Texas Agricultural Extension Service

Texas Citrus Concepts of Pest Management

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The purpose of a citrus pest management program is to achieve satisfactory long-range pest control, maximizing net profit to growers in an environmentally compatible manner. This objective is approached through the application of various IPM strategies with emphasis on preventive methods and preservation of natural control agents. Ideally, this objective is achieved with minimum pesticide use. However, citrus programs involving the Texas fresh fruit industry need to emphasize optimization rather than minimization of pesticide use. Rapid increases in pest or disease incidence sometimes require an increase in frequency of pesticide applications to protect fruit quality and crop investment.

IPM strategies are developed and governed in large part by the relationships between pest/disease development and weather conditions, cultural practices, beneficial organisms and pesticide usage. Information is provided to help growers use preventive methods of pest control when possible, structure management programs to meet individual needs and avoid practices leading to disruption of natural control.

Identification of Pests and Beneficials

Recognition of both harmful and beneficial organisms impacting on citrus production is essential to development of a sound IPM program. Growers and field scouts need to recognize pests and beneficials in various stages of development with the help of a hand lens. Equally important is the ability to recognize pest activities or diseases through use of symptomology. Most insect and mite pests can be identified with a low power (10 to 14X) lens, but visual evidence of damage to fruit, foliage or trees is useful for identification of causal agents. Moreover, the presence of microscopic pathogens (fungi, bacteria, viruses and nematodes) can be characterized by symptoms. Symptomology allows for the distinction between pathogenic and physiological disorders which sometimes are confused.

Management Strategies

Three general approaches available for managing pests of citrus are: cultural control, biological control and chemical control. The first two are preventative in nature and may have more impact on long-term production, while chemical control provides short-term relief or prevention from pest pressure.

Cultural Control

The goal of cultural control is to use all practical horticultural techniques to reduce the likelihood of pest problems. These should encompass all phases of production, beginning with site selection and progress through the nursery operation to field establishment and eventually during full production. Site selection should take into consideration the soil type and elevation to avoid prolonged surface flooding and to minimize cold damage to trees. Site leveling is important to permit uniform irrigation. Planting schemes also influence the efficiency of pesticidal sprays applied after trees reach maturity.

Selection of a rootstock with acceptable disease tolerance and good horticultural characteristics is an important cultural component to pest management, as is use of healthy disease-free scion budwood. Sour orange rootstock offers the greatest tolerance to soil-borne disease problems in a wide range of Texas citrus soils. It is susceptible to the Tristeza virus but, with the exception of citrumelo and citrange as possible replacements in sandy

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soils, sour orange remains the best overall rootstock for Texas citrus. No disease prevention effort is more important or pays greater dividends to the grower in the long run than planting and maintenance of healthy virus-free trees. Every effort should be made in this regard to promote availability of certified, virus-free budwood for all commercially important citrus cultivars.

Other preventive measures in the nursery include the practice of budding high enough on the rootstocks to minimize chances for infection by foot rot fungi. Further protection can be applied by timely treatments with systemic fungicides to prevent or eradicate incipient infection before or soon after trees are moved to the field. Annual treatment of tree trunks with appropriate fungicides before applying tree wraps is a further precaution against foot rot during early years of orchard establishment.

Biological Control

Many citrus pests in Texas are subject to population reductions from naturally occurring or imported predators, parasites and pathogens. These organisms assist in management of citrus pests and, in many cases, reduce or eliminate the need for applications of pesticides for control. While the organisms responsible for natural control are not always apparent, steps should be taken to preserve these beneficial insects, mites and pathogens. A brief discussion of biological control agents attacking the major groups of pests follows.

Mites: A variety of predators and diseases attack citrus rust mite and spider mite species. Several fungal diseases, including *Hirsutella thompsonii*, occur naturally in orchards and, during periods of moist weather, cause tremendous rust mite population crashes. Citrus red mite and Texas citrus mite also are attacked by fungi, and rapid population decline has been documented. Predators of the mite complex include thrips mites, coccinellid beetles, dusty wings and other insects.

Scales: Texas citrus enjoys a long history of biological control of scale pests with natural enemies. Florida red scale, purple scale and glover scale are currently under complete biological control due to the action of parasitic wasps. In the absence of major disruptions to the citrus ecosystem, this level of control is permanent and does not require any manipulation by producers. California red scale and chaff scale are each attacked by a series of parasites, none of which are able to consistently control populations below damaging levels. Nevertheless, they contribute significantly to pest reductions, but outbreaks of theses pests occur in their absence. Likewise, brown soft scale, cottony cushion scale and barnacle scale populations are generally kept below damaging levels by natural enemies which have been imported from other citrus areas and field-released in Texas.

Whiteflies: Whiteflies in Texas citrus are attacked by parasites and disease pathogens. The most outstanding example of whitefly control with a parasite is the citrus blackfly, which is under complete biological control by two parasitic wasps.

Citrus mealybug: The citrus mealybug is attacked by a series of parasites and predators which have been introduced and, in general, populations of the mealybug are kept below damaging levels.

