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Institute of Food and Agricultural Sciences

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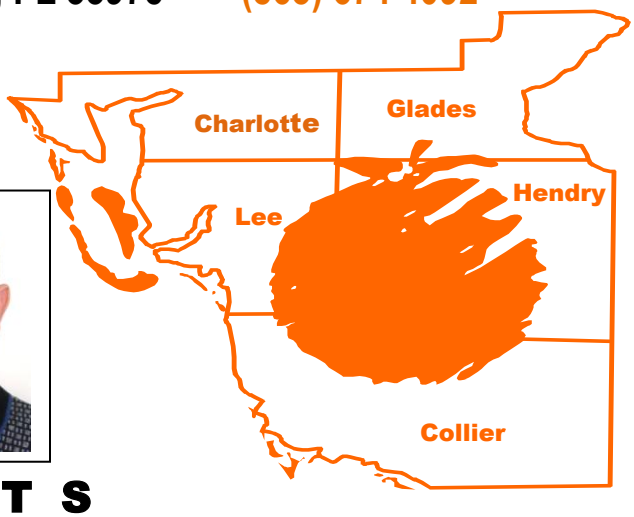
Flatwoods Citrus



Vol. 11, No. 2 February 2008

Dr. Mongi Zekri
Multi-County Citrus Agent, SW Florida

U P C O M I N G E V E N T S

COLLIER COUNTY EXTENSION AG TOUR

Date: Wednesday, 12 March 2008

For more information or to sign up, Contact
Robert Halman
Phone: 239 353 4244, rdhalman@ifas.ufl.edu

FROM THE IMMOKALEE IFAS CENTER

We are pleased to announce the opening of the HLB Lab at the UF/IFAS SW Florida Research and Education Center in Immokalee. The HLB Lab is a new facility dedicated to the Real Time PCR-based molecular diagnostics of Huanglongbing (HLB), also known as Greening Disease. We will begin accepting suspect-HLB citrus samples on February 4. For detailed instructions about how to collect and submit citrus samples, please review the HLB Sample Submission Form and the sampling and submission procedures that are attached. Additional information is being posted to our Web page: http://swfrec.ifas.ufl.edu/hlb/. Our facility is located at 2686 SR 29 N., which is just north of Immokalee. Our phone number is 239-658-3400. We are open Monday through Friday from 8:00 AM to 5:00 PM.

If you want to print a color copy of the Flatwoods Citrus Newsletter, get to the Florida Citrus Resources Site at http://flcitrus.ifas.ufl.edu/ You can also find all you need and all links to the University of Florida Citrus Extension and the Florida Citrus Industry

FLORIDA'S CERTIFIED PILE BURNER TRAINING

Tuesday, February 26th, 2008

The training will be held from 8:30 am till 4:30 pm at the Immokalee IFAS Center, 2686 State Road 29 North, Immokalee, FL 34142-9515, Phone: 239-658-3400

There will be a test at the end of the session. There is a $50.00 cost to attend, please make checks payable to Lake County Citrus Extension Program. Please send checks to the Lake County Extension office care of Ryan Atwood at 1951 Woodlea Rd., Tavares, FL 32778. If you have any other questions please contact Ryan at raatwood@ufl.edu
Extension Agent-Multi County Fruit Crops, Lake County Extension/UF/IFAS
1951 Woodlea Rd, Tavares, FL 32778
Phone: 352-343-4101
Fax: 352-343-2767 or Maggie Jarrell (mjarrell@ufl.edu) or myself (Mongi Zekri) at maz@ifas.ufl.edu or at 863 674 4092.

Florida's Certified Pile Burner Training

1. Opening Comments and Introduction	08:30 – 09:10
2. Smoke Management	09:10 – 10:30
3. BREAK	10:30 – 10:40
4. Fire Weather	10:40 – 11:20
5. Planning and Implementation	11:20 – 12:15
6. LUNCH (provided)	12:15 – 01:15
7. Open Burning Regulations	01:15 – 02:30
8. Safety	02:30 – 03:10
9. BREAK	03:10 – 03:20
10. Public Relations	03:20 – 04:00
11. Wrap Up & Test	04:00 – 04:30

Special Thanks to all the sponsors of the Flatwoods Citrus newsletter for their generous contribution and support. If you would like to be among them, please contact me at 863 674 4092.

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USDA FURTHER EXPANDS CITRUS GREENING QUARANTINE IN FLORIDA

WASHINGTON, Jan. 11, 2008--The U.S. Department of Agriculture's Animal and Plant Health Inspection Service issued a federal order today, effective immediately, that expands the citrus greening quarantine zone to include the entire state of Florida.

This action, which revises the Nov. 2, 2007 federal order that quarantined 28 counties in Florida, is necessary to prevent the spread of citrus greening, also known as Huanglongbing. In 2005, the United States first detection of citrus greening occurred in Florida. While the disease does not pose a human health risk, it greatly reduces fruit production which results in economic losses. Once infected, there is no cure for a tree with citrus greening.

On Nov. 30, 2007, APHIS confirmed citrus greening in two additional Florida counties--Lake and Hernando--bringing the total number of infected counties in the state to 30. Following discussions with the state of Florida, APHIS determined that it is necessary to impose statewide restrictions on the movement of all live host plants and host plant parts from Florida.

If, in the future, scientific evidence demonstrates that nursery stock can be handled in a way that prevents the risk of spreading citrus greening, APHIS would pursue rulemaking to allow the interstate movement of these plants. However, until these requirements are established, nursery stock from areas quarantined for citrus greening only can be moved interstate for immediate export accompanied by a limited permit that prevents distribution to any citrus-producing states or territories.

The interstate movement of citrus fruit is not restricted by the federal order; however, under the federal citrus canker quarantine, fresh citrus from Florida must meet certain requirements and cannot be shipped to any citrus-producing states or territories.

