

Developing a successful pest management program

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Any successful pest management program will follow a few basic steps from developing the program to implementing and then evaluating the effectiveness of control measures. The five basic steps of a successful pest management program are:

1. Pest identification
2. Monitoring the pest population
3. Developing control goals (prevention, eradication or suppression)
4. Implementing pest control measures
5. Evaluating results

1. PEST IDENTIFICATION

The first step in any effective pest management program is to properly identify the pest that is causing the problem. Pests could include insects, mites, diseases, nematodes or weeds. Stop for a moment and think. If you don't know what is causing the problem, then how can you select an action to effectively control an unknown pest? Selected control actions could include, but are not

limited to: applying a pesticide, harvesting the crop, cultural practices like cultivation to eliminate the food source, or developing actions that prohibit introduction of the pest into an area. Once the pest has been accurately identified, proper control measures can be considered and successfully implemented.

In the identification process, one should determine the name and type of pest that is causing the problem and understand the factors that influence development and spread of the pest. Pest life cycle and how environmental factors such as temperature and humidity impact the rate of development aid in the selection process for best management practices. By understanding the life cycle, pest control strategies can be more effectively timed to optimize control.

When surveying the area for a pest, you may encounter other insects that are not causing damage to the crop. These insects could be beneficial insects such as predators and/or parasites of harmful pests, or they could even be pollination insects like bees. Other insects may be food for birds, fish, mammals, reptiles, amphibians or other insects. These insects are classified as insects of ecological importance. About 99

percent of all insects fall into this category, forcing the recognition that not all insects encountered are detrimental to the crop and must be considered to avoid collateral damage to the environment.

Consideration of the following factors aid in the identification and control of the insect pests:

- A. Physical features or characteristics like size, shape, color, number of body regions and legs
- B. Type of damage caused like notching of leaves, leaf distortion or fruit blemishes
- C. Life stages present (eggs, nymphs and/or adults)

A. Physical Features of Insect Pests

The physical characteristics of adult insects include three pairs of jointed legs and three body regions. The three body regions are head, thorax and abdomen.

Head. The head has antennae, eyes and mouthparts. Antennae vary in shape and size and may aid in identifying the insect. Eyes are compound in nature and aid the insect in detecting motion or finding the target crop by color or other factors.

The mouthparts are of four basic types: chewing, piercing-sucking, sponging and siphoning.

Insects with chewing mouthparts bite and tear the plant tissue using toothed jaws. Evidence of this type of damage can aid in determining the type of pest that caused the damage. Examples of insects with chewing mouthparts include ants, beetles, caterpillars, grasshoppers and weevils.

Insects with piercing-sucking mouthparts use a needle-like tube to pierce into the animal or plant from which they withdraw fluids. Insects that have piercing-sucking mouthparts include aphids, Asian citrus psyllids, lice, mosquitos and whiteflies.

Insects with sponging mouthparts use a tubular or tongue-like structure that contains a spongy tip for lapping up liquids or solid food. An example of insects with sponging mouthparts include some types of house flies.

Other types of insects may have a flexible, siphoning tube to withdraw nectar from flowers. Examples of these types of insects are butterflies and moths.

Thorax. The thorax is the part of the body where the three pairs of legs and wings are located. The color, shape and size of the wings are helpful in determining the insect type. In the case of beetles, the wings are located under the hard, shell-like structure that may obscure the wings upon casual observation.

Abdomen. The abdomen is composed of distinct sections or segments. The abdomen contains tiny obscure holes along the side through which the insect breathes.

B. Damage Caused

Insects with chewing mouthparts bite or tear away part of the leaf. In the case of weevil feeding, the notching usually occurs along the margin of the leaf and is key to identifying if weevils have been present. In the case of grasshoppers, they consume more of the leaf tissue than weevils. Therefore, the amount of leaf consumed can aid in identifying which pest was feeding on the plant.



Recognizing damage symptoms can help growers identify the type of pest or pests that may be or has been in their grove. Shown here are fruit injured by citrus rust mites (top) and leaves with greasy spot damage (bottom).

In the case of Asian citrus psyllid feeding on citrus, the damage is limited to new growth. The psyllid feeding causes curling and distortion of the new growth due to toxins present in the saliva injected into the tissue as the insects feed.

C. Life Cycle of Insects

For most insects, male and female must mate to produce offspring. However, females of some aphids and parasitic wasps are capable of producing viable eggs or live young without mating.

The eggs of insects come in various shapes, sizes, colors and in some cases, are deposited in various but specific

patterns or locations that aid in identification. In the case of the citrus black fly, the eggs are laid in spiral patterns on the underside of the leaves. Katydid's lay tan-colored eggs in a row along the leaf margin.

Insect metamorphosis is the process by which an insect grows from egg to adult. Larvae and nymphs hatch from eggs. As the larva or nymph grows, it sheds its skin in a process called molting and forms a new skin to accommodate its larger size. Each of these developmental stages are called instars, and the number of instars can vary between insect species. Usually the heaviest feeding occurs during the final two instar stages.



Visual methods and sticky traps can be used to monitor pest populations.

Metamorphosis is either gradual or complete. Gradual metamorphosis consists of three stages: egg, nymph and adult. Complete metamorphosis has four stages: egg, larva, pupa and adult. Pupa is the stage when the larva changes into an adult. When in the pupa stage, insects do not feed, thus making control very difficult due to the lack of feeding and protective structures covering their bodies.

2. MONITORING PEST POPULATIONS

For a pest control program to be successful, the grower or manager must regularly monitor crop pest populations. Monitoring may involve a number of different types of assessment methods, including programs that establish the mere presence of the pest, population numbers and/or damage level.

