CENTRAL CEU

Integrated pest management

By Stephen H. Futch and Tim Gaver

This is a CEU article that grants one General Standards (CORE) CEU when submitted and approved.

Integrated pest management (IPM) is a tool that farmers should utilize to address their pest control needs. It is both an effective strategy and an environmentally sound form of pest management. This pest control program does not use a single pest control method, but a series of management decisions and controls.

Even the best IPM program often has to rely upon the judicious use of various types of pesticides. An IPM program uses a combination of common-sense practices that include, but are not limited to:

1) proper pest identification;
2) monitoring the pest population and understanding its life cycle;
3) developing a multi-component management plan;
4) putting these IPM practices into action; and
5) evaluating the results.

Formulating pest management as an integration of components allows the grower to understand the pest and its interaction with the local environment, thereby allowing management actions that are effectively conceived, economical and have the least possible impact on people and the environment.

Integrated pest management practices can be applied in both agricultural and urban settings, including lawns and home gardens. The IPM program uses multiple pest control options, including a series of management evaluations, decisions and controls as mentioned above.

If you reflect back in time, you will remember that many of the chemicals used in the past were broad-spectrum pesticides that remained in the environment for long periods of time. Some of these pesticides came from chemicals synthesized for use in World War I and World War II. During this period, little attention was given to effects on humans and the environment.

In today's IPM program, the chemicals used are safer to man and to the environment and have shorter residual effects. However, the shorter residual period may require repeated applications to supply adequate or sufficient pest control. Growers in some cases may be able to incorporate a few biologically-based pesticides that inhibit the pest through various means or biological mechanisms. Biological pesticides may be more environmentally friendly, but often lack residual effect that some pesticides may offer.

PEST IDENTIFICATION

The first step in any pest control program is proper and accurate identification of the specific pest, be that insect, disease, nematode or weed. A grower should never attempt any pest control action until the pest is properly identified. In the identification process, efforts should be directed to understand the pest's life cycle to allow a more target-specific control to be selected.

For proper identification, determine the following items about the pest:

- The physical characteristics and, in the case of insects, the body regions, number of legs, color, mouth parts, etc.
- Development and biology, which helps to define where and when the pest occurs
- The damage caused or plant symptoms which develop
- Frequency of the pest found in your situation
- Control goals, i.e. prevention, suppression or eradication

PHYSICAL CHARACTERISTICS

Adult insects have three pairs of legs, and three body regions (head, thorax and abdomen). The head is where the antennae, eyes and mouthparts are found. The mouthparts are of four general types (chewing, piercing-sucking, sponging or siphoning). The specific characteristics (shape, type and size) of each of these parts will aid in proper identification.

INSECT DEVELOPMENT AND BIOLOGY

Insects vary in their size with some being quite small and requiring magnification to see the insect body parts and shape (elongated, round, oval or flat). The egg size, shape or position where it is placed on the leaf will also aid in identification. For example, the eggs of katydid are laid in a row along the leaf margin whereas the eggs of citrus blackfly are in spiral patterns on the underside of the leaves.

The process whereby an insect passes from egg to adult is called metamorphosis, which can be classified as gradual or complete. Gradual metamorphosis defines a developmental process by which the insect passes through three stages (egg, nymph and adult). Complete metamorphosis has four stages (egg, larva, pupa and adult). As the insect hatches from the egg, it is called either a larva or nymph. As the larva or nymph grows and the skin can't continue to stretch farther, the insect will shed its skin and form another skin in a process called molting. Each of the molts or stages will be called instars and will vary with insect species. The final two instar stages are where the heaviest plant feeding takes place during the life cycle.

DAMAGE CAUSED BY INSECTS AND WEEDS

The damage caused by an insect will often provide a clue that can aid in insect identification. Some insects are leaf eaters and can consume large quantities of the plant foliage, causing significant damage and crop loss. Examples of leaf eaters include fall army worms and beetles.

Snails and slugs will tear holes in foliage, fruit and soft stems. These pests feed mainly at night. As they move along the plant foliage, they leave a slime-like mucous trail that dries into a silvery streak.

Some insects will feed inside the leaf, fruit or seeds. The larval stage is most frequently the cause of the feeding problem. Pests in the larval stage are usually more difficult to control as they are located in an area where it is hard to contact the pest with pesticide. Insects in this group could include fruit flies or citrus leafminers. The citrus leafminer not only damages the citrus leaf, but the tunnel beneath the leaf surface greatly increases the severity of citrus canker.

Some insects will have sucking mouthparts. When these insects feed on plants, they cause curling and stunting of leaves or stems. This damage is mainly caused by toxins injected into the plant during feeding. Some insects with sucking mouthparts can vector viruses or bacteria. Aphids are in the sucking insects group and may also vector diseases like citrus tristeza virus or various blights. The Asian citrus psyllid can cause some leaf damage as well as vector citrus greening (huanglongbing, HLB). Many of the sucking insects will also secrete honeydew which later supports the growth of sooty mold. Examples of insects that have sucking mouth parts and feed on plants are aphids and psyllids; those that feed on humans include mosquitos and horseflies.