The wide variety of pests under partial or complete biological control points out the importance of preserving these natural enemies in Texas orchards. Unfortunately, many beneficial insects, mites and pathogens are more susceptible to commonly used pesticides than are the target pests, and spray applications can severely disrupt the balance between natural enemies and the pests they attack. In the absence of natural enemies, pest species are able to reproduce unhindered and the result is a rapid pest increase. Improper selection of a pesticide often has resulted in outbreaks of brown soft scale, citrus mealybug or whitefly species. In most cases, this occurred because natural enemies of these pests were inadvertently destroyed. One important consideration in the selection of a pesticide in addition to its efficacy against the target is its impact on beneficials. Materials vary tremendously in their impact on parasites and predators and, given a choice of two or more materials, the one least toxic to beneficials should be used. In addition, fungicides commonly used for melanose and greasy spot in citrus destroy fungi such as *Hirsutella thompsonii*, which help to reduce mite populations. The list of suggested pesticide materials for use in Texas citrus includes information on toxicity of materials to selected natural enemies. This information should be used in deciding which pesticide to apply. The presence of high numbers of natural enemies in a pest population allows a higher action threshold to be used for control application, as pests are less likely to develop rapid population increases while predators, parasites or pathogens are present.

Chemical Control

Of the insecticides and miticides registered for use on citrus, some are specific in their range of pests controlled while some are nonspecific. Good management philosophy for selection of pesticides embraces the premise that for a given pest situation, a particular pesticide or combination of pesticides will provide the most appropriate and cost-effective control among those available. Choosing the proper pesticide requires familiarity with product labels and performance. Among the factors which influence the selection of a pesticide, efficacy of the product against the target pest is perhaps the most important. Other factors to consider in selecting a pesticide include:

1. Cost effectiveness
2. Hazard to beneficials and other non-target organisms
3. Potential hazards to applicators, environment, orchard or fruit crop
4. Limitations or restrictions on application
5. Impact on development of pest resistance

Product efficacy refers to the level of pesticidal qualities of a product with respect to specific target pests and is a relative measure of effectiveness when compared to performance of other products available for similar usage. Characteristics influencing efficacy include the time required for the product to gain control, the amount of residual control and the spectrum of pests controlled. A knowledge of individual product characteristics is important when choosing the most appropriate pesticide. For example, Vendex® is a miticide with an excellent performance record for control of rust mite and several other citrus mites but is not recommended for use when rust mite populations are increasing rapidly because of its relatively slow miticidal action. When rust mite damage is not imminent, it is an excellent choice because of broad-spectrum miticidal activity and long residual action. Residual action in itself may or may not be a desirable quality depending on circumstances. In most situations, the applicator hopes for at least 60 days between applications for rust mite control, yet a rust-mite "explosion" may dictate use of a fast-acting material with relatively short residual. Long-residual pesticides also may reduce the effectiveness of beneficial organisms.

The comparison of the cost effectiveness of different pesticide strategies should factor in the amount of pest kill, length of control and cost of the product per acre. The spectrum of activity of the pesticides also should be considered. A single broad spectrum material may substitute for two or more specific ones. In such cases, broad-spectrum materials which control potential secondary pests provide overall benefits much greater than those expected from a selective material. Some may have adverse effects on beneficials; scale and parasites can result in additional pesticide use later in the season. Therefore, cost effectiveness relates to cost of product per unit of fruit produced or to net income received and is best determined over a period of at least one season, preferably longer.

Practically all citrus pests in Texas are controlled in large part through natural control agents, either native or introduced. Complete destruction of these beneficials would result in the advancement of minor or secondary pests to primary pest status, resulting in greatly increased pest management costs. Pesticides most frequently implicated in destruction of beneficials are organo-phosphate and carbamate materials applied as foliar sprays. Parasitic fungi active in controlling mite and certain insect pests are adversely affected by the application of Zineb and copper fungicides. For specific comparisons of pesticide effects on beneficials, refer to Table 1 in L-2325 *Texas Citrus Insecticide and Miticide Guide.*

Safety should be a consideration when choosing a pesticide. Materials hazardous to the applicator or to the environment are labeled as such on product containers and should be handled accordingly. Product selection may be influenced by orchard location relative to residential areas, human traffic in the vicinity, or weather conditions favoring drift of materials to non-target sites. All possible precautionary measures must be observed with materials labeled for restricted use.

Other hazards of pesticide use include possible phyotoxicity to trees, foliage and/or fruit. Certain combinations of pesticides or overlapping applications of incompatible materials can cause severe damage. The most notable combinations are citrus spray oil and sulfur, oil and Morestan® or oil and Difolatan®. Oil, if applied incorrectly or without regard to limiting weather-conditions, may cause severe oleosis of fruit and defoliation.

Product use should be considered in choosing an insecticide. Such restrictions specify when and how the pesticide may be applied, special application procedures, re-entry periods after application and pre-harvest periods. These restrictions provide a margin of safety for the user and farm worker and also prevent the occurrence of excessive pesticide residues at harvest.

The chemistry of the pesticide as it relates to the development of pest resistance also should be considered. Resistance develops because one or more individuals in any given pest population may tolerate or resist effects of exposure to a specific pesticide. When that pesticide is used consecutively for several applications, offspring of resistant individuals multiply to eventually establish a resistant population no longer controlled by the specific material. Some materials are so similar in mode of pesticidal action that resistance developed in response to one pesticide provides or confers cross resistance to other similar materials, e.g., organo-phosphate insecticides and the benzimidazole-type fungicides. Consequently, management decisions need to consider the class of product along with product efficacy in determining the pesticide selection process. In general, repeated use of any pesticide season-long should be avoided. Use of citrus spray oil as an alternative to organic pesticides is an excellent management practice to deter pest resistance. In contrast to physiological modes of action characteristic of the organic materials, oils kill pests by physical suffocation which prevents the development of resistance.

References

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Issued in furtherance of Cooperative Extension Work in Agriculture and Home Economics, Acts of Congress of May 8, 1914, as amended, and June 30, 1914, in cooperation with the United States Department of Agriculture. Zerle L. Carpenter, Director, Texas Agricultural Extension Service, The Texas A&M University System.
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