNGICIDES

Examples:

- Sulfur
- Copper
- Chlorothalonil
- Oils
- Soaps

## Pesticide types by pest



**INSECTS**



**INSECTICIDES**

Examples:

- Pyrethrin 
- Permethrin
- Bifenthrin
- Carbaryl ↓
- Imidacloprid ↓
- Oils ↑
- Insecticidal Soaps ↑



Statewide IPM Project  
2001 Report, University of California

## MITES



## MITICIDES

Examples:

- Oils
- Soaps
- Some insecticides control mites

## Pesticide types by pest



VERTEBRATE PESTS



RODENTICIDES

Examples:

- Warfarin
- Diphacinone
- Chlorophacinone
- Zinc phosphide



SLUGS AND SNAILS



MOLLUSCICIDES

Examples:

- Iron phosphate
- Metaldehyde

Deadline discontinued. Corry's does not contain Metaldehyde anymore, and is now Ferric sodium EDTA. Bug-Geta contains 1% sulfur.

## 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

## Fungicides: powdery mildew & other foliar diseases

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



Copper fungicides are organic; used primarily in the dormant season

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

## What are some organic and less toxic insecticides?

- Insecticidal soaps
- Petroleum oils
- Neem and other plant based oils
- Microbials such as *Bacillus thurengiensis (Bt)*



For aphids, whiteflies and other soft bodied insects



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

## Plant essential oils and other exempt or “25b” products

- Most are derived from food plants
- Considered nontoxic to people
- Can be effective on soft-bodied insects and mites. Some have fungicidal activity
- Some act as repellents
- Very short residual



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

## Soaps vs Oils

- Smother pests/disrupt gas exchange— good coverage essential
- 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



## Soaps and Oils

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



APHIDS

SCALES



SPIDER MITES

WHITEFLIES



## Microbial Insecticides— derived from insect pathogens

- 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

## Other lower toxicity insecticides

- **Spinosad**— chewing insects and thrips. A natural fermentation product.
- Botanical or plant-derived insecticides—**pyrethrin** and **azadirachtin** (neem extract)
- **Boric acid** or **borate** for ant control.



UNIVERSITY OF CALIFORNIA AGRICULTURE & NATURAL RESOURCES  
**UC IPM**  
 Statewide Integrated Pest Management Program

UC IPM Home > Homes, Gardens, Landscapes, and Turf > Powdery Mildew on Fruits and Berries

**How to Manage Pests**  
**Pests in Gardens and Landscapes**

**Powdery Mildew on Fruits and Berries** [Download PDF](#)  
[Quick Tip](#)  
[Nota Breve](#)

Revised 1/11

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. Several powdery mildew fungi cause similar diseases on different plants (such as *Podosphaera* species on apple and stone fruits; *Sphaerotheca* species on berries and stone fruits; *Erysiphe necator* on grapevines, see Table 1). Powdery mildew fungi generally require moist conditions to release overwintering spores and for those spores to germinate and infect a plant. However, no moisture is needed for the fungus to establish itself and grow after infecting the plant. Powdery mildews normally do well in warm, Mediterranean-type climates. Thus powdery mildews are more prevalent than many other diseases in California's dry summer and fall seasons.



Powdery mildew on a grape leaf.

**IDENTIFICATION AND DAMAGE**

Powdery mildew can be recognized easily on most plants by the white to gray powdery mycelium and spore growth that forms on both sides of [leaves](#), sometimes on [flowers](#) and [fruit](#), and on [shoots](#).



**How to Use.** Apply protectant fungicides to susceptible plants before or in the earliest stages of disease development. Once mildew growth is mild to moderate, it generally is too late for effective control with protectant 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**  
 Compare risks >>>

Find information on toxicity in the UC IPM Pest Notes

Pest Note last updated 2009.

**How to Manage Pests**  
**Pesticide Information**

[| About Pesticide Information |](#)

**Active ingredient: Horticultural oil**

**Pesticide type: fungicide, insecticide (oil)**

Synonyms: fungicidal oil; horticultural oils; insecticidal oil; mineral oil; narrow range oil; oil; summer oil; supreme oil  
 See [example products](#) below.

