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Texas Agricultural Extension Service
The Texas A&M University System

Texas Citrus
Disease Management

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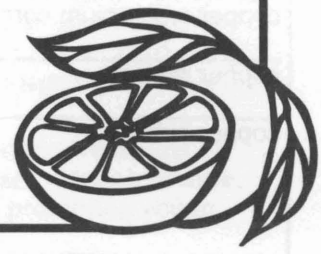

If a plant pathogen is present in an orchard, the severity of the disease it causes will be determined by the level of infestation, by environmental conditions, and the susceptibility of the plant, which, in turn, is determined by its genetic characteristics. Good disease management requires a thorough knowledge of how these factors interact in the development of the disease; particularly, knowledge of environmental conditions that stress the plant, predisposing it to disease. This will help in preventing a disease problem. However, regular monitoring is needed to detect diseases as soon as they occur, before they become well established.

The chemicals listed here are registered for use on citrus. Since fungicide labels are often changed, check the actual label before use. Refer to the label for specific instructions for rates and timing of applications and other information.

Melanose

Decisions on the use of a fungicide for melanose control are best made pre-season or before bloom. Fungicide sprays are recommended for orchards where serious levels of disease usually occur. In other orchards, the potential for disease can be estimated based on the quantity of dead twigs in trees. If climatic conditions in the previous season resulted in a serious disease problem, the number and appearance of seriously affected fruit in the north or northwest quadrants of trees are good indicators for the need of fungicide applications. Factors to be considered before the application of fungicides for melanose control include:

- **Size of fruit**. Grapefruits up to 3 1/4 inch and oranges up to 1 1/2 inch diameter are susceptible to melanose infection in the spring.
- **Amount of dead wood**. Chemical control efforts in heavily infected orchards may need to be combined with supplemental pruning to reduce the quantity of the pathogen. Orchards six years old or younger normally do not require treatment for melanose.
- **Orchard locations**. Traditionally, orchards in the eastern end of the Valley have required regular spraying because of higher humidity, which favors melanose development.

Timing for melanose control sprays should take precedence over rust mite control when disease potential is high. A single post-bloom spray application will not give acceptable melanose control except in dry seasons when little control is needed. Increased fruit growth requires a second fungicide application no later than 30 to 35 days following the post-bloom spray. Copper fungicide mixtures require thorough and constant agitation in the spray tank to maintain the ingredients in suspension. Field observations and demonstrations indicate that liquid formulations of copper fungicides generally are more effective than dry formulations at equivalent rates of application.

Refer to Table 1 for chemical control recommendations.

Greasy Spot

Management decisions for greasy spot control should be made during winter months when the need for control is most apparent. Either citrus oils or copper fungicides can be applied during the summer for control. Benomyl was very effective under Valley conditions when greasy spot infection was severe. In orchards with a history of severe damage, oil, copper or benomyl sprays applied exclusively for greasy spot control may be economically feasible. Infection takes place on

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Table 1. Chemical controls for melanose.

Chemical	Formulation	Application guideline
copper ammonium complex	Copper Count N	Apply 1-3 weeks after bloom. Do not apply with oil.
copper resinate	Tenn-Cop 5E	Apply 1-3 weeks after petal fall, and 4 weeks later as needed.
copper sulfate	Basicop WP CP Basic Copper TS TopCop Tribasic Cuproxat F	Apply 1-3 weeks after petal fall, then 4 weeks later. Apply pre- and post-bloom.
copper sulfate + sulfur	Top Cop with Sulfur Top Cop with Sulfur F	Apply 1-3 weeks after petal fall and then 4 weeks later.
cupric hydroxide	3 LB. Copper Flowable Champ F Champion WP Kocide	Apply pre- and post-bloom.

the lower leaf surface; therefore, thorough spray coverage is essential for effective control of greasy spot. Factors to be considered in the management of greasy spot include:

- Previous history of greasy spot occurrence in the orchard and the variety being grown.
- Levels of mites that may predispose leaves and fruit to damage by greasy spot.
- Rainy weather during late summer and early fall that may be favorable for disease development. Spores of the fungus are released following an irrigation or rainfall. High levels of spores occur from May to October.