To determine if the pest is present, the grower or manager should survey the area to see if the pest can be found using visual methods or by placing sticky traps around the property. When visually looking for some pests, they may be so small that a magnifying hand lens or microscope is required to see what is present. Sticky traps that have been collected are inspected to see what has been captured onto the sticky surface since deployment. The disadvantage of the sticky trap is

that it only shows what has occurred since the trap was placed in service, so it may not currently reflect what is presently going on in the field related to pest numbers or populations.

Once the pest has been identified and relative population abundance determined, the grower needs to figure out if the current pest population exceeds an economic threshold at which a pest control action is required. The threshold varies, depending on the crop, its intended market (fresh or processed), environmental conditions and the cost of the control action compared to the value of the crop which would be reduced or lost.

Thresholds are established to determine the pest population density where the economic losses caused by the pest damage are greater than the cost of controlling the pest. Once the threshold is reached for the specific crop and conditions, a control action is required. The threshold varies with pest and location. In the case of a rodent, the threshold may be zero inside your house but higher in an outside structure like a barn. In the case of regulated pests like Mediterranean fruit fly, the threshold also may be zero. In this scenario, once one reproductive individual is found, a control action is immediately required to keep the pest from becoming established in the area.

3. DEVELOPING PEST CONTROL GOALS

Pest control goals fall into three groups: prevention, suppression or eradication. In some cases, more than one group may be utilized in conducting a pest control program.

For prevention, the goal is to prevent loss or damage to the crop from a pest or pests. Sanitation is often a component in this goal. One starts with a pest- or disease-free plant or a plant that is resistant to the key pest.

Pesticides also can be used in the prevention strategy. Pesticides are applied to prevent the pest from reaching levels that would cause unacceptable plant injury. Normally, fungicides are applied prior to an anticipated infection, as most fungicides provide protection against infection. Once infection has occurred, the fungicide provides little future control of the pest or damage potential.

Suppression strategies are used to reduce the current pest population to a level where the damage caused does not result in unacceptable injury or damage to the crop. Suppression does not eliminate (eradicate) the entire pest population, providing only an incremental reduction.

Eradication strategies are designed to eliminate the entire pest population from an area. Eradication is usually reserved for isolated or confined areas where once the pest is eliminated, it can then be excluded.

4. IMPLEMENTING PEST CONTROL MEASURES

Once the pest has been properly identified and the appropriate control measures have been selected, it is then time to implement those strategies into action. These actions must consider the pest, how pest populations are monitored after application, what is the best application method for the control strategy, and, finally, evaluation of the benefits and risks of a selected pest control product.

5. EVALUATION OF THE RESULTS

After implementation of any pest management program, the grower

should evaluate the achieved results. This evaluation should include a variety of control methods to better understand the results for both the success and failure of the management program. This information is used to adequately plan future strategies.

If failures have occurred, consideration should be given to determine if pesticide resistance could have been a factor. If resistance is confirmed, the grower should not apply chemicals from the same chemical group in subsequent applications, as the likelihood of repeated failure is very high. To minimize the chance of developing pesticide resistance, the grower should rotate between the various pesticide modes of action, apply the pesticide at full rate, never combine with products that have the same mode of action, and strive for complete and thorough coverage.

Properly developing and implementing an effective pest management program will improve profitability and minimize adverse environmental impacts. 🍌

Source of information: Applying Pesticides Correctly (SM1) and Private Application Agricultural Pest Control (SM53). Both publications by Fred Fishel and published by the University of Florida.

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'Developing a successful pest management program' test

To receive one Core continuing education unit (CEU), read "Developing a successful pest management program" in this 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 address at the bottom of the page. The article and test set are valid for up to one year from the publication date. After one year, this test will no longer grant a CEU.

1. The first step in an effective pest management program is the proper identification of the pest. T F
2. Factors about the life cycle and environmental conditions are not important in developing an effective pest management program. T F
3. All insects encountered in the crop should be considered as pests to the crop. T F
4. Physical features of the insect aid in identification. T F
5. The type of damage caused by the pest can aid in identifying which pest or pests may have caused the damage. T F
6. Adult insects have four pairs of jointed legs and three body regions. T F
7. The thorax is the part of the body where the wings of insects are located. T F
8. Weevil damage is usually more extensive than that of a grasshopper, as noted by the amount of the leaf that is consumed by the pest. T F
9. All insects reproduce whereby male and female mate and produce subsequent offspring. T F
10. Complete metamorphosis has three stages: egg, nymph and adult. T F
11. Sticky traps are a pest survey method used to determine the current pest population in a location. T F
12. An action threshold is the level where pest control action is recommended to avoid damage. T F
13. Economic thresholds are established for a specific pest population density where the economic losses caused by the pest damage are greater than the cost of controlling the pest. T F
14. Sanitation can be a component of the pest-prevention strategy. T F
15. Suppression is a pest control strategy developed to eliminate the entire pest population from a given area. T F
16. Eradication is usually intended for isolated or confined areas. T F
17. When implementing pest control measures, it is necessary to identify the pest to be controlled along with how to evaluate the success of the pest control action. T F
18. Evaluation of pest control results should include a diversity of control measures to better understand both the successes and failures to improve future actions. T F
19. If pesticide resistance has occurred, it is acceptable to use the same pesticide in the next application as long as the pesticide rate is increased. T F
20. Properly developing and implementing an effective pest management program will improve profitability and minimize adverse environmental impacts. T F

Please circle the number below to rate this article and test:

Not Very Useful 1 2 3 4 5 6 7 8 9 10 Very Useful

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First Name: _____ Last Name: _____

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