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Texas Agricultural Extension Service

Texas Citrus Disease Management

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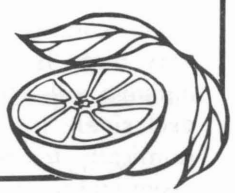

Several factors affect disease occurrence in citrus orchards. Of these, the most important are variety, virulence of the pathogen and environmental conditions. Good disease management involves a thorough knowledge of these factors and how they interact in the development of the diseases. Efforts should be made to learn as much as possible about the conditions that predispose trees and fruit to infection by the different organisms. Prevention is the most economical and often the only mean of control. Good disease management is based on avoiding initial infection by careful planning before and after establishing the orchard and by maintaining trees in vigorous growing conditions that lessen the chances of diseases. Regular monitoring and complete knowledge of all symptoms associated with each disease are essential to detect diseases as soon as they occur, before they become well established and control is no longer possible.

Melanose

Estimates of inoculum potentials and subsequent decisions on the use of a fungicide for melanose control are best made pre-season or before bloom. For some orchards, where serious damage habitually occurs, crop history dictates the need for control every year. In others, estimates may be based on the quantity of dead twigs in trees. If climatic conditions the previous season were conducive to a serious disease problem, the number and appearance of seriously affected fruit in the north or northwest quadrants of trees are good indicators of need for fungicide applications. Factors to be considered before the application of fungicides for melanose control include:

- **Size of fruit.** The most opportune time for melanose control is when the fruit is close to 1 inch in diameter or slightly larger, or when frequent rainfall periods are forecast for May and June. Timing for melanose should take precedence over rust mite control when inoculum potential is high.
- **Need for a second application.** A single post-bloom spray application will not result in acceptable melanose control except in dry seasons when little control is needed. Rate of fruit growth and surface expansion is such as to require a second fungicide application no later than 30 to 35 days following the post-bloom spray.
- **Fungicide agitation in sprayer.** Copper fungicide mixtures require thorough and constant agitation in the spray tank to maintain suspensions. Brief stops may result in permanent settling of large portions of wettable powder formulations.
- **Fungicide formulation.** Field observations and demonstrations indicate that liquid formulations of copper fungicides at equivalent rates of application generally are more efficacious than dry formulations.
- **Amount of dead wood.** Chemical control efforts in heavily infected orchards may not prove satisfactory without supplemental pruning or hedging to reduce the level of inoculum.
- **Orchard locations.** Traditionally, orchards in the eastern end of the Valley have been sprayed regularly because of higher humidity and, thus, more favorable conditions for melanose.

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Greasy Spot

Management decisions regarding greasy spot should originate during winter months when the need for control is most apparent. Control measures in the form of either citrus oils or copper fungicides can be applied during the summer. Benomyl was found to be very effective under Valley conditions when greasy spot infection was very high. In orchards with a history of severe damage, oil, copper or benomyl sprays applied exclusively for greasy spot control may be economically feasible. Thorough spray coverage is essential for effective control of greasy spot because infection takes place only on the lower leaf surface where coverage is most difficult to achieve. Factors to be considered in the management of greasy spot include:

- Previous history of greasy spot occurrence in the orchard and variety being grown; navel orange is most susceptible.
- Infestation levels of mites that may predispose leaves and fruit to damage by greasy spot.
- Weather conditions during late summer and early fall that may be favorable for disease development.

Foot Rot

Until recently, control of foot rot was achieved only through propagative and cultural methods practiced to reduce disease incidence. With the advent of systemically active materials effective for curative or remedial treatment of non-bearing trees, monitoring for foot rot assumes added significance.

Frequent monitoring for foot rot during periods following wet, rainy weather is important from the standpoint of early recognition of the disease before extensive trunk damage occurs. Gumming of bark tissues becomes most noticeable under moist, cool conditions, while hot dry weather favors drying and apparent healing of affected areas.

Methods for prevention of foot rot remain important and must begin in the citrus nursery. Care should be taken in field planting to ensure that young trees are not transplanted to depths exceeding the original planted depth. All activities that might result in wounding of trunk tissues just prior to anticipated rainfall or irrigation must be avoided.

For young trees wrapped for cold protection, activity by the southern fire ant inside the wrap increases the likelihood of infection. Wraps should be removed from trees exhibiting signs of ant activity to inspect for signs of bark damage and/or gumming.

Pruning and sprout removal are best done only in dry weather. Cultural activities that result in occasional trunk injury, such as disking, tree hoeing or boom spray applications should be done at least 2 days in advance of irrigation.

