# 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 Extension
UNIVERSITY of FLORIDA

PALM BEACH COUNTY FLORIDA

# 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

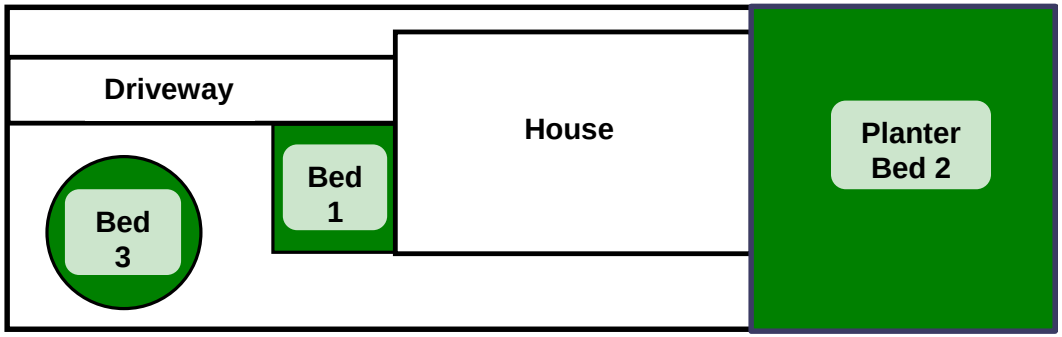
WHY?

# 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?

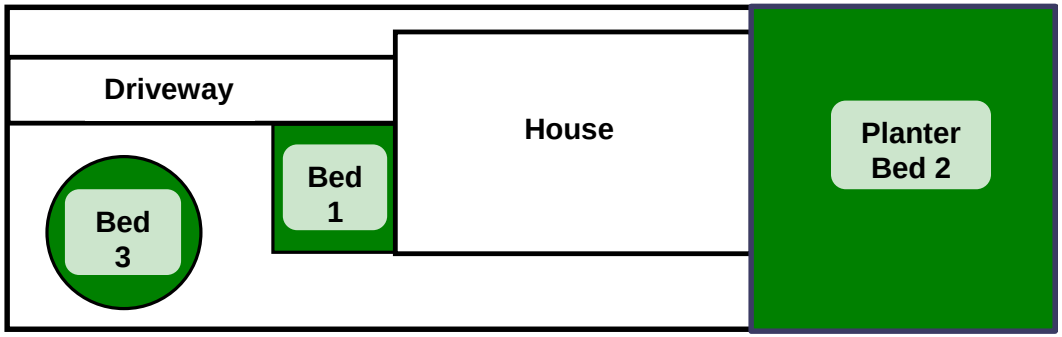
# Using This Yard




**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 $ft^2$**

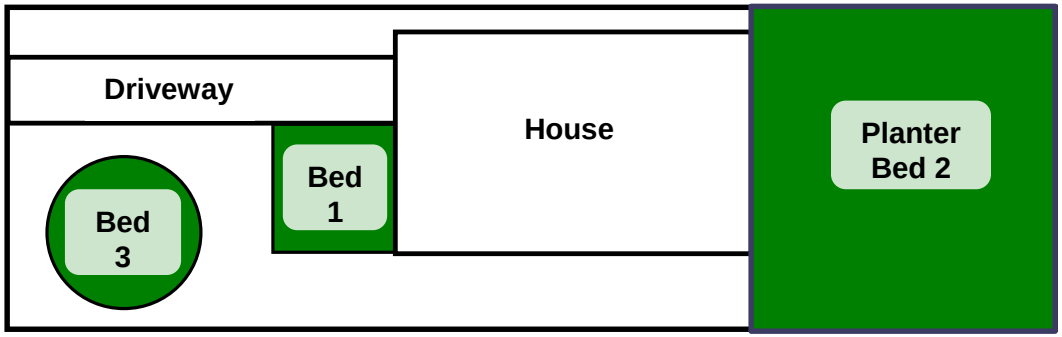
# Using This Yard




**2. How many square feet are in the <u>rectangular</u> 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**

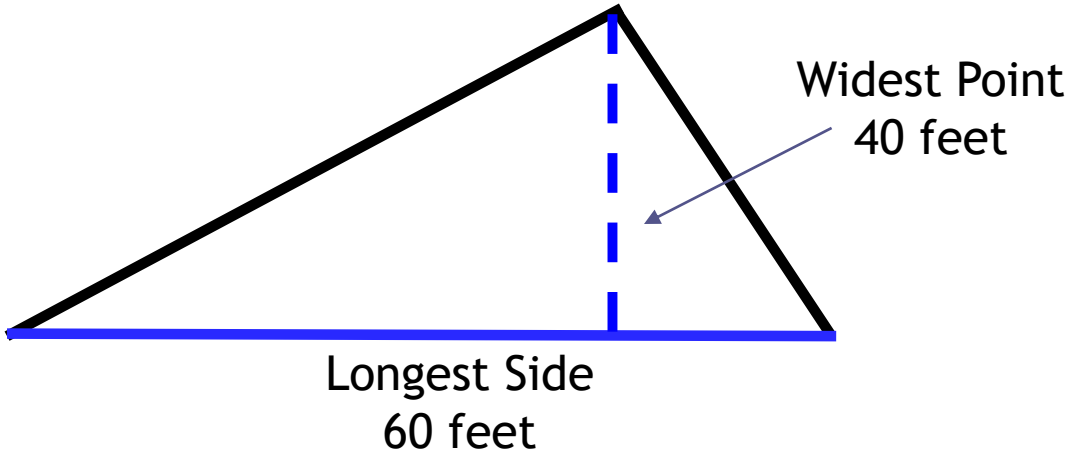
# Using This Yard




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

Area of a rectangle is Pi X $R^2$ (the same as 3.14 X Radius X 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 X $10^2$ = 3.14 X 10 X 10 = **314 $ft^2$**

