

Plant Bed Calculations & Integrated Pest Management (IPM) in Plant Beds

Limited Commercial Landscape Maintenance (LCLM)
Pesticide Applicator Certification Workshop

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UF / IFAS

Palm Beach County Cooperative Extension
Service



Love the Math!

We want to learn how to do the following:

- Determine Square Feet in a Rectangular plant bed
- Determine Square Feet in a Square plant bed
- Determine Square Feet in a Circular plant bed
- Determine Square Feet in a Triangular plant bed

WHY?

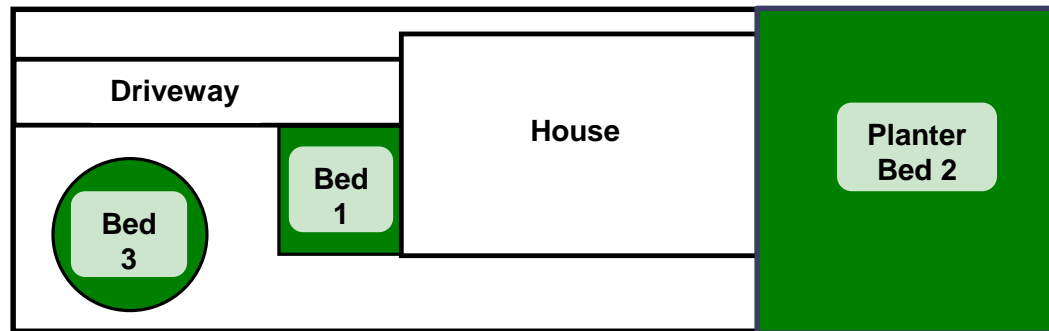
WHY?

Because we need to know them to calculate how much pesticide to use for weed, insect, disease or other pest management

Questions on Calculations for Square Footage?



Using This Yard



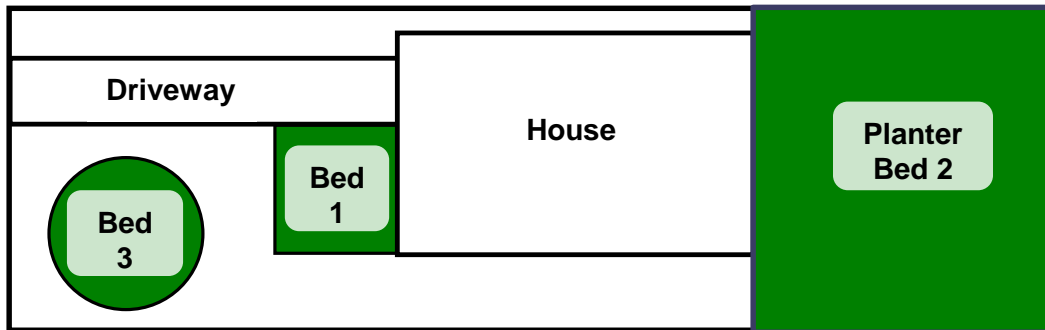
How many square feet are in the square planter bed 1?

Area of a square = Length X Width

Planter Bed 1 is 20 feet by 20 feet, so:

20 feet X 20 feet = **400 ft²**

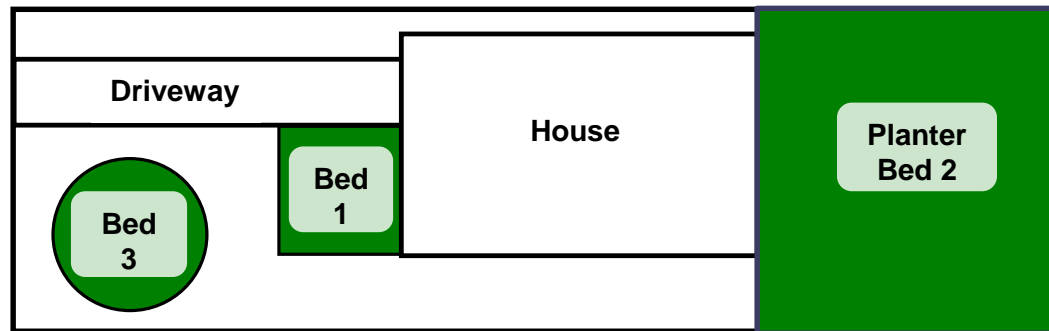
Using This Yard



2. How many square feet are in the rectangular planter bed 2?

Area of a rectangle is the same as a square = Length X Width
Planter Bed 2 is 45 X 50 feet, so
45 feet X 50 feet = **2,250 ft²**

Using This Yard



How many square feet are in the circular planter bed 3?

Area of a circle is $\pi \times R^2$ (the same as $3.14 \times \text{Radius} \times \text{Radius}$)

Radius is half the diameter

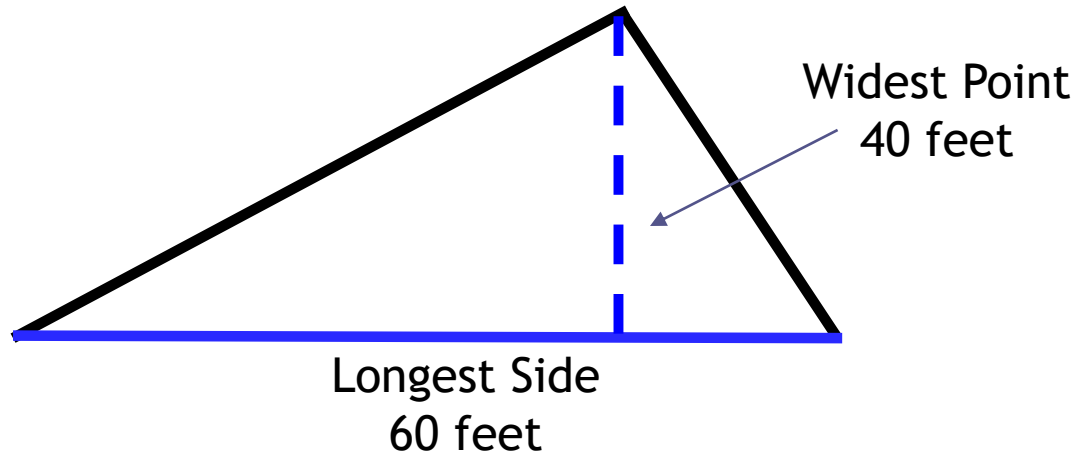
Diameter is the distance across the widest spot on the circle