A plant is considered a weed when it is growing where it is not wanted; thus what is a weed to one individual may be a very desirable plant to someone else. A good example of one of these weedy plants is lantana growing in a citrus grove where it is generally considered to be very undesirable, but when grown in many landscape locations, it may be considered a desirable plant.

Plant life cycles are divided into annuals (one-year life cycle), biennials (two-year life cycle) or perennials which live for more than two years. Weeds compete with the desirable plant for space, water, nutrients and light. The degree of competition will vary with the crop grown and the crop stage.

PEST MONITORING

Regular monitoring of pest populations is an integral part of a successful IPM program. Pest monitoring will determine if the pest is present in sufficient numbers to cause plant injury which might warrant a specific pest management treatment. Monitoring will also aid in describing population trends of a given pest over time. Finding a single pest in a single field location does not necessarily mean control is necessary.

Field scouting and/or trapping are commonly used to determine the presence of insects and their activity and abundance. Pest populations will be impacted by season, weather, temperature and the pest's life cycle. All of these factors can be used to predict population increases over time. Proper monitoring and identification will ensure that the correct set of tactics are used — including that the most appropriate pesticide products are used — to ensure adequate pest control.

ACTION THRESHOLDS

Not all pests (insects, weeds or diseases) found in an agricultural field will necessarily require intervention. Some living organisms may be beneficial. Pest thresholds have been established for many of the more common pest problems for numerous crops. These thresholds are based upon a given pest population or conditions under which pest control actions must be implemented. Once these thresholds have been reached or anticipated to be reached, an action threshold or chemical intervention will be scheduled to reduce the pests to a population level where they will not cause economic plant injury. These thresholds will vary with the crop grown and the intended market for a given crop. In many cases, the thresholds are developed based upon the appearance or aesthetics of the crop, plant health, or of various economic factors.

The economic threshold is established at a level where the economic losses caused by a given pest would be greater than the cost of controlling the pest where the pest populations are expected to continue to grow.

For some pests like the Mediterranean fruit fly, the action threshold may be mere detection of a single individual. In these cases, once detection is made, the control action will be instituted because of the harm caused by even a very small population of the pest.

CONTROL GOALS

The goal of an IPM program is to maintain pest populations at or below an economically acceptable level. The pest control goals will be crop specific and include one or more of the following strategies: prevention, suppression or eradication. The grower may use one or more of these strategies during the cropping season; pest population levels which trigger each strategy may also vary.

Prevention

Prevention is incorporated into IPM programs to prevent the pest from becoming established in an area or to keep the damage or losses at an acceptable level. These techniques could include planting pest-free plants or seeds to minimize future pest problems. Planting during a specific growing season when the pest is not present could be a cultural strategy to avoid growing a crop when the pest is known to be a problem. Sanitation is also used to keep from introducing a pest to a new area where it was not previously found.

In areas where a known pest is present, pesticide applications may be used to prevent the pest from causing significant injury to the crop. These preventative actions will usually be targeted for various fungal pathogens or could include pre-emergent herbicides to keep weed seeds from sprouting. These preventative actions will usually be more successful than targeting a management practice against a pest once it has become well established in a field.

Suppression

Suppression is the most frequently used of the three strategies. Suppression is used to reduce the pest populations to an acceptable level. These actions do not eliminate all pests present, but reduce pest populations and their corresponding damage to an acceptable level. Using this strategy may require repeated applications of the particular tactic during the cropping cycle.

Eradication

When eradication is the pest control goal, a strategy will be developed to eliminate the entire pest population from the target area. This strategy works best when the pest is isolated to a small, confined area and an area where reintroduction is not likely. Attempts to eradicate an established pest over a large area have met with limited success. These large-area eradication programs tend to be very expensive and are usually directed toward exotic or recently introduced pests that pose a public health or a significant economic risk.

The selected pest control goal (prevention, suppression or eradication) will vary depending on the pest present, environmental conditions and economic considerations.

Once an IPM program has been placed into action, the grower needs to evaluate the results of the program to fine-tune actions to ensure future success and efficiency. Programs that were successful in one year may need to be modified over time as pests are impacted by climatic factors and seasons.

Growers need to remember that the judicious use of pesticides in combination with an integrated pest management program is essential to maintain a healthy and vibrant agricultural industry.

Source: Applying Pesticides Correctly, SM1, UF IFAS, Gainesville, FL

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Test is on page 20.

The Scientists Leading the Projects

By Harold Browning

When we communicate about ongoing and planned research projects that are addressing citrus industry disease threats, we often speak about priorities, projects, funding levels and whether the project is addressing short-, intermediate- or long-term solutions. We also categorize whether the work is focused on HLB via the vector, Asian citrus psyllid (ACP), the pathogen *Candidatus Liberibacter asiaticus (CLas)*, or the host plant, citrus. There generally is little mention of the scientists who are dedicating their time to these efforts, and the commitment they are making to respond to the industry challenges.