# Area of a Triangle

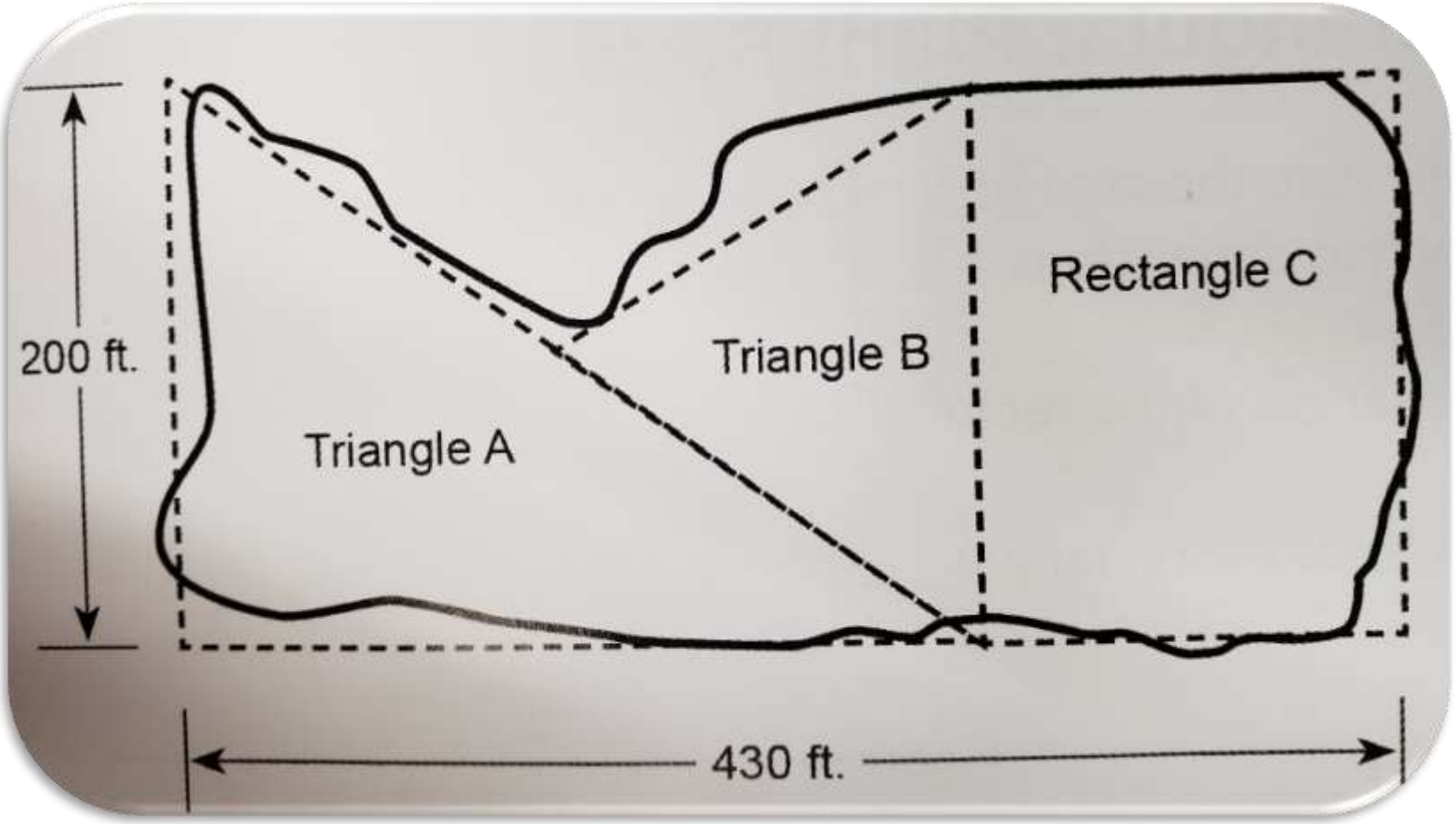



**How many square feet in a triangle?**

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

Area = 60 feet X 40 feet / 2 = **1,200 ft$^2$**

# 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.

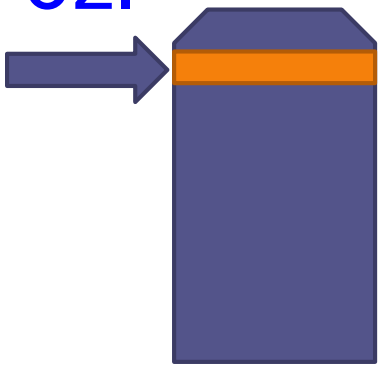
How many ounces of herbicide are needed to make 3 gallons of a 2% solution spray?