Methods of control for infected trees vary according to tree age. Non-producing trees may be treated with approved systemic fungistats or fungicides. Affected areas or lesions on producing trees can be contained by treatment of active infection sites. The latter involves scraping of the bark to determine lesion perimeters, after which the leading edge of infected tissue is killed by heat or mechanical removal. Factors to consider in the management of this disease are:

- Prevention is the most effective means of control. Infected trees are difficult to cure; recently approved chemicals help in protecting young trees from infection.
- Location, ways in which trees are produced and previous history of disease occurrence in nurseries from which the trees were obtained are important in disease management.
- Plant trees with high bud unions at least 6 inches high in locations that drain well, even after very heavy rains.

Citrus Nematode

Symptoms of citrus nematode infection are difficult to diagnose visually. Poor drainage, excess salt, improper watering and damage caused by other soil-borne organisms will affect the trees in much the same way as the citrus nematode. Consequently, the presence of the citrus nematode in soil and roots can best be determined in the laboratory with the aid of a microscope.

Sampling and laboratory determinations are relatively simple. However, they should be done properly and the results interpreted correctly to determine if treatment is justifiable.

Take soil samples at a time when soil moisture is neither excessive nor very low. The best period for sampling is during the second week following an irrigation or a rain. Collect samples under the drip line of the tree. After removing the debris, use a shovel to cut a slice of soil from the surface to about 12 inches deep. Place soil and feeder roots in a clean plastic bucket and mix well with soil and roots from other trees. Then place a composite sample from these in a plastic bag and label for

laboratory examination. One laboratory sample should represent five trees sampled at random for every 5 acres.

Take care not to allow the plastic bags to be exposed to heat or direct sunlight, which will kill the heat-sensitive, juvenile nematodes and make laboratory analysis impossible. Have an insulated icebox available for transporting the samples to a competent laboratory for analysis.

Results are expressed in numbers of juvenile nematodes per 100 grams of soil and 3 grams of roots. Counts will vary at different sampling times because of soil moisture, age of trees, soil types, other stresses on trees and management practices. Table 1 is based on many years of research conducted in the Valley, and should serve as a guideline in interpreting results.

Table 1. Citrus nematode counts considered low, medium or high at different sampling times during the growing season.

Sampling time	Number of juvenile nematodes in 100 grams of soil and 3 grams of feeder roots		
	low population	medium population	high population
June to September	100—200	400—600	750—5,000
October to January	200—500	1,000—3,000	5,000—10,000
February to May	500—1,500	3,000—6,000	10,000 +

Chemical control of nematodes on established trees is expensive and must be repeated annually for best results. Prevention by exclusion is a practical option when establishing a new orchard. Avoid old sites known to be infested if possible. On new citrus soil, make every effort to plant trees free of nematodes, grown in containers or in fumigated nursery soil. Factors to consider before applying nematicides include:

- What is potential orchard production with and without treatment?
- Will treatment result in increased yields, fruit grade or fruit size?
- Will treatment control other pests, such as mites?
- How will the treatment affect beneficial organisms in the orchard?
- Can soil incorporation, activation or other application requirements be satisified under existing water limitations, soil and climactic conditions?
- What are re-entry limitations and restrictions on time required between treatment and harvest?

Table 2. Fungicides and nematicides and rates of formulation per acre for disease and nematode control in Texas citrus.

	aldicarb (Temik 15G®)	benomyl[3] (Benlate®)	benomyl[3] (Freshgard 113®)	Biphenyl[4]	copper ammonium complex (Copper-Count-N®)	copper hydroxide[1] (Kocide 101®) (Champion WP®)	(Tribasic Copper®)[2]	oil	oxamyl[6] (Vydate L®)	(Sopp®)[5]	thiabendazole[3] (Fungicide conc. 1020 and 6®)	thiabendazole[3] (Fungicide conc. 2020®)	thiabendazole[3] (Decco Salt 19®)
Melanose					1.5-2 gal	5 lb	10-26 lb						
Greasy spot		1.5-3 lb			1-1.5 gal	5 lb	15 lb	8 gal					
Post-harvest disease		1 to 2 lb 100 gal	600 to 2400 ppm	see note						2000 to 3500 ppm	1000 to 3000 ppm	1000 to 3000 ppm	2000 to 3000 ppm
Nematodes	66 lb								1 to 2 gal				

[1]Two or more applications provide best control. For single post-bloom application use 7.5 lb. per acre. Kocide 606 and Champion Flowable, liquid formulations, may be substituted at equivalent rates.

[2]Finely ground liquid formulation such as Top Cop is labeled for use at .75 to 1 gallon per acre.

[3]For post harvest, apply as a dip or spray, incorporate into the citrus wax. Do not immerse fruit in Benlate for more than five minutes.

[4]Several formulations are available. Do not treat fruit for more than five minutes; rinse thoroughly after application.

[5]Must be impregnated in pads; impregnated pads are commercially available.

[6]Apply as foliar spray, making 3 to 6 applications per year (maximum 6 gal per acre per season.)

lb = pounds, gal = gallons, ppm = parts per million

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