The federal order also maintains a quarantine for the Asian citrus psyllid (ACP) for all of Florida along with Guam, Hawaii, Puerto Rico, and 32 counties in Texas. On Nov. 30, 2007, Texas established a parallel quarantine, restricting the intrastate movement of ACP-host material in order to prevent the spread of the disease to additional Texas counties. The ACP is a serious citrus pest, as well as the main vector of citrus greening. Although the ACP has been detected in these areas, citrus greening only has been found in Florida. In order for ACP-host material to be shipped from these quarantined areas, it must be treated, inspected and accompanied by a limited permit that prevents distribution to any citrus-producing states or territories where the ACP is not present. The federal order can be found on the APHIS Web site at http://www.aphis.usda.gov/plant_health/plant_pest_info/citrus_greening/index.shtml

CURRENT FLOWER BUD INDUCTION ADVISORY #7 for 2007-2008 - 01/18/08

Flower Bud Induction Overview and Advisory

http://www.lal.ufl.edu/extension/flowerbud/index.htm

L. Gene Albrigo, Horticulturist
Citrus Research & Education Center, Lake Alfred, FL

Currently, all central to northern citrus areas have flower buds initiated and growing. Southern areas such as Ft. Pierce and Immokalee probably have bud growth also, but the Flowering Monitor System does not indicate that this has happen, even though there are now 880 to over 900 hours below 68 degrees F in those areas. The Flowering Monitor System indicates this bud growth started about 20-22 December in most areas and the projected bloom dates for this first wave of flowers is from February 22 to 27 if normal or warmer weather continues. This first wave was induced at about 640 to 800+ accumulated hours below 68 degrees F from Sebring to northern districts. Another 200 hours has accumulated and a second wave of buds is initiated, and they should reach peak flowering March 11 to 14th.

Trees, particularly with a heavy crop and in areas with low total induction, , may still benefit from a spray of urea or PO3,but that time will probably be past one week after the next cold front goes by. Review the 5th advisory for more information. These sprays should be applied at temperatures above 70 degrees F.

Some blocks over-flower and set poorly. Some Valencia selections have this problem, and mandarin blocks with a light crop also are good candidates for a spray of 10 ppm GA3 at 125 gal/acre. The best timing for this spray is probably the end of next week if temperatures warm up to above 70 degrees F.

If you have any questions, please contact Dr. Gene Albrigo at: (albrigo@crec.ifas.ufl.edu or phone 863-956-1151).

NUTRITION OF CITRUS TREES

Fertilizer management should include calibration and adjustment of fertilizer spreaders, booms, pumps, or irrigation systems to accurately deliver fertilizer rates and place fertilizers within the tree rootzone. To increase fertilizer efficiency, soil and leaf analysis data should be studied and taken into consideration when generating a fertilizer program and selecting a fertilizer formulation. Dry fertilizer application should be split into 3 to 4 applications per year with a complete balanced fertilizer. For mature trees, the highest nutrient requirement extends from late winter through early summer. This coincides with flowering, heavy spring flush, fruit set, and fruit development and expansion. For best fresh fruit quality, nutritional requirements, particularly nitrogen (N), should decrease late in the summer and fall. Based on tree demands, 2/3 to 3/4 of the yearly fertilizer amount should be applied between February and June. In warm areas such as southwest Florida where tree growth can continue certain years during the winter, fertilizer applications should also be made in the fall to satisfy vegetative growth demand. However, fall fertilizer applications may sometimes delay fruit color development and fruit maturity for early and mid-season cultivars.

IFAS fertilizer guidelines for nonbearing citrus trees

Year in grove	Lb N/tree/year (range)	Lbs Fertilizer/tree/year (range)		Lower limit of application frequency	
		6-6-6	8-8-8	Dry	Fertigation
1	0.15 – 0.30	2.5-5.0	1.9-3.8	6	10
2	0.30 – 0.60	5.0-10.0	3.8-7.5	5	10
3	0.45 – 0.90	7.5-15.0	5.6-11.3	4	10

IFAS fertilizer guidelines for bearing citrus trees (4 years and older)

Oranges	Grapefruit	Other varieties	Lower limit of application frequency	
Lbs N/acre/year (range)			Dry	Fertigation
120 - 200	120 - 160	120 - 200	3	10

Rates up to 240 lbs/acre may be considered for orange groves producing over 700 boxes/acre and up to 180 lbs/acre for grapefruit groves producing over 800 boxes/acre. Young trees planted on previously uncropped soils should receive fertilizer containing the following ratio of elements: nitrogen-1, phosphorus-1, potassium-1, magnesium-1/5, manganese-1/20, copper-1/40, and boron-1/300.

For more information on citrus nutrition, get to the following EDIS publications:

Increasing Efficiency and Reducing Costs of Citrus Nutritional Programs
Mongi Zekri, Thomas Obreza and Arnold Schumann
http://edis.ifas.ufl.edu/SS442 [pdf]

Irrigation, Nutrition, and Citrus Fruit Quality
Mongi Zekri, Thomas A. Obreza and Robert Koo
http://edis.ifas.ufl.edu/SS426 [pdf]

Micronutrient Deficiencies in Citrus: Iron, Zinc, and Manganese
Mongi Zekri and Thomas A. Obreza
http://edis.ifas.ufl.edu/SS423 [pdf]

Micronutrient Deficiencies in Citrus: Boron, Copper, and Molybdenum
Mongi Zekri and Thomas A. Obreza
http://edis.ifas.ufl.edu/SS422 [pdf]

Macronutrient Deficiencies in Citrus: Calcium, Magnesium, and Sulfur
Mongi Zekri and Thomas A. Obreza
http://edis