Prior to emergence of HLB in Florida, strong support for citrus research and education was provided by University of Florida (UF) at various locations around the state in addition to the main campus in Gainesville. Similarly, researchers at the USDA laboratories at Fort Pierce and in Winter Haven (now also at Fort Pierce) provided support for production and post-production research. The Florida Department of Citrus (FDOC) Research Division also provided support to post-production challenges and harvesting.

The commitment from UF, USDA, and FDOC continues. A recent review of ongoing and planned research projects sponsored by the Citrus Research and Development Foundation (CRDF) upon rigorous outside peer and grower review indicates that approximately 70 percent of the 114 current projects are led by University of Florida scientists. Another 20 percent of projects are led by USDA, ARS scientists, most of whom are located in Florida. For obvious reasons, laboratory, greenhouse and field research that directly involves ACP, *CLas*, citrus canker bacteria, and more recently citrus black spot, is restricted to Florida or to locations that have laboratories approved for handling these pests and pathogens. Thus, it is no surprise that the majority of effort is focused in Florida.

In addition, the UF and USDA research programs have significant experience with citrus, and are engaged internationally with colleagues working in citrus science. Their laboratories and locations are suited for close interaction with the Florida citrus industry, and the UF Extension mission dictates that Extension scientists work closely to bridge the gap between research and delivery to growers and other recipients. Often overlooked, each of the agencies is committing significant institutional and other extramural funding to support the citrus priorities, and this magnifies the reach of projects funded by the industry through CRDF.

The value added by the industry reaching out nationally and internationally to seek scientists to participate in HLB and canker research is immense. They, too, are dedicated to finding solutions, and represent excellent scientists in universities, foundations and international research institutions.

This column is too short, and the list too long, to individually acknowledge the hundreds of scientists, staff, and students who are working on behalf of the Florida citrus industry to address the challenges that are the greatest threat to the industry. However, it is important for us all to realize that researchers are faced with tremendous technical and logistical challenges as they seek solutions. These are real people who have much in common with producers and others in industry who are highly trained specialists working long days primarily for the satisfaction of having an impact.

The importance of the diseases to the well-being of Florida citrus adds a human dimension of urgency that is difficult to reconcile with the need for diligent and careful pursuit of solutions, and their testing and approval under field conditions. At CRDF, we take some pride in helping to make the connection between research and applications, between scientists and growers more direct and more effective.

Harold Browning is Chief Operations Officer of CRDF. The foundation is charged with funding citrus research and getting the results of that research to use in the grove.

'Integrated pest management' test

To receive one Core continuing education unit (CEU), read "***Integrated pest management***" in this issue of *Citrus Industry* magazine. Answer the 21 questions on the magazine's website (www.citrusindustry.net) or mail the answers and application information to the address at the bottom of the form. The article and test set will be valid for up to one year from the publication date. After one year, this test will no longer grant a CEU.

1. *Integrated pest management (IPM) is an effective and environmentally sound form of pest management.* T F
2. *IPM program prohibits the use of pesticides.* T F
3. *IPM is applicable in only agricultural settings.* T F
4. *IPM will use chemicals that are safer to only the environment.* T F
5. *Biological pesticides may be more environmentally friendly, but often lack residual effect that other pesticides may offer.* T F
6. *The first step in any pest control program is the proper and accurate identification of the pests.* T F
7. *Adult insects have two body regions.* T F
8. *The placement of eggs on the leaf surface may aid in the identification of the pest.* T F
9. *The process whereby an insect passes from egg to adult is called metamorphosis.* T F
10. *Complete metamorphosis has three stages.* T F
11. *The damage caused by an insect will not aid in the insect identification.* T F
12. *Snails and slugs feed primarily during the day.* T F
13. *Pests that feed on the inside of fruit are just as easy to control as pests that feed on the outside of the fruit.* T F
14. *Many sucking insects secrete honeydew which later supports the growth of sooty mold.* T F
15. *Weeds compete with desirable plants for only space, nutrients and water.* T F
16. *Monitoring will aid in the development of pest population trends over time.* T F
17. *All pests (insects, weeds or diseases) found in agricultural situations will require some form of intervention actions.* T F
18. *The threshold of pests like Mediterranean fruit flies in Florida is zero.* T F
19. *Pest control goals are crop specific.* T F
20. *The three major pest control strategies are prevention, suppression and eradication.* T F
21. *The judicious use of pesticides is essential to maintain a healthy and vibrant agricultural industry.* T F

Pesticide Applicator CEU Form

First Name: ____________ **Last Name:** ____________

Email: ____________

Pesticide License Number: ____________

Address: ____________

City: ____________ **State:** ____________ **Zip:** ____________

Phone Number: ____________

Please mail the answer sheet or a copy of the form to: Steve Futch, Citrus Research & Education Center, 700 Experiment Station Road, Lake Alfred, FL 33850

If you have questions regarding this form, test or CEUs, email Steve Futch at shf@ufl.edu or call (863) 956-8644.