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

- 2/100 = 0.02

(Note: 128 ounces in 1 gallon)

- 0.02 X 128 oz. per gallon = 2.6 oz.
- 2.6 oz. X 3 gal. = 7.8 ounces



**2% of every gallon is herbicide**

Slide Inspiration: UF NE Green Team Comm. Hort. Group

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?

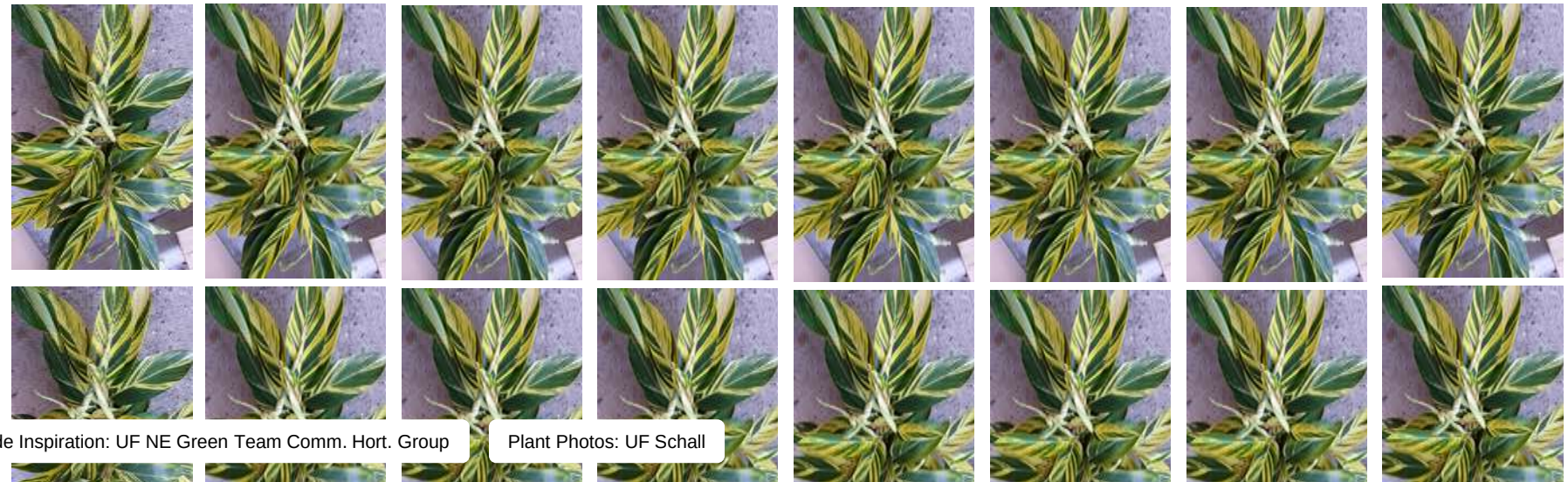
# What do you know?

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 <u>180 ounces</u> for all of them



