Integrated pest management and control measures

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This CEU article grants one General Standards (Core) CEU when submitted and approved toward the renewal of a Florida Department of Agriculture and Consumer Services restricted use pesticide license.

This article will discuss the keys to an integrated pest management (IPM) program as well as control measures used in an IPM program. Every IPM program should contain the following steps:

1) Identify the pest
2) Monitor the pest populations
3) Develop a pest management goal
4) Execute integrated pest management plan
5) Evaluate the results of your pest management plan

IDENTIFY

It is very important that you not attempt to control a pest that hasn't been correctly identified. Costly mistakes in terms of time and money can result from using the wrong product that didn't control the targeted organism.

There are key occasional and secondary pests for almost every crop. For example, the bacteria that causes citrus greening or huanglongbing and its vector, the Asian citrus psyllid (ACP), are both key pests in citrus production. An occasional pest in citrus production would be citrus scab (*Elsinoe fawcetti*) occurring on processing oranges (Hamlin and Valencia), which are not as susceptible as the fresh-market types (grapefruit, Temples, Murcotts and tangelos). Sooty mold, a variety of different species of fungi that grows on honeydew secretions of insects, is an example of a secondary pest when scale, aphids and whiteflies are not controlled using an insecticide or other measures.

If you are stuck at the first step of IPM, many resources are available to assist with pest identification. These include agents and personnel within the University of Florida Cooperative Extension Service, certified crop advisors, identification cards, as well as diagnostic services provided by the Institute of Food and Agricultural Sciences on the University of Florida main campus (or through various outlying research and education centers) including the plant disease diagnostic clinic, nematode assay lab and insect identification service. Some of these resources are free or require minimal costs on behalf of the producer. The turnaround time on these services varies from a few days (insect identification) to a week (cultured disease diagnostics).

MONITOR

The second step of IPM is monitoring the pest population. For many citrus producers in Florida, ACP populations are monitored through scouting programs funded by the U. S. Department of Agriculture and the Florida Department of Agriculture and Consumer Services. On three-week intervals (called a cycle), blocks are scouted for ACP. The number of psyllids detected are recorded, compiled and entered into a database. From this database, the citrus health management areas (CHMAs) website (www.flchma.org) creates graphs, maps and other reports. It is possible to use these graphs and reports to make decisions regarding the next insecticide application or to evaluate the results of your plan (step 5).

In addition to the routine ACP scouting conducted on behalf of the CHMAs, growers can monitor for other pests including Diaprepes root weevils (*Diaprepes abbreviates*) and citrus leafminers (*Phyllocnistis citrella*) by using traps. These traps are species specific. For example, Diaprepes root weevils can be trapped using a Tedder trap, which is cone-shaped. Leafminers can be monitored using a trap baited with a pheromone.

DEVELOP

The third step in IPM is developing a pest management goal. Most IPM program goals are to maintain the pest damage at an economically acceptable level. Once a goal is set for the IPM program, a strategy can be developed using multiple tactics to control the pest population. There are three important pest control goals: prevention, suppression and eradication.

Prevention is the main goal when managing plant diseases in an IPM program. The development of a plant disease requires a host plant, a plant pathogen and an environment conducive for the pathogen to infect the host plant. This is called the disease triangle (Figure 1). When all three are present, a particular disease is likely to occur. We can try to manipulate these three factors to help prevent the occurrence of diseases.

Suppression is a term often used to describe an incremental reduction in insect pest populations. The goal is not to eliminate all pests, but reduce the population to a point that is below the economic injury level. The economic threshold is the population density of a pest in which the