Planter Bed 3 Diameter in example is 20 feet, so

$$R = 20/2 = 10$$

$$\pi \times 10^2 = 3.14 \times 10 \times 10 = 314 \text{ ft}^2$$

Area of a Triangle

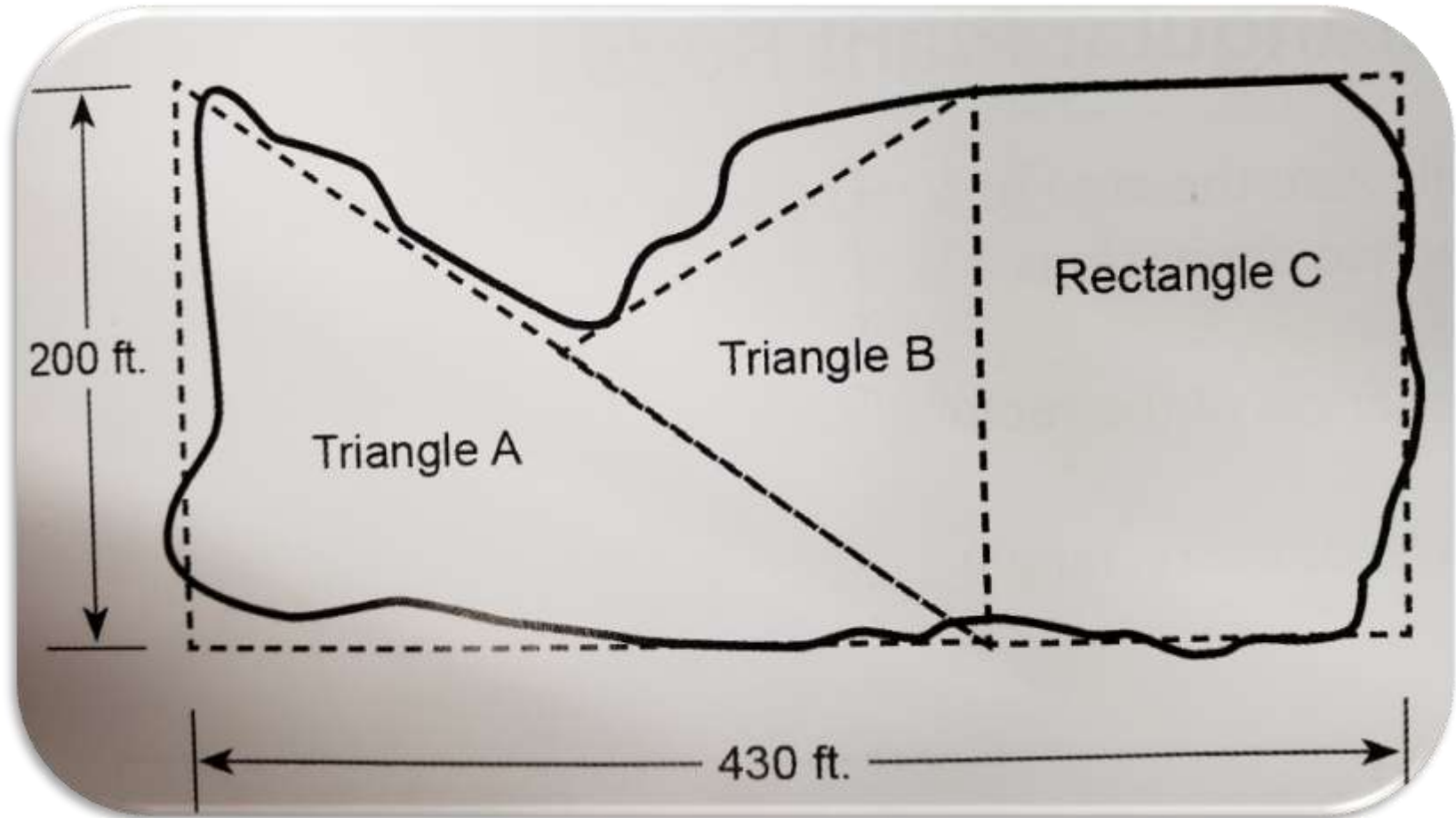


How many square feet in a triangle?

Area of a triangle: (longest side X length at widest point)/2

Area = 60 feet X 40 feet / 2 = **1,200 ft²**

How about odd shaped properties?



Break up into shapes you can figure and add together

Calibrating Calculations

How many ounces of herbicide are needed to make **3 gallons** of a **2% solution** spray?



Photo: M.J. Weaver, VA Tech Univ.

How many ounces of herbicide are needed to make **3 gallons** of a **2% solution** spray?

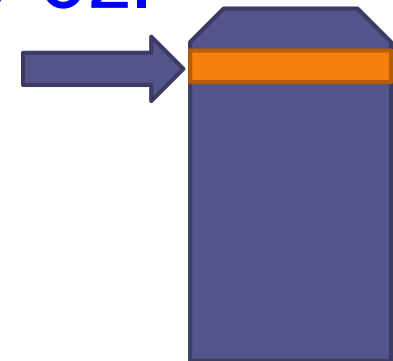
Divide by 100 to convert percent to decimal Ex. for 1%

- $2/100 = 0.02$

(Note: 128 ounces in 1 gallon)

- $0.02 \times 128 \text{ oz. per gallon} = 2.6 \text{ oz.}$

- $2.6 \text{ oz.} \times 3 \text{ gal.} = 7.8 \text{ ounces}$



2% of every gallon is herbicide

A plant bed containing 18 variegated ginger plants has spider mites. The miticide labeled rate is 3 fluid ounces per gallon of water applied as “spray to wet”.

With just water in your backpack sprayer, you determine that it requires 12 seconds to spray an average size plant. When you spray for 12 seconds into a bucket, you collect 10 ounces of water. How much insecticide will be needed for this entire job?

What do you know?