Slide Inspiration: UF NE Green Team Comm. Hort. Group

Plant Photos: UF Schall

# Now what?

5. **Convert 180 ounces to gallons**

   **128 ounces = 1 gallon**

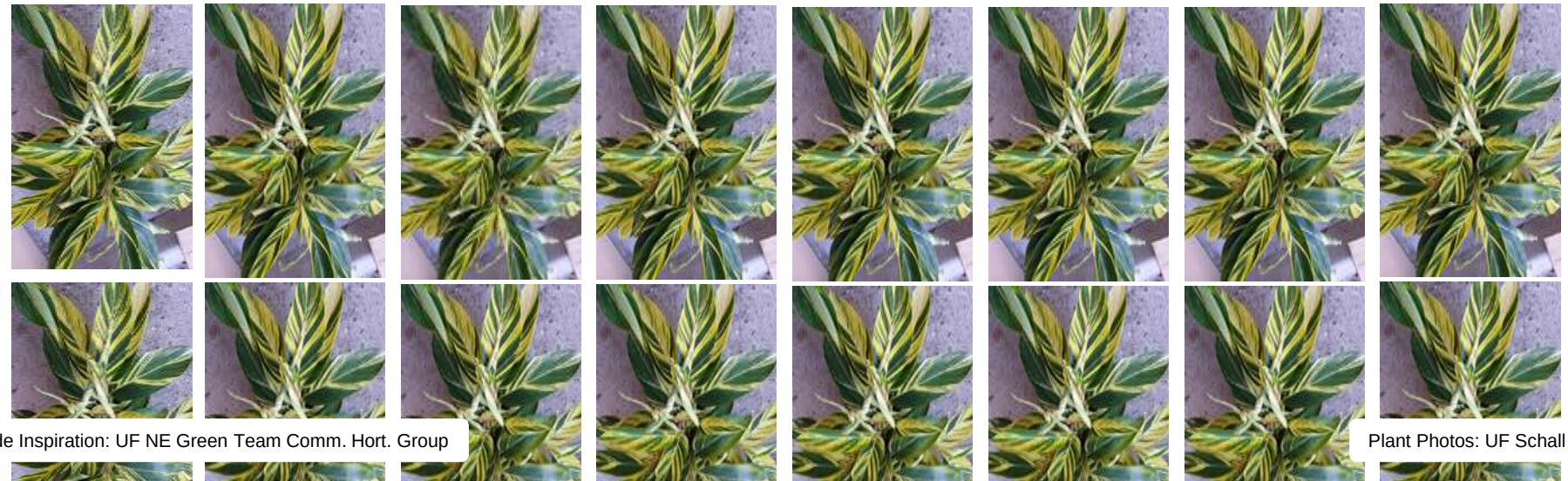
   **180 ounces ÷128 ounces per gal.**

   **= <u>1.4 gallons</u> of water needed to treat 18 plants**

6. **Label rate is 3 ounces per gallon**

   **1.4 gal. x 3 ounces = <u>4.2 ounces</u>**

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



Slide Inspiration: UF NE Green Team Comm. Hort. Group

Plant Photos: UF Schall

# 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?

Photo: UF Schall

- Convert 0.5% to a decimal:
  So, 0.5 ÷100 = 0.005
- 0.005 X 16 ounces of water = 0.08 ounces
- 0.08 ounces X 29.6 ml = **2.37 ml**
- if you were trying to do teaspoons, this would be just under ½ teaspoon. However, it becomes more important when you drop below 1/4 or 1/8 teaspoon

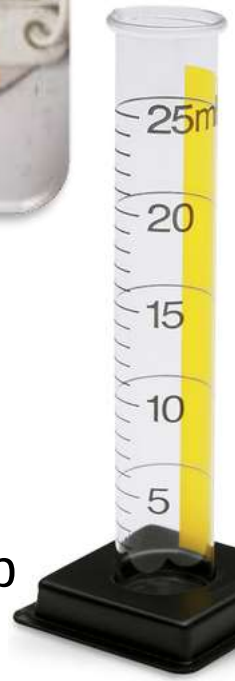


Photo: https://www.enasco.com/p/SB07940M

Slide Inspiration: UF NE Green Team Comm. Hort. Group

# 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

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

# 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

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