Potential Hazard <sup>1</sup> to				
Water quality <sup>2</sup> (aquatic wildlife)	Natural enemies (beneficials)	Honeybees <sup>3</sup>	People and Other Mammals	
			Acute <sup>4</sup>	Long Term <sup>5</sup>
<input type="checkbox"/> NKR	<input type="checkbox"/> L	<input type="checkbox"/> M	<input type="checkbox"/> VL	Not listed

**Acute Toxicity to People and other Mammals<sup>4</sup>**

- Toxicity rating: **Not Acutely Toxic**

**Long-Term Toxicity to People and other Mammals<sup>5</sup>**

- **On US EPA list:** Not listed;
- **On CA Proposition 65 list:** Not listed

**Water Quality Rating<sup>2</sup>**

- Absorbed runoff toxicity risk to fish rating: **No Known Risk**
- Solution runoff toxicity risk to fish rating: **No Known Risk**
- Source: UC IPM WaterTox Database (originally NRCS Pesticide Properties Database)

**Impact on Natural Enemies**

- Overall toxicity rating: **Low**
- Specific impacts: predatory mites (**Low**), parasitoids (**Low**), general predators (**Low**)

**Impact on Honeybees<sup>3</sup>**

- Toxicity category: III - **Apply only during late evening, night, or early morning**

**Pests for which it is mentioned in Pest Notes**

[Aphids](#) • [Apple and Pear Scab](#) • [Avocado Lace Bug](#) • [Biological Control and Natural Enemies](#) • [California Oakworm](#) •

## 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

<b>ACTIVE INGREDIENT:</b>	
Permethrin: [*3-Phenoxyphenyl] methyl (±) cis/trans 3-(2,2-dichloroethenyl)-2,2- dimethylcyclopropanecarboxylate] .....	2.5%
<b>OTHER INGREDIENTS</b> .....	97.5%
	Total 100.0%
*cis/trans isomer ratio: Min 35% (±) cis Max 65% (±) trans	
<b>KEEP OUT OF REACH OF CHILDREN</b>	
<b>CAUTION</b>	See Booklet For Additional Precautionary Statements

Look closely for:

- ✓ Active ingredients
- ✓ Signal word
- ✓ EPA registration number

## 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

### Weed Pharm Label

KEEP OUT OF REACH OF CHILDREN

**DANGER - PELIGRO**

Si usted no entiende, busque a alguien para que se la explique a usted en detalle. (If you do not understand the label, find someone to explain it to you in detail.)

EPA Registration No. 81936-1-81935  
EPA Establishment No. 81936-WA-001

Pharm Solutions Inc.  
2023 E. Sims Way.  
Suite #358  
Port Townsend, WA 98368

Active Ingredients by wt.  
Acetic Acid . . . . . 20.0%\*  
Other Ingredients . . . . . 80.0%  
TOTAL . . . . . 100.0%

\*Equivalent to 200 grain vinegar by titration

#### First Aid

**If in Eyes**  
Hold eyelids open and flush with a steady, gentle stream of water for 15-20 min. Remove contact lenses, if present, after first 5 min., then continue rinsing eye.

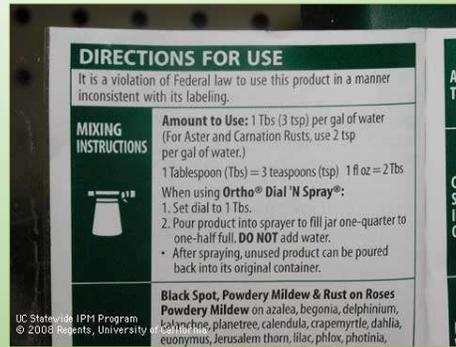
**If on Skin or Clothing**  
Take off contaminated clothing. Rinse skin immediately with plenty of water for 15-20 min. Call poison control center or doctor for further treatment.

**If Swallowed**  
Call poison control center or doctor immediately for

Top one has better pixels than bottom.

## Directions for use

- How to mix up product (if applicable)
- Plants or sites you can use it on
- Pests it controls
- Special restrictions