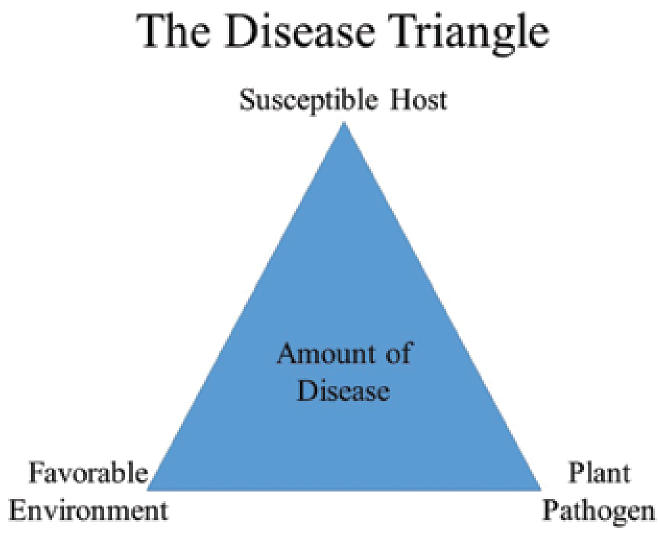

Figure 1. A depiction of the disease triangle as a conceptual model which shows the interaction between host, environment and pathogen.

cost to control the pest is equal to the amount of damage that population would inflict upon the plant. Most pesticide applications are not capable of eradicating or eliminating a pest, but are used to suppress pest populations.

The last of the three main goals is eradication. Eradication is the total elimination of a pest from a designated area. Citrus producers are no strangers to this goal as the last citrus canker eradication program ended in January 2006. In earlier eradication programs, citrus canker had been successfully eliminated from Florida in 1933 and 1994.

EXECUTE

The next step in an IPM program is executing the plan. The steps to putting an IPM plan to work are to: 1) identify the pest, 2) set up a monitoring program (scouting cycle), 3) know the economic threshold or injury level that triggers control, 4) know what control measures are available (biological, mechanical, cultural, physical/environmental modification, host resistance and chemical) and 5) evaluate the benefits and risks of each method. Out of these five steps, we have not discussed each individual control measure (step 4) or evaluated the benefits and risks of each method (step 5).

The control measures available will depend upon the targeted pest. Insect pests have natural enemies that can suppress a population. The use of this mechanism is called biological control. Biological control can involve any type of natural enemy, including other insects and pathogens. An example of a biological control measure is the use of *Tamarixia radiata,* a tiny parasitoid wasp, for ACP management. This parasitic wasp lays an egg inside an immature psyllid and develops within it. During the development of the larval *Tamarixia radiata*, the host insect, ACP, is killed.

Mechanical control involves the use of machines or other physical devices to control pests. Some examples of mechanical control are fences, traps, barriers, screens and cultivation. In the production of citrus nursery trees, the exclusion of ACP by insect screening is an example of mechanical control.

Cultural control is altering the environmental conditions around the host plant or site to prevent or suppress a pest infestation. Some cultural controls used in citrus production include variety selection, irrigation management and timing, and sanitation. The objective of sanitation is to reduce pest inoculum such as with the use of citrus canker decontamination hoops or by elimination of food, water, shelter and other necessities required for the survival of a pest.

Physical/environmental modification as a control measure is typically not used to any great extent in commercial citrus production. It involves pests that occur in enclosed areas that may be suppressed by modification of the physical or environmental conditions. Increasing the air movement within a greenhouse or protective structure to suppress fungal disease development is an example of modifying the environment as a control measure. Thermal (heat) treatment is also an example of a physical control measure that can be used to manage pests.

Plant host resistance or genetic control measures involve the use of specific varieties which have been bred to be resistant or tolerant to the targeted pest. This control measure is probably the most commonly used in planning a new citrus grove. The rootstock/scion combinations used in citrus production are very important since opportunities exist to manage a diverse range of root and foliar pests. It is only limited by compatibility between the two (rootstock and scion). Citrus tristeza virus (CTV) is a good example of how host resistance can be used to manage an important citrus disease pest. Sour orange is susceptible to CTV, but other rootstocks offer resistance to the virus.