# Steps in IPM

- Monitor & Scout Pests
- Identify Pests Properly
- Determine action guidelines
- Prevent pest problems
- Use different IPM practices together

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

Slide Inspiration: UF NE Green Team Comm. Hort. Group

# 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

Slide Inspiration: UF NE Green Team Comm. Hort. Group

# IPM

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 110620
Building 78 Mowry Road
University of Florida
Gainesville, FL 32611-0620
(352) 392-1994 Fax# (352) 392-3438
E-mail: nemalab@ifas.ufl.edu

GROWER/OWNER NAME AND ADDRESS
Name
Address
City/State Zip
Phone ( ) Fax ( )
E-mail
COUNTY EXT AGENT
DATE COLLECTED

CONSULTANT, PEST CONTROL COMPANY, etc:
Name
Address
City/State Zip
Phone ( ) Fax ( )
E-mail
Send Results To: ☐ Grower ☐ Pest Control/Consultant
By: ☐ Mail ☐ E-mail ☐ FAX

Information Needed for Correct Interpretation of Assay Results:

IS THIS SAMPLE FOR:
☐ Diagnosis of problem of existing crop/plant
☐ Advice for a future planting
☐ 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

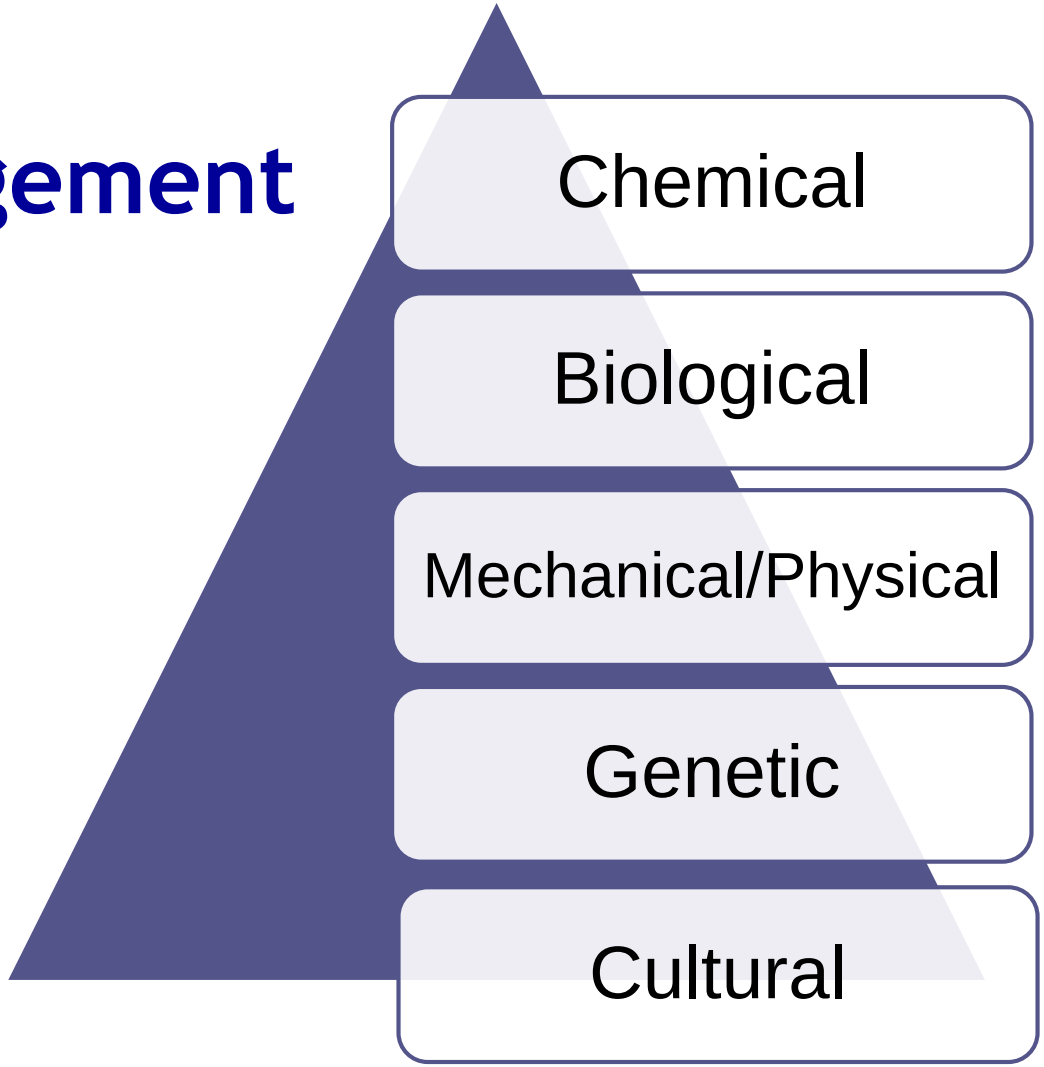
SITUATION (✓) ☐ Commercial ☐ Residential ☐ Public

CIRCLE ONE OF THE FOLLOWING:
Field, Grove, Nursery, Golf Course, Lawn, Garden, Park, Playing Field, Landscaping,
Containerized/Interior Ornamental, Other

MAIN SOIL TYPE (✓) ☐ Sand ☐ Clay ☐ Muck ☐ Artificial Mix ☐ Marl
Size of crop area
Recent nematicide use, prior history of nematodes, other pertinent information

Lab Sample No. Date Received
Sample Status: ☐ Paid ☐ IFAS Service ☐ Other (explain)

# IPM Management Methods



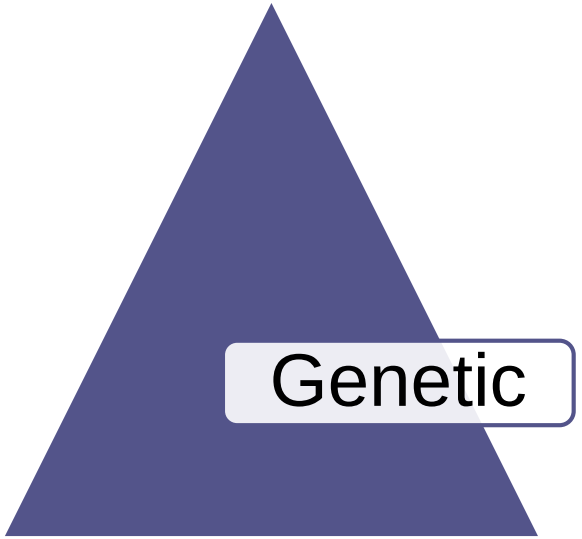

Slide Inspiration: UF NE Green Team Comm. Hort. Group

# IPM Management Methods - Genetic

**Example:**

**Plant breeding to be resistant**

- **Turfgrass**
- **Impatiens**
- **Crape Myrtle**
- **Etc.**




Slide Inspiration: UF NE Green Team Comm. Hort. Group

# IPM

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



**http://www.plantbook.org**

# IPM

## 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

# IPM

Follow Control Action Guidelines

**<u>Mechanical/Physical</u>** 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

# IPM

## 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**

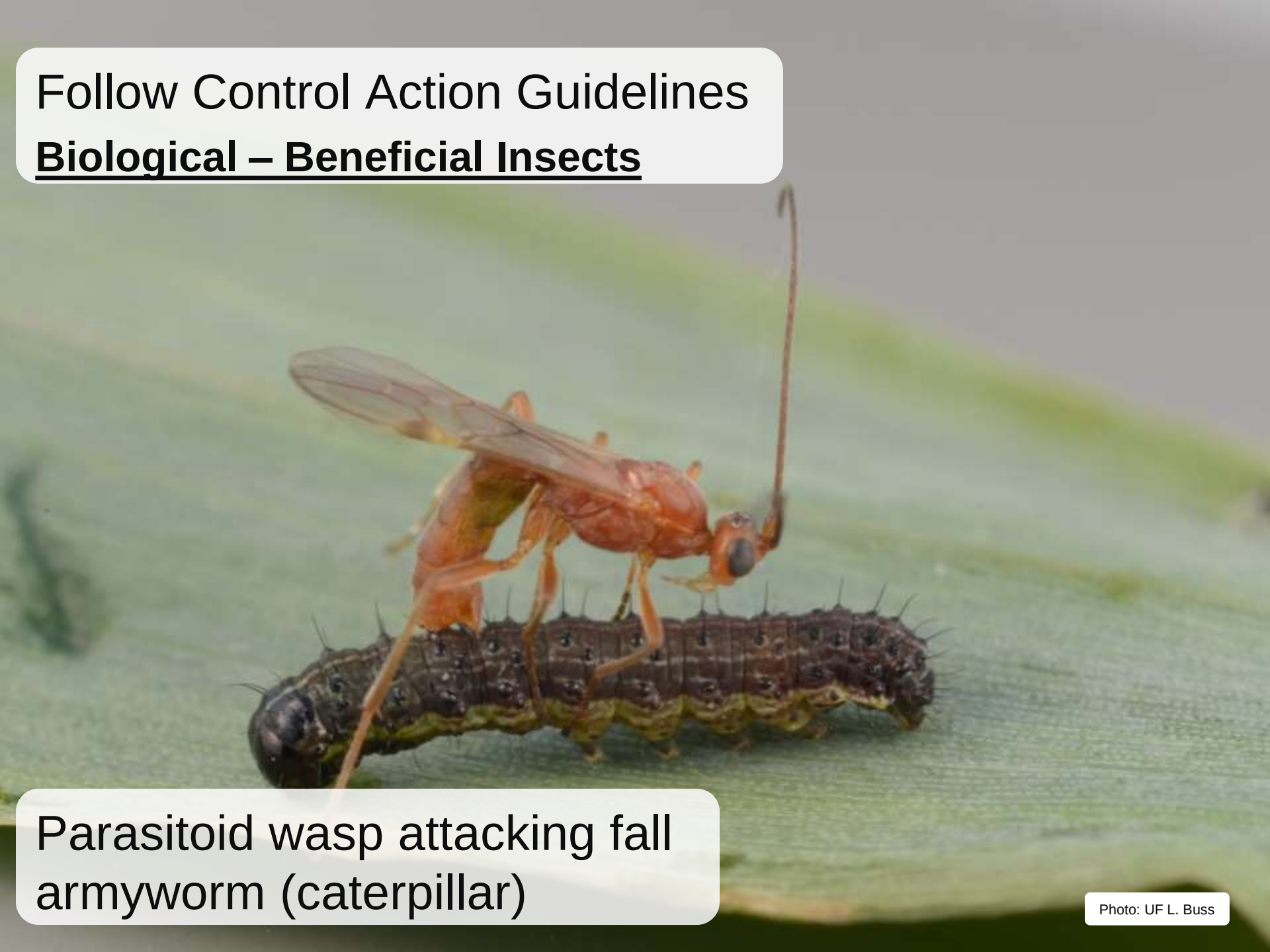
Photo: Whitney Cranshaw, Colorado State University, Bugwood.org

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

Convergent Lady Beetle &
Molted Exoskeletons & Larva

Follow Control Action Guidelines

**Biological – Beneficial Insects**



Parasitoid wasp attacking fall armyworm (caterpillar)

Photo: UF L. Buss

# 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?

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

- **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



https://content.ces.ncsu.edu/southeastern-us-pest-control-guide-for-nursery-crops-and-landscape-plantings

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## 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

Slide Inspiration: UF NE Green Team Comm. Hort. Group

# IPM

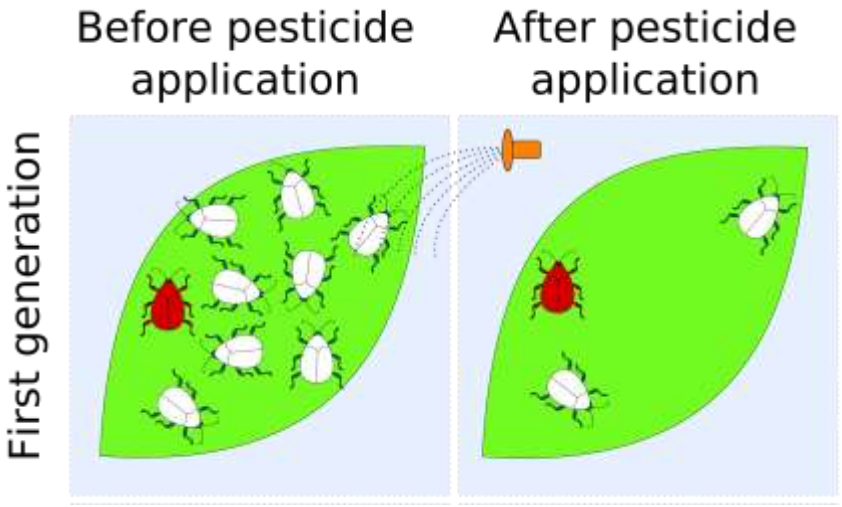
Use integrated methods combined into a strategy