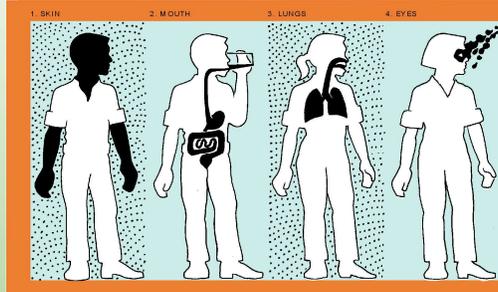




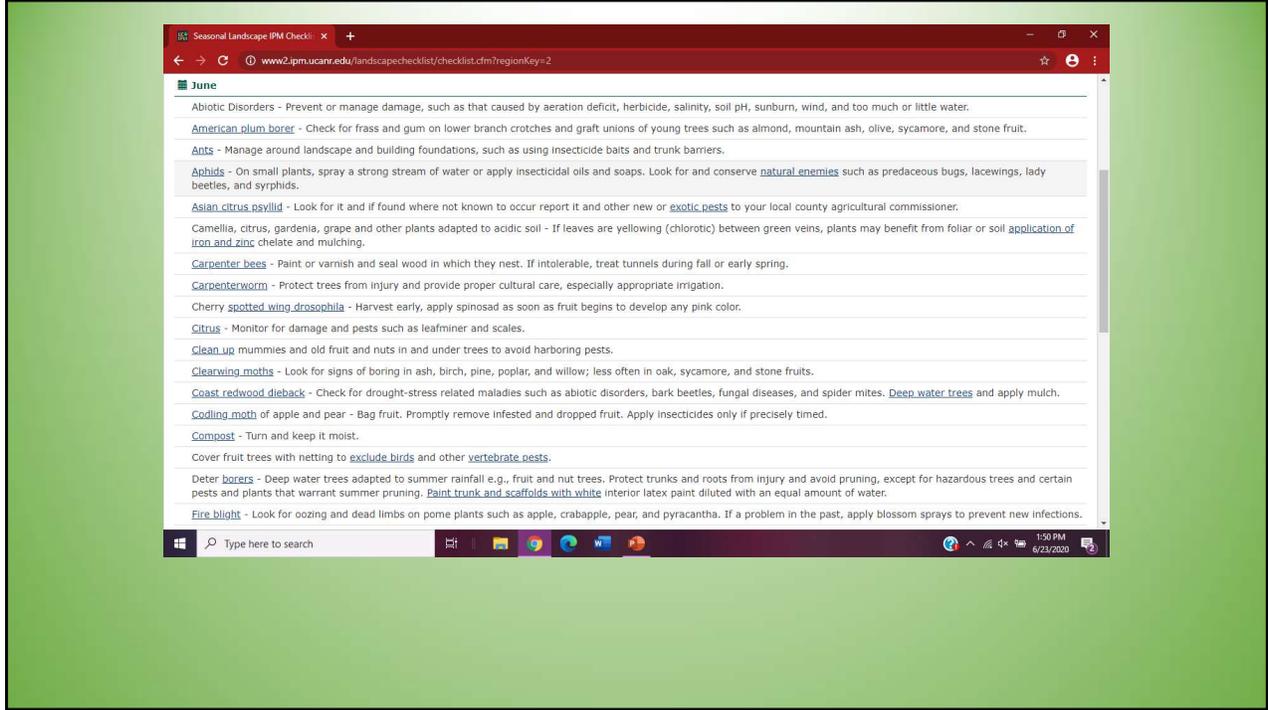
Dress for Safety

## 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.







## Sources of Pesticide Environmental and Health Impact Information on the Web

- National Pesticide Information Center:  
<http://npic.orst.edu>
- UC IPM Web site, pesticide active ingredients database:  
<http://www.ipm.ucanr.edu>
- Pesticide Action Pesticide Database:  
<http://www.pesticideinfo.org/>

For information on how to manage specific home and garden pests, visit the UC IPM Web site: [www.ipm.ucanr.edu/homegarden](http://www.ipm.ucanr.edu/homegarden)

## Resources

- California Master Gardener Handbook 2<sup>nd</sup> Edition, Pittenger, Dennis R., University of California Division of Agriculture and Natural Resources, 2015
- Amador County Master Gardeners [https://ucanr.edu/sites/Amador\\_County\\_MGs/](https://ucanr.edu/sites/Amador_County_MGs/)
- UCCE [www.ucanr.edu](http://www.ucanr.edu)
- UC Statewide Integrated Pest Management Program Web Site (<http://ipm.ucanr.edu/>)
- UC IPM Natural Enemies Gallery <http://ipm.ucanr.edu/PMG/NE/index.html>
- IPM Natural Enemies Poster <http://ipm.ucanr.edu/FAQ/natural-enemies-poster.pdf>
- California Native Plant Society [www.cnps.org](http://www.cnps.org)
- California Native Plant Society deer resistant plants <https://www.cnps.org/gardening/deer-resistant-native-plants-5588>
- Beneficial Insects for a Healthy Garden, Rachel Opendahl, Master Gardener Tuolumne County