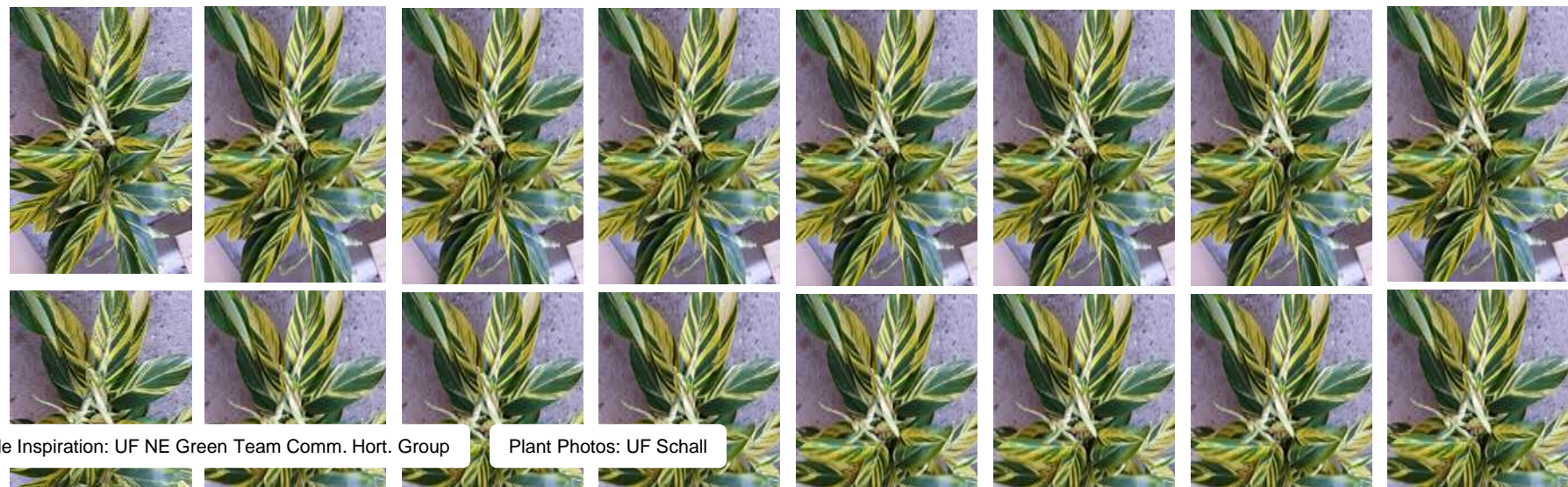
1. Rate is 1 gallon of water with 3 ounces of product

2. You have 18 plants to treat at 12 seconds per plant to spray

3. In 12 seconds you fill the bucket with 10 ounces of water



4. That means that each plant receives 10 ounces of water or 180 ounces for all of them

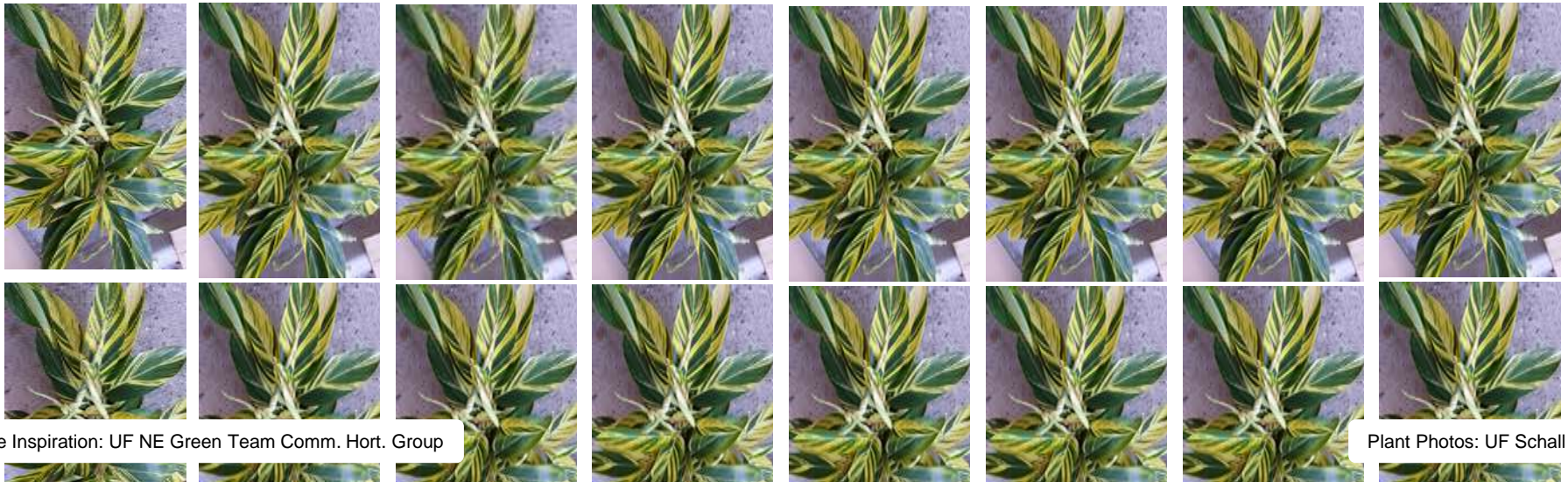


Now what?

- 5.** Convert 180 ounces to gallons
128 ounces = 1 gallon
180 ounces ÷ 128 ounces per gal.
= 1.4 gallons of water needed to
treat 18 plants

- 6.** Label rate is 3 ounces per gallon
1.4 gal. x 3 ounces = 4.2 ounces

- 7.** Add 1.4 gallons of
water and 4.2 ounces
of product to treat
your plants.



Quantities Too Small to Measure with Teaspoon

Convert to milliliters (ml)
1 fluid ounce = 29.6 milliliters (ml)

How much insecticide should be mixed into a full 16-ounce hand-held compressed air spray bottle to prepare a 0.5% spray solution?

- Convert 0.5% to a decimal:
So, $0.5 \div 100 = 0.005$
- 0.005×16 ounces of water = 0.08 ounces
- 0.08 ounces $\times 29.6$ ml = **2.37 ml**
- if you were trying to do teaspoons, this would be just under $\frac{1}{2}$ teaspoon. However, it becomes more important when you drop below $\frac{1}{4}$ or $\frac{1}{8}$ teaspoon



Photo: UF Schall

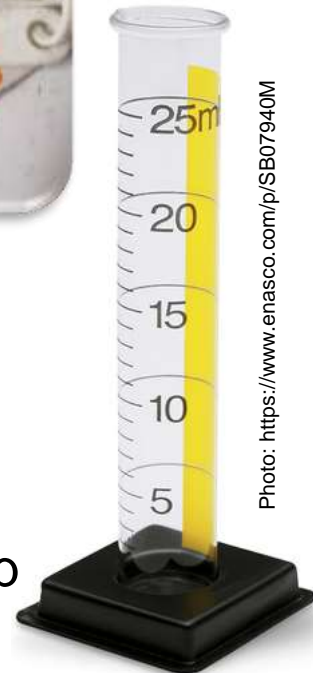


Photo: <https://www.enasco.com/p/SB07940M>

IPM

Integrated Pest Management

- Developed in 1950s to reduce pesticide use, environmental contamination, & pesticide resistance
- Combines cultural, biological, genetic, mechanical/physical & **chemical controls**

Objectives to:

- Reduce pest management expenses, conserve energy, & reduce exposure risks for people, animals & the environment