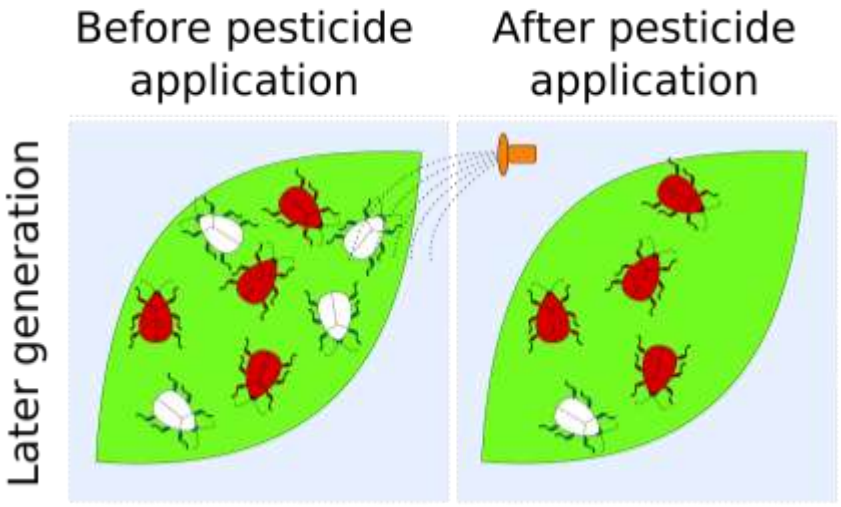
Photo: USDA Agricultural Research Service Archive, USDA Ag. Research Service, Bugwood.org

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

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

# Understanding Pesticide Resistance



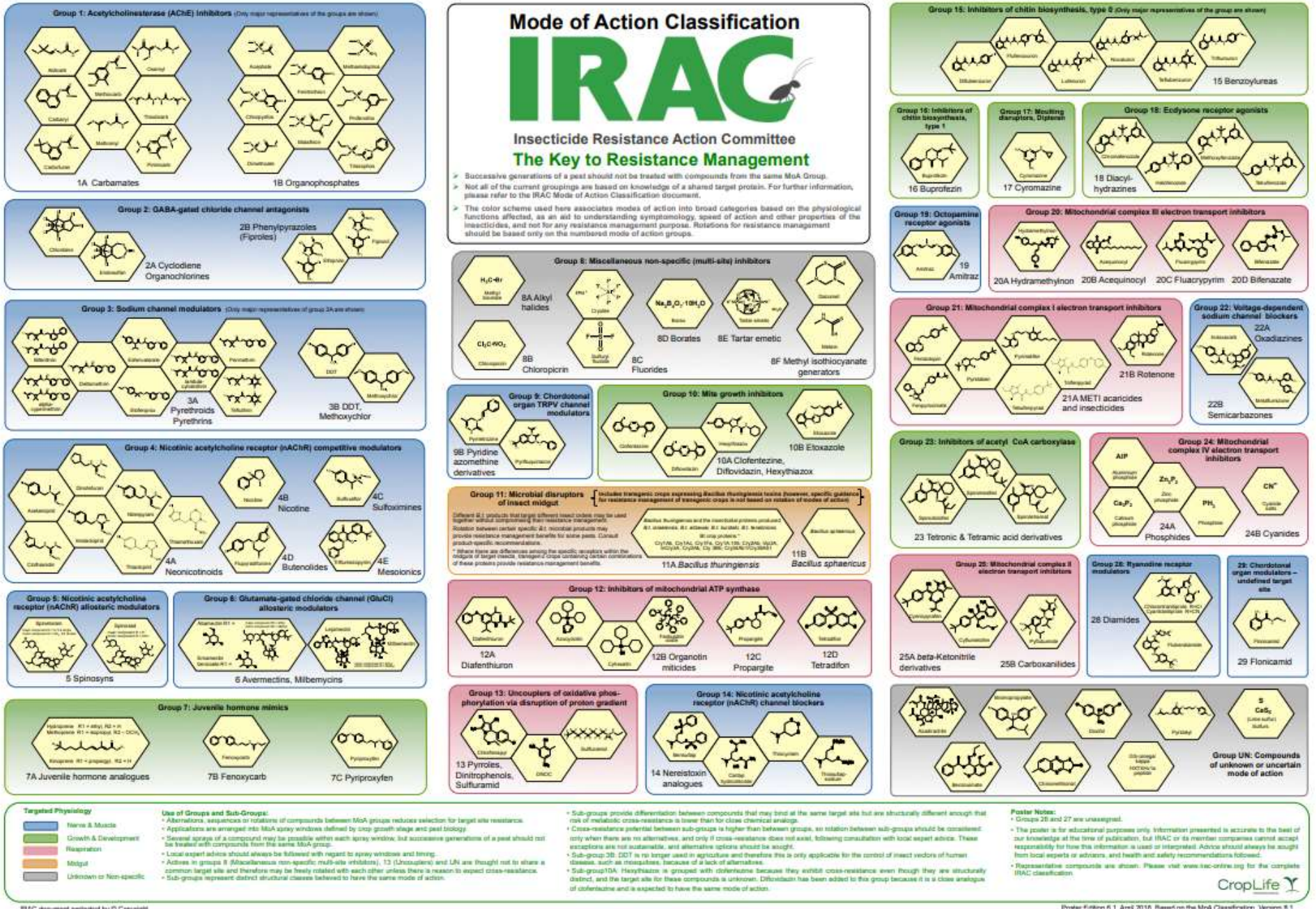




- The gene change or selection (red here) is induced by the pesticide overuse and is the main reason for resistance developing
- Applying doses that are too low to kill most of the insects (sub-lethal) also contributes in a secondary way

Slide Inspiration: UF NE Green Team Comm. Hort. Group

# Reducing Resistance

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




http://www.irac-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

# Roundup PROConcentrate

PROFORMANCE TECHNOLOGY

Herbicide

The complete broad-spectrum post[illegible]ergence professional herbicide for industrial, turf and or[illegible]mental weed control.

## Complete Dire[illegible]ions for Use

AVOID CONTACT OF HERBICIDE WITH F[illegible]TEMS, EXPOSED NON-WOODY ROOTS OR FRUIT OF CROPS, DESIRABLE PLANT[illegible]TREES, BECAUSE SEVERE INJURY OR DESTRUCTION IS LIKELY TO RESULT.

| GROUP | 9 | HERBICIDE |
|---|---|---|

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** | • Hold eye open and rinse slowly and gently with water for 15-20 minutes.<br>• Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. |
| • 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) (90ºF on most labels as limit)



Slide Inspiration: UF NE Green Team Comm. Hort. Group

# 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

Photo: UF L. Buss

# 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

Source: Merit Label: https://www.backedbybayer.com/-/media/PRFUnitedStates/Documents/Resource-Library/Product-Labels/Merit-2-F.ashx

# 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 55º F or 60º 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

Photo: Lesley Ingram, Bugwood.org

# 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

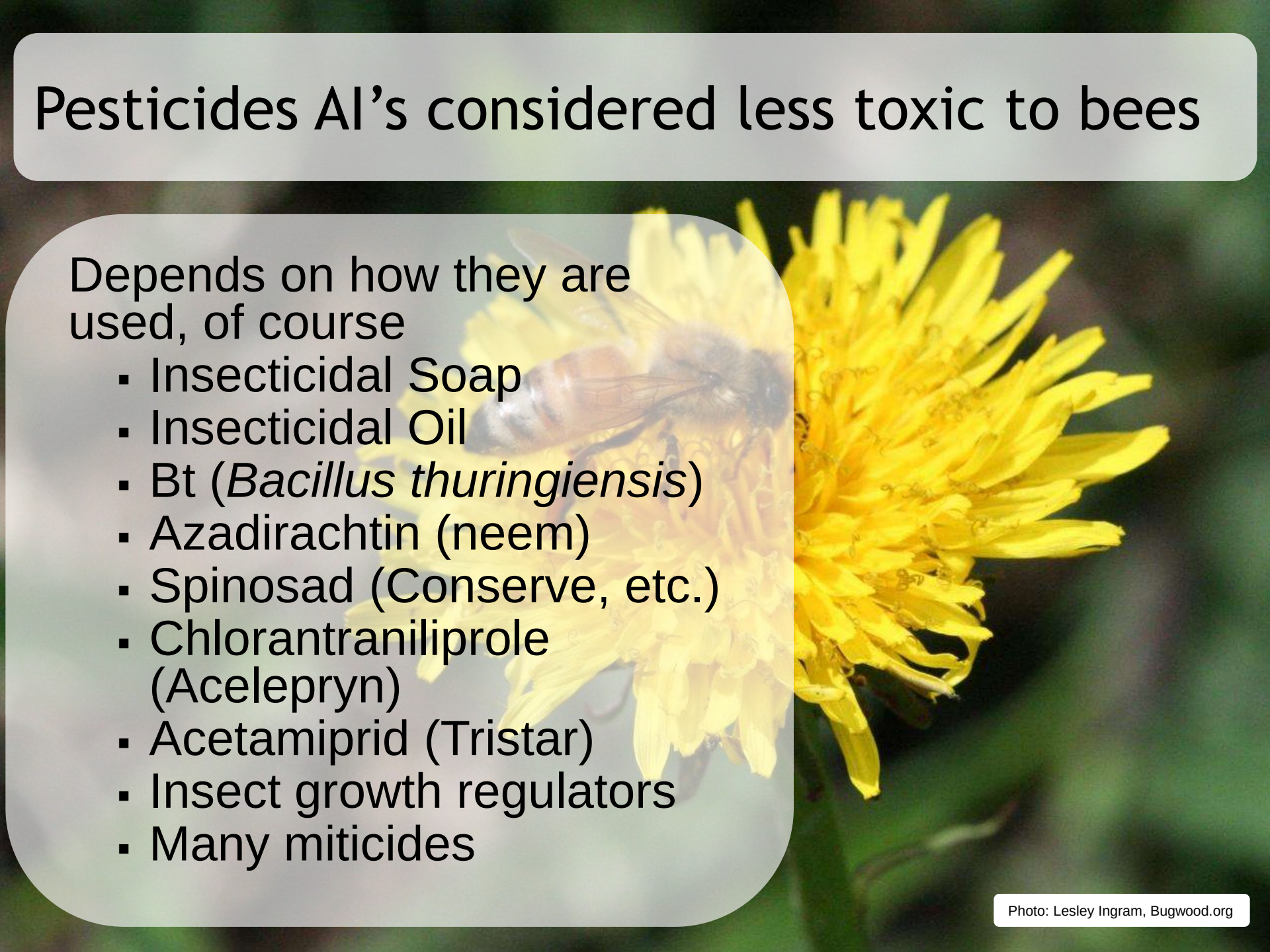


Photo: Lesley Ingram, Bugwood.org

# Questions on IPM?

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

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

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2. Use safest, most expensive strategy
3. Combine best, most effective & safest techniques into a strategy
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# 8. Is it possible to completely eradicate most pests?

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# 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

UF | IFAS Extension
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