Chemical control (the use of pesticides) is frequently used. In some cases, it is the only effective method of control available. Pesticides are defined as any materials that are applied to the soil, water, crop, structures, clothing/furnishings or animals to kill a pest. Pesticides are grouped into multiple classes depending on specific modes of action in killing the pest. Knowing the class of a pesticide (carbamates, organophosphates, botanicals, pyrethroids, etc.) helps in rotating modes of action for managing key pests and will aid in minimizing the risk of developing pesticide resistance within the target pest. Remember that if you use a pesticide, the label is the law!

EVALUATE

The final step in implementing an IPM program is evaluating the results. Recordkeeping of scouting results and methods used can assist in determining if a program needs to be changed. When a pesticide doesn't work, a producer should evaluate why the failure occurred. Was the pest incorrectly identified? Was the pesticide added to the tank? Was the application properly timed? Was the targeted pest on the label? Were the environmental conditions unfavorable? Was it an old pesticide that was stored improperly? Or was there pesticide resistance?

Pesticide resistance is often brought up first when a pesticide fails to control a pest. In reality, pesticide resistance is the ability of a pest to now tolerate a pesticide that once controlled it. Pesticide resistance occurs when a pest population is exposed to repetitive applications of pesticides having the same mode of action. The continuous use of one mode of action selects for those individuals in the pest population that survive the treatments and are genetically more tolerant of the pesticide. These individuals in the pest population reproduce and become the majority of a pest population. Pesticide resistance management demands the rotation of pesticides via their different modes of action (Fungicide Resistance Action Committee, Herbicide Resistance Action Committee and Insecticide Resistance Action Committee codes).

Source: Fishel, F. 2014. Applying Pesticides Correctly. SM1 University of Florida Institute of Food and Agricultural Sciences

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If you have questions regarding this form, test or CEUs, contact Cami Esmel McAvoy at cami13@ufl.edu or 352-569-6872. Please allow two weeks to process your CEU request.

'Integrated pest management and control measures' test

To receive one Core continuing education unit (CEU), read "Integrated pest management and control measures" in the February issue of *Citrus Industry* magazine. Answer the 20 questions on the magazine's website (www.citrusindustry.net) or mail the answers and application information to the senior author. The article and test set will be valid up to one year from the publication date. After one year, they expire and CEU credit will no longer be available.

1. There are three steps in developing an IPM plan. T F
2 A favorable environment is one of the three requirements for a disease to develop. T F
3. The economic injury level is the point at which no one gets paid. T F
4. Examples of control measures include biological, mechanical and cultural control. T F
5. Citrus tristeza virus can be managed with host resistance. T F
6. Key pests only show up some of the time during the crop. T F
7. Pest identification is not a step in developing an IPM plan. T F
8. Eradication can be a goal of an IPM plan. T F
9. Pesticide resistance is the ability of a pest to tolerate a pesticide. T F
10. A citrus canker decontamination hoop is an example of mechanical control. T F
11. Scouting can be used to monitor pest populations. T F
12. A fence is an example of mechanical control. T F
13. Suppression eliminates all pests. T F
14. The Asian citrus psyllid is an example of a key pest in citrus. T F
15. An occasional pest is not always present during the cropping cycle. T F
16. Forgetting to add the pesticide to the spray tank is an example of how pesticides can fail. T F
17. *Tamarixia radiata* is an example of biological control for the Asian citrus psyllid. T F
18. Using pesticides with the same mode of action can prevent pesticide resistance. T F
19. Using traps to monitor insects is a method of scouting. T F
20. Organophosphates, carbamates and botanicals are all classes of pesticides. T F

Please mark the boxes below to rate your knowledge gained from this exercise:

Your knowledge of integrated pest management and control measures **before** completing this exercise:

❒ Very Low ❒ Low ❒ Moderate ❒ High ❒ Very High

Your knowledge of integrated pest management and control measures **after** completing this exercise:

❒ Very Low ❒ Low ❒ Moderate ❒ High ❒ Very High

Pesticide Applicator CEU Form

First Name: ____________________ **Last Name:** ____________________

E-mail: ____

Pesticide License Number: ________________________________

Address: ____

City: ____________________ **State:** ________ **Zip:** __________

Phone Number: ________________________________