IPM

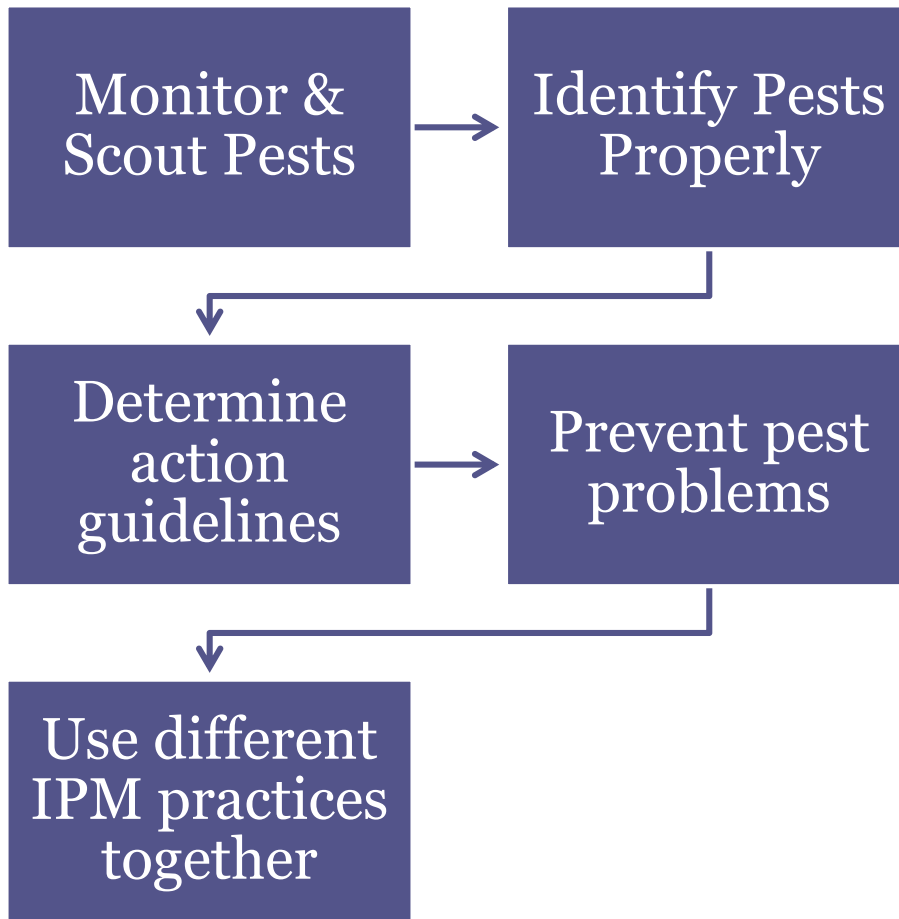
Integrated Pest Management

Emphasis should be on preventative practices like:

- Sanitation (e.g. weed control; plant debris removal)
- Proper fertilization
- Proper irrigation
- Proper pruning
- Etc.

Basically trying to create a strategy combining the best tools (safest, most effective, & most economical) to **manage** pest or diseases





Steps in IPM



IPM

Scouting (monitoring)

- Must be systematic - weekly typically optimal – why?
- Monitor pest outbreaks for early detection & learn when they most frequently occur
- Monitor pest densities or disease severity
- Monitor for “natural enemies”
- Look for the “unusual” - what appears to be a problem

Photo: Stephen Fouch, Mich. State Univ. Extension



Photo: Scott Bauer, USDA Ag. Research Service, Bugwood.org



Photos: UF Schall



Scouting - also take into account

- Growth & health of plant
- Weather conditions
- Environment around plants
- Keep records of your findings



IPMI

The first step in an IPM program
Identify Pests Correctly – why?

- Take the time for proper ID
 - Labs
 - Extension agents
 - Consultants
 - Web or other reference sources

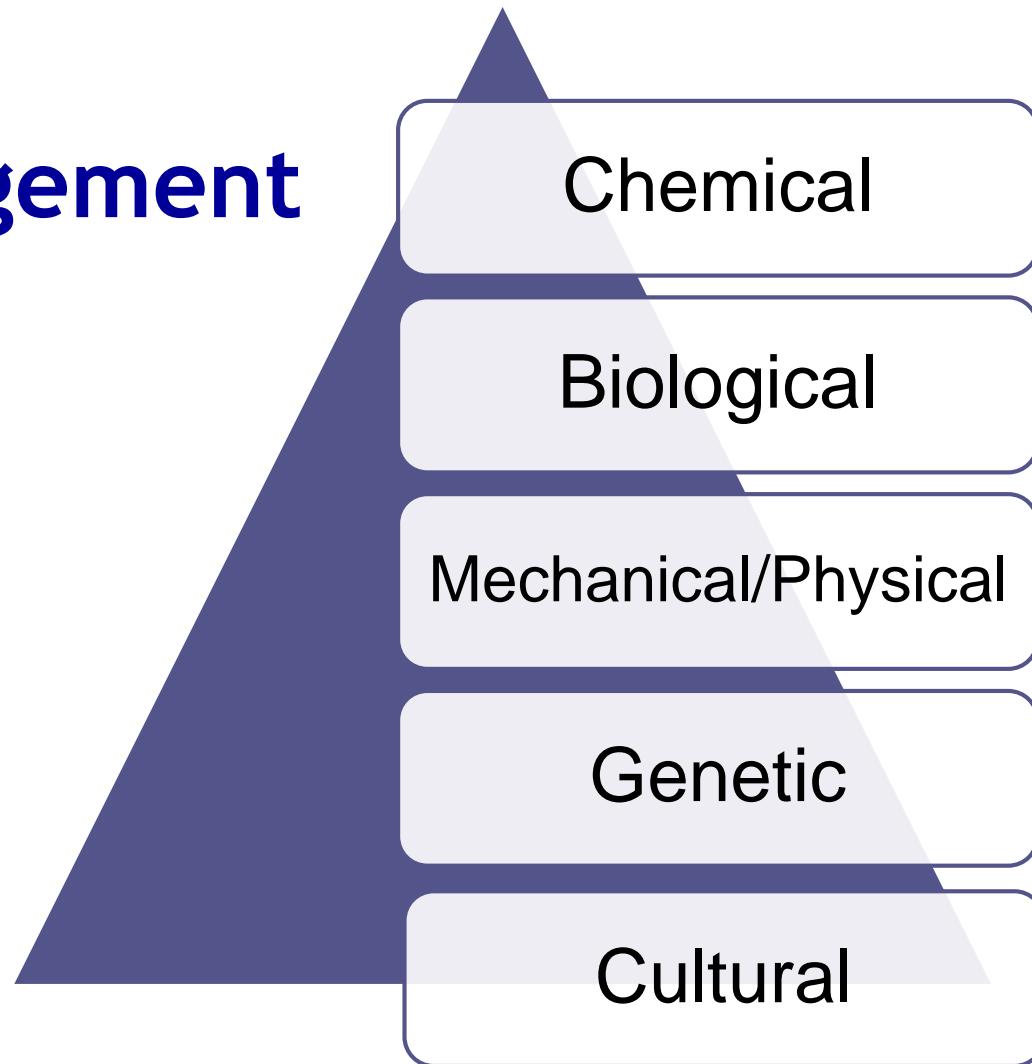
EDIS:

edis.ifas.ufl.edu

UF UNIVERSITY of FLORIDA IFAS Extension		NEMATODE ASSAY FORM		Nematode Assay Laboratory P.O. Box 110829 Building 78 Mowry Road University of Florida Gainesville, FL 32611-0829 (352) 392-3994 Fax# (352) 392-3438 E-mail: nematlab@ifas.ufl.edu	
GROWER/OWNER NAME AND ADDRESS			CONSULTANT, PEST CONTROL COMPANY, etc.		
Name _____			Name _____		
Address _____			Address _____		
City/State _____ Zip _____			City/State _____ Zip _____		
Phone () _____ Fax () _____			Phone () _____ Fax () _____		
E-mail _____			E-mail _____		
COUNTY _____ EXT AGENT _____			Send Results To: <input type="checkbox"/> Grower <input type="checkbox"/> Pest Control/Consultant		
DATE COLLECTED _____			By: <input type="checkbox"/> Mail <input type="checkbox"/> E-mail <input type="checkbox"/> FAX		
Information Needed for Correct Interpretation of Assay Results:					
IS THIS SAMPLE FOR:					
<input type="checkbox"/> Diagnosis of problem of existing crop/plant					
<input type="checkbox"/> Advice for a future planting					
<input type="checkbox"/> Experimental data					
PLANT/CROP - species and variety if known:					
Present _____ Age _____					
Previous _____ Future _____					
SYMPTOMS: Circle terms which describe the crop.					
Plant - wilted, stunted, yellow, decline, dead					
Root - galls, stunted roots, root rot, pod rot					
SITUATION (✓) <input type="checkbox"/> Commercial <input type="checkbox"/> Residential <input type="checkbox"/> Public					
CIRCLE ONE OF THE FOLLOWING:					
Field, Grove, Nursery, Golf Course, Lawn, Garden, Park, Playing Field, Landscaping, Containerized/Interior Ornamental, Other _____					
MAIN SOIL TYPE (✓) <input type="checkbox"/> Sand <input type="checkbox"/> Clay <input type="checkbox"/> Muck <input type="checkbox"/> Artificial Mix <input type="checkbox"/> Marl					
Size of crop area _____					
Recent nematocide use, prior history of nematodes, other pertinent information _____					

Lab Sample No. _____ Date Received _____					
Sample Status: <input type="checkbox"/> Paid <input type="checkbox"/> IFAS Service <input type="checkbox"/> Other (explain) _____					

IPM Management Methods

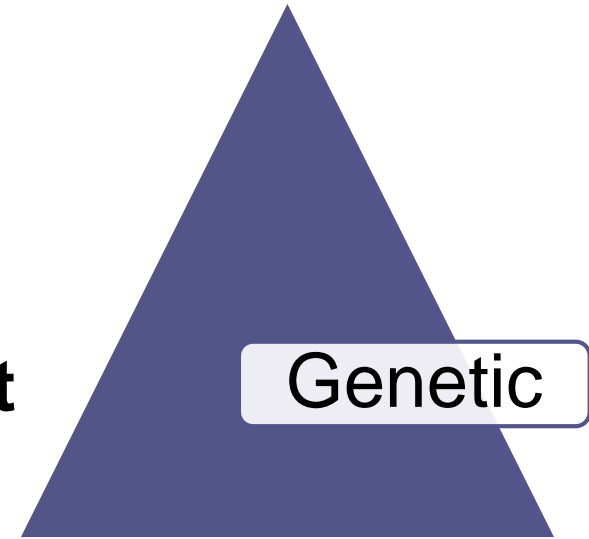


IPM Management Methods - Genetic

Example:

Plant breeding to be resistant

- Turfgrass
- Impatiens
- Crape Myrtle
- Etc.



IPMI

Follow Control Action Guidelines - methods include Cultural

- Right Plant/Right Place
- Plant pest-resistant material
- Use pest free seeds & plants
- Mulch
- Sanitize Equipment
- Reduce compacted soil
- Prepare planting sites
- Observe planting dates
- Be tolerant



LANDSCAPE PLANTS FOR SOUTH FLORIDA
A Manual for Gardeners, Landscapers & Homeowners

Welcome to the Online Manual of Subtropical Landscaping Plants prepared by the Horticulture students and staff at Palm Beach State College in Palm Beach Gardens, Florida.

This Online Manual is an ever-evolving project under the directorship of Department Chair George Rogers, Ph.D.

The Landscape Plants for South Florida (5th Ed.) books have arrived at Palm Beach State College

<http://www.plantbook.org>



IPMI

Cultural

Watering

You are trying to apply just enough to wet the root zone

- 1/2 to 3/4 inch wets our fine sands to about 12 or 14 inches – this should be the maximum amount applied per irrigation
- About 1 inch total, including rainfall per week is optimal
- Newly planted material will require more until established

IPMI

Follow Control Action Guidelines

Mechanical/Physical Examples

- Chop out weeds, or remove diseased branch
- Clean leaves & plant debris off ground, etc.
- No scalping
- No lion-tailing or hatracking trees or over-shearing shrubs



IPMI

Follow Control Action Guidelines

Biological Examples

- Release or conservation (protection) of natural enemies like predator or parasitoid insects or pathogens to attack pest
- Treat only infested areas
- Recognize all stages of beneficial insects
- Avoid broad spectrum insecticides when possible
- Soil drench may be softer on beneficials than leaf sprays



Photo: Frank Peairs, Colorado State University, Bugwood.org



Photo: David Cappaert, Bugwood.org



Photo: Whitney Cranshaw, Colorado State University, Bugwood.org

Follow Control Action Guidelines
Biological – Beneficial Insects



Convergent Lady Beetle &
Molted Exoskeletons & Larva

Photo: Whitney Cranshaw, Colorado State University, Bugwood.org

Photo: Louis Tedders, USDA Agricultural Research Service, Bugwood.org

Follow Control Action Guidelines
Biological – Beneficial Insects



Parasitoid wasp attacking fall
armyworm (caterpillar)

Follow Control Action Guidelines

Biological – Beneficial Insects or pest?



Photo: University of Florida



Red Imported Fire Ants

Photo: John Ruberson, Kansas State University, Bugwood.org

IPM

Follow Control Action Guidelines

Chemical – Use of pesticides. They are not generally considered “natural” control

- **Biorational** considered softer forms of pesticides

Examples

- Insecticidal soaps & oils
- Bt
- Pyrethrum



Photo: USDA APHIS PPQ Archive,
USDA APHIS PPQ, Bugwood.org

IPM

More Control Action Guideline Terms

- **Aesthetic Injury Level** – how much damage will customer put up with
- Highly maintained landscapes have a lower aesthetic injury level threshold

Another way to look at it – at what level does the plant look so bad that treatment is necessary?

- **Treatment Thresholds** – relates to the number of pests on a plant or disease severity that trigger your treatment. Example: controlling ficus whitefly when you see the insect, but before the hedge defoliates



IPM

More Control Action Guideline Terms

- **Timing** – an example is when insects are still young and numbers are low – like caterpillars. Another example, applying fungicide before symptoms are seen
 - What if rain is headed in?
Answer – Washes off, and possible leaching
- **Eradication** – try to wipe the pest out. Almost always impossible
- **Suppression** – reduce pest numbers to acceptable levels – not eradication – ficus whitefly again is another good example



Photo: USDA APHIS PPQ Archive,
USDA APHIS PPQ, Bugwood.org



2017 **Southeastern U.S.**
Pest Control Guide for Nursery
Crops and Landscape Plantings





EDIS

- ▼ **Topics**
 - Agriculture
 - Community Development
 - Environment
 - Families & Consumers
 - 4-H Youth Development
 - Lawn & Garden
- ▼ **Feature Pages**

New and Revised Publications

Dune Restoration and Enhancement for the Florida Panhandle



1K

What is EDIS?

EDIS is the Electronic Data Information Source of UF/IFAS Extension, a collection of information on topics relevant to you. [More...](#)

Levels of IPM - again, lets review

Eradication – eliminating pest completely

Monitoring – observing a population

Prevention – stopping a pest population before it starts

Suppression – reducing pests to an acceptable level

IPMI

Use integrated methods
combined into a strategy



Photo: USDA Agricultural Research Service
Archive, USDA Ag. Research Service,
Bugwood.org

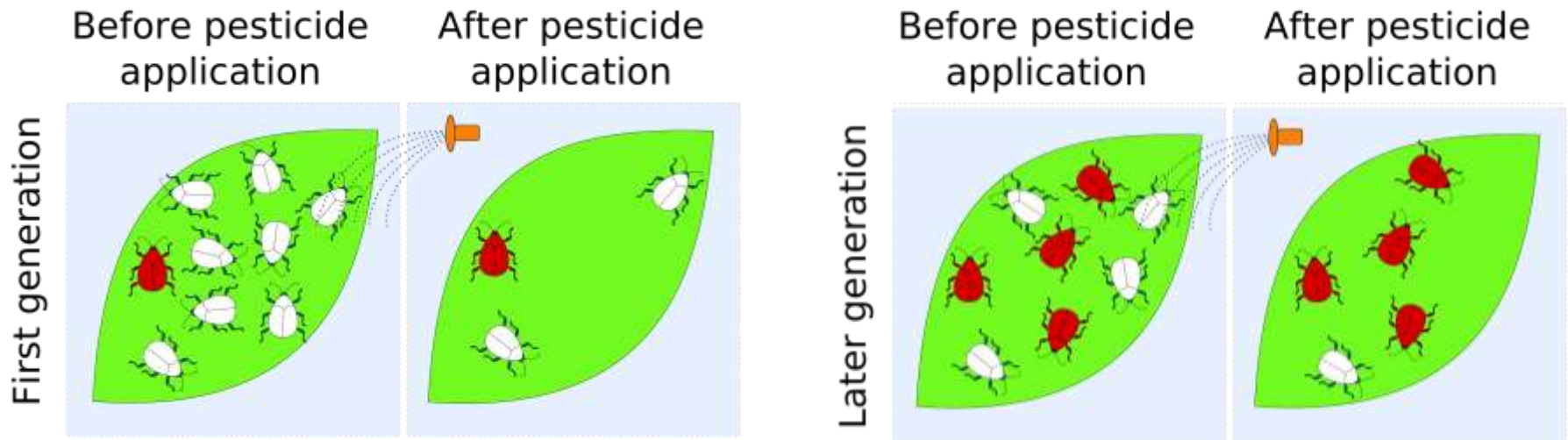


Photo: Scott Bauer, USDA Ag.
Research Service, Bugwood.org



Photo: Andrew Koeser, International
Society of Arboriculture, Bugwood.org

Understanding Pesticide Resistance



- The gene change or selection (red here) is induced by the pesticide overuse and is the main reason for resistance developing
- Applying doses that are too low to kill most of the insects (sub-lethal) also contributes in a secondary way

A close-up photograph of a dark beetle, possibly a weevil, on a green leaf. The beetle is positioned in the upper center of the frame, with its head and thorax visible. The leaf's texture is clearly visible in the background. The text is overlaid on the image in white rounded rectangles.

Reducing Resistance

- Hundreds of fungi, weed & insect species worldwide have developed pesticide resistance
- **Rotate products with different modes of action, not just different names**

Mode of Action Classification

IRAC

Insecticide Resistance Action Committee The Key to Resistance Management

➤ Successive generations of a pest should not be treated with compounds from the same MoA Group.
➤ Not all of the current groupings are based on knowledge of a shared target protein. For further information, please refer to the IRAC Mode of Action Classification document.
➤ The color scheme used here associates modes of action into broad categories based on the physiological functions affected, as an aid to understanding symptomatology, speed of action and other properties of the insecticides, and not for resistance management purposes. Rotations for resistance management should be based only on the numbered mode of action groups.

Group 1: Acetylcholinesterase (AChE) inhibitors (Only major representatives of the groups are shown)

1A Carbamates
1B Organophosphates

Group 2: GABA-gated chloride channel antagonists

2A Cyclopyridone Organochlorines
2B Phenylpyrazoles (Fiproles)

Group 3: Sodium channel modulators (Only major representatives of group 3A are shown)

3A Pyrethroids Pyrethrins
3B DDT, Methoxychlor

Group 4: Nicotinic acetylcholine receptor (nAChR) competitive modulators

4A Neonicotinoids
4B Nicotine
4C Sulfoximines
4D Butenolides
4E Mesoloxins

Group 5: Nicotinic acetylcholine receptor (nAChR) allosteric modulators

5 Spinosyns

Group 6: Glutamate-gated chloride channel (GluCl) allosteric modulators

6 Avermectins, Milbemycins

Group 7: Juvenile hormone mimics

7A Juvenile hormone analogues
7B Fenoxycarb
7C Pyriproxyfen

Group 8: Miscellaneous non-specific (multi-site) inhibitors

8A Alkyl halides
8B Chloropicrin
8C Fluorides
8D Borates
8E Tartar emetic
8F Methyl isothiocyanate generators

Group 9: Chordotonal organ TRPV channel modulators

9B Pyridine azomethine derivatives
9C Diflufenican
9D Etoxazole

Group 10: Mite growth inhibitors

10A Clofentezine, Diflovidazin, Hexythiazox
10B Etoxazole

Group 11: Microbial disruptors of insect midgut

11A *Bacillus thuringiensis*
11B *Bacillus sphaericus*

Group 12: Inhibitors of mitochondrial ATP synthase

12A Diafenthiuron
12B Organotin miticides
12C Propargite
12D Tetradifon

Group 13: Uncouplers of oxidative phosphorylation via disruption of proton gradient

13 Pyriproles, Dintrophenols, Sulfiramid

Group 15: Inhibitors of chitin biosynthesis, type 2 (Only major representatives of the group are shown)

15 Benzoylureas

Group 16: Inhibitors of chitin biosynthesis, type 1

16 Buprofezin

Group 17: Neotenic disruptors, Dipterin

17 Cyromazine

Group 18: Ecdysone receptor agonists

18 Diacylhydrazines

Group 19: Octopamine receptor agonists

19 Amitraz

Group 20: Mitochondrial complex II electron transport inhibitors

20A Hydramethylnon
20B Acequinolyl
20C Fluacrypyrim
20D Bifenazate

Group 21: Mitochondrial complex I electron transport inhibitors

21A METI acaricides and insecticides
21B Rotenone

Group 22: Voltage-dependent sodium channel blockers

22A Oxadiazines
22B Semicarbazones

Group 23: Inhibitors of acetyl CoA carboxylase

23 Tetrone & Tetramic acid derivatives

Group 24: Mitochondrial complex IV electron transport inhibitors

24A Phosphides
24B Cyanides

Group 25: Mitochondrial complex II electron transport inhibitors

25A beta-Ketonitrile derivatives
25B Carboxanilides

Group 26: Ryanodine receptor modulators

26 Diamides

Group 27: Chordotonal organ modulators - undefined target site

27 Fonicamid

Group 28: Nerve & Muscle

28 Diamides
29 Fonicamid

Group UN: Compounds of unknown or uncertain mode of action

5 $CaCl_2$ (lime sulfur) sulfate

Targeted Physiology

- Nerve & Muscle
- Growth & Development
- Respiration
- Mitgyl
- Unknown or Non-specific

Use of Groups and Sub-Groups:

- Alternations, sequences or rotations of compounds between MoA groups reduces selection for target site resistance.
- Applications are arranged into MoA spray windows defined by crop growth stage and pest biology.
- Several sprays of a compound may be possible within each spray window, but successive generations of a pest should not be treated with compounds from the same MoA group.
- Local expert advice should always be followed with regard to spray windows and timing.
- Address in groups 8 (Miscellaneous non-specific multi-site inhibitors), 13 (Uncouplers) and UN are thought not to share a common target site and therefore may be freely rotated with each other unless there is a reason to expect cross-resistance.
- Sub-groups represent distinct structure classes believed to have the same mode of action.

Sub-groups provide differentiation between compounds that may bind at the same target site but are structurally different enough that risk of metabolic cross-resistance is lower than for close chemical analogs.

- Cross-resistance potential between sub-groups is higher than between groups, so rotation between sub-groups should be considered only when there are no alternatives, and only if cross-resistance does not exist, following consultation with local expert advice. These exceptions are not sustainable, and alternative options should be sought.
- Sub-group 2B: DDT is no longer used in agriculture and therefore this is only applicable for the control of insect vectors of human disease, such as mosquitoes, because of a lack of alternatives.
- Sub-group 10A: Hexythiazox is grouped with chlorfenapyr because they exhibit cross-resistance even though they are structurally distinct, and the target site for these compounds is unknown. Diflufenican has been added to this group because it is a close analogue of chlorfenapyr and is expected to have the same mode of action.

Poster Notes:

- Groups 26 and 27 are unassigned.
- The poster is for educational purposes only. Information presented is accurate to the best of our knowledge at the time of publication, but IRAC or its member companies cannot accept responsibility for how this information is used or interpreted. Advice should always be sought from local experts or advisers, and health and safety recommendations followed.
- Representative compounds are shown. Please visit www.irc-online.org for the complete IRAC classification.

<http://www.irc-online.org/modes-of-action>

ATTENTION:

This specimen label is provided for general information only.

- This pesticide product may not yet be available or approved for sale or use in your area.
- It is your responsibility to follow all Federal, state and local laws and regulations regarding the use of pesticides.
- Before using any pesticide, be sure the intended use is approved in your state or locality.
- Your state or locality may require additional precautions and instructions for use of this product that are not included here.
- Monsanto does not guarantee the completeness or accuracy of this specimen label. The information found in this label may differ from the information found on the product label. You must have the EPA approved labeling with you at the time of use and must read and follow all label directions.
- You should not base any use of a similar product on the precautions, instructions for use or other information you find here.
- Always follow the precautions and instructions for use on the label of the pesticide you are using.

2120313-23



The complete broad-spectrum post-emergence professional herbicide for industrial, turf and ornamental weed control.

Complete Directions for Use

AVOID CONTACT OF HERBICIDE WITH FOLIAGE, FRUIT, SEEDS, EXPOSED NON-WOODY ROOTS OR FRUIT OF CROPS, DESIRABLE PLANTS, TREES, BECAUSE SEVERE INJURY OR DESTRUCTION IS LIKELY TO RESULT.

GROUP	9	HERBICIDE
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EPA Reg. No. 524-529

2010-1

Read the entire label before using this product.

Use only according to label instructions.

Not all products listed on this label are registered for use in California. Check the registration status of each product in California before using.

Read the "LIMIT OF WARRANTY AND LIABILITY" statement at the end of the label before buying or using. If terms are not acceptable, return at once unopened.

THIS IS AN END-USE PRODUCT. MONSANTO DOES NOT INTEND AND HAS NOT REGISTERED IT FOR REFORMULATION. SEE INDIVIDUAL CONTAINER LABEL FOR REPACKAGING LIMITATIONS.

CAUSES MODERATE EYE IRRITATION

Avoid contact with eyes or clothing.

FIRST AID: Call a poison control center or doctor for treatment advice.	
IF IN EYES	<ul style="list-style-type: none"> • Hold eye open and rinse slowly and gently with water for 15-20 minutes. • Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye.
<ul style="list-style-type: none"> • Have the product container or label with you when calling a poison control center or doctor, or going for treatment. • You may also contact (314) 694-4000, collect day or night, for emergency medical treatment information. • This product is identified as Roundup PRO® Concentrate Herbicide, EPA Registration No. 524-529. 	

DOMESTIC ANIMALS: This product is considered to be relatively nontoxic to dogs and other domestic animals; however, ingestion of this product or large amounts of freshly sprayed vegetation may result in temporary gastrointestinal irritation (vomiting, diarrhea, colic, etc.). If such symptoms are observed, provide the animal with plenty of fluids to prevent dehydration. Call a veterinarian if symptoms persist for more than 24 hours.

Personal Protective Equipment (PPE)

Applicators and other handlers must wear: long-sleeved shirt and long pants, shoes plus socks. Follow manufacturer's instructions for cleaning/maintaining Personal Protective Equipment (PPE). If there are no such instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry.

Discard clothing and other absorbent materials that have been drenched or heavily contaminated with this product's concentrate. Do not reuse them.

When handlers use closed systems, enclosed cabs or aircraft in a manner that meets the requirements listed in the Worker Protection Standard (WPS) for agricultural pesticides (40 CFR 170.240 (d) (4-6)), the handler PPE requirements may be reduced or modified as specified in the WPS.

IMPORTANT: When reduced PPE is worn because a closed system is being used, handlers must be provided all PPE specified above for "applicators and other handlers" and have such PPE immediately available for use in an emergency, such as a spill or equipment breakdown.

User Safety Recommendations



Reducing Resistance

- Hundreds of fungi, weed & insect species worldwide have developed pesticide resistance
- **Rotate products with different modes of action, not just different names**
- The larval, nymph or instars (juvenile stages) are the most susceptible to chemicals

Horticultural soaps and oils

- Oil - light-weight and petroleum based generally recommended
- Both work best when contact pests
- Once dried they have little effect on pest or pollinators (bees)
- Reasonable control of armored scales, aphids, whiteflies, mites, and caterpillars – usually with repeat applications
- Can cause phytotoxicity if applied during high humidity (oil) or high temps (soap and oil) (90°F on most labels as limit)



What About Bees?

- The western honey bee is the most important pollinator of many of our food crops
- Several ways to protect bees
- On many products, bee toxicity is contained in the Environmental Hazards section of the label
- Neonicotinoids (imidacloprid, dinotefuran, clothianidin, thiamethoxam) have “**bee boxes**” on the labels and are considered highly toxic to bees
- **Imidacloprid** is the most commonly used of the neonicotinoids

Bee Advisory Box on Neonicotinoids



PROTECTION OF POLLINATORS
APPLICATION RESTRICTIONS EXIST FOR THIS PRODUCT BECAUSE OF RISK TO BEES AND OTHER INSECT POLLINATORS. FOLLOW APPLICATION RESTRICTIONS FOUND IN THE DIRECTIONS FOR USE TO PROTECT POLLINATORS.

Look for the bee hazard icon



in the Directions for Use for each application site for specific use restrictions and instructions to protect bees and other insect pollinators.

This product can kill bees and other insect pollinators.

Bees and other insect pollinators will forage on plants when they flower, shed pollen, or produce nectar.

Bees and other insect pollinators can be exposed to this pesticide from:

- Direct contact during foliar applications, or contact with residues on plant surfaces after foliar applications
- Ingestion of residues in nectar and pollen when the pesticide is applied as a seed treatment, soil, tree injection, as well as foliar applications.

When Using This Product Take Steps To:

- Minimize exposure of this product to bees and other insect pollinators when they are foraging on pollinator attractive plants around the application site.
- Minimize drift of this product on to beehives or to off-site pollinator attractive habitat. Drift of this product onto beehives or off-site to pollinator attractive habitat can result in bee kills.

Information on protecting bees and other insect pollinators may be found at the Pesticide Environmental Stewardship website at: <http://pesticidestewardship.org/PollinatorProtection/Pages/default.aspx>.

Pesticide incidents (for example, bee kills) should immediately be reported to the state/tribal lead agency. For contact information for your state, go to: www.aapco.org/officials.html. Pesticide incidents should also be reported to the National Pesticide Information Center at: www.npic.orst.edu or directly to EPA at: beekill@epa.gov

Several ways to protect bees

- Try not to spray between the hours of 8:00 AM – 5:00 PM when bees are most active
- Bees fly when air temperatures are above 55° F or 60° F
- Try to avoid treating just before or during flowering, or when you see bee activity
- Tank mixes tend to be more damaging than single insecticides
- Longer lasting insecticide formulations or **microencapsulated** formulations can be more damaging

Pesticides AI's considered less toxic to bees

Depends on how they are used, of course

- Insecticidal Soap
- Insecticidal Oil
- Bt (*Bacillus thuringiensis*)
- Azadirachtin (neem)
- Spinosad (Conserve, etc.)
- Chlorantraniliprole (Acelepryn)
- Acetamiprid (Tristar)
- Insect growth regulators
- Many miticides

Questions on IPM?



Photo: Sturgis McKeever, Georgia Southern University, Bugwood.org

1. What is the formula for calculating the area of a square?

1. πR^2
2. Length X Width
3. $2\pi R$
4. Length X Width X Height

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2. **Length X Width**

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4. Length X Width X
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2. What is the formula for calculating the area of a rectangle?

1. πR^2
2. Length X Width
3. $2\pi R$
4. Length X Width X Height

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1. πR^2

2. **Length X Width**

3. $2\pi R$

4. Length X Width X
Height

3. What is the formula for calculating the area of a circle?

1. πR^2
2. Length X Width
3. $2\pi R$
4. Length X Width X Height

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1. πR^2

2. Length X Width

3. $2\pi R$

4. Length X Width X
Height

4. What is Integrated Pest Management (IPM)?

1. Eliminate the use of pesticides
2. Use safest, most expensive strategy
3. Combine best, most effective & safest techniques into a strategy
4. Use only low-toxicity pesticides

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5. After scouting, what is the first step in an IPM Program?

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2. Identify pest or problem
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4. None of the above

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6. Give examples of mechanical and chemical pest management

1. Prune off infested branch & spray remainder of plant with pesticide
2. Release green lacewing larvae
3. Drench soil around the plant with an insecticide
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7. Insecticidal Soap

1. Kills via contact
2. Gives excellent control after drying
3. Control scale, whitefly and caterpillars
4. Both 1 & 3

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8. Is it possible to completely eradicate most pests?

1. Yes
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2. **No**

Plant Bed Calculations & Integrated Pest Management (IPM) in Plant Beds

Limited Commercial Landscape Maintenance (LCLM)
Pesticide Applicator Certification Workshop

Bill Schall

UF / IFAS

Palm Beach County Cooperative Extension
Service