Refer to Table 2 for chemical control recommendations.

Table 2. Chemical controls for greasy spot.

Chemical	Formulation	Application guideline
benomyl	Benlate WP	One spray in mid-June to July.
copper ammonium	Copper Count N	Apply pre- and post-bloom and within 1 month after leaf expansion of any growth flush. Do not apply with oil.
copper sulfate	Basicop WP CP Basic Copper TS TopCop Tribasic Cuproxat F Copper FF	Apply post bloom and within one month after leaf expansion of any growth flush. Limit 60lb/acre. Apply during 2 months after spring flush expansion and within 1 month of other growth flushes. Apply pre- and post-bloom, 30-day interval, June-August. Summer spray in mid-July.
cupric hydroxide	3 LB. Copper Flowable Champ F Champion WP Kocide	Apply pre- and post-bloom. Apply during 2 months of spring growth expansion.
propiconazole	Banner EC	For non-bearing use only in nursery and landscape. Do not use within 12 months of fruiting.

Foot Rot

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

Methods of 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 the trunk 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.

Trunk lesions can be treated with metalaxyl or fosetyl-Al. Severely damaged or unproductive trees should be removed from the orchard. Factors to consider in the management of this disease are:

- Prevention is the most effective means of control. Infected trees are difficult to cure; fungicides may help in protecting young trees from infection.
- Location of trees in the orchard, 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 above the ground in locations that drain well, even after very heavy rains.

Refer to Table 3 for chemical control recommendations.

Table 3. Chemical controls for foot rot.

Chemical	Formulation	Application guideline
cupric hydroxide	Kocide DF	Tree trunk paint for preventative use only. Apply prior to wrapping for freeze protection.
fosetyl-Al	Aliette	4 applications per year, limit of aluminum 20 lbs/acre/year. Do not apply within 30 days of harvest.
metalaxyl	Ridomil 5G Ridomil 2E Subdue G Subdue 2E	Soil application. Soil and trunk application. Soil application. Soil and trunk application.

Citrus Nematode

Symptoms of citrus nematode infection are difficult to diagnose visually. Poor drainage, excess salt, improper watering and damage caused by other soilborne 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 by laboratory testing.

Proper sampling is important to obtain an accurate assessment of the problem. Collect 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 8 to 10 inches deep from the four sides of a tree. 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 at least five trees sampled at random diagonally from rows 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 ice chest available for transporting the samples to a competent laboratory for analysis.

Results of laboratory analysis are expressed in numbers of juvenile nematodes per 100 cubic centimeters (cc) 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 4 is based on many years of research conducted in the Valley, and should serve as a guideline in interpreting results.

Table 4. Citrus nematode counts considered low, medium or high at different sampling times during the growing season.

	Number of juvenile nematodes in 100 cc of soil and 3 grams of feeder roots		
Sampling time	**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 (i.e., 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 satisfied under existing water limitations, soil and climatic conditions?
- What are re-entry limitations and restrictions on time required between treatment and harvest?

Refer to Table 5 for chemical control recommendations.

Table 5. Chemical controls for nematodes.

Chemical	Formulation	Application guideline
metam sodium	Vapam Soil Prep	Pre-plant only.
oxamyl*	Vydate L	Do not apply more than 4 qt/acre in any 30-day period, 7-day preharvest interval.
aldicarb*	Temik 15G	Apply just before or during spring flush of growth.
fenamiphos*	Nemacur 3 Nemacur 15G	Limit 3.33 gal/season. Limit 67 lbs/season.

*Restricted use - permit required.

The information given herein is for educational purposes only. Reference to commercial products or trade names is made with the understanding that no discrimination is intended and no endorsement by the Cooperative Extension Service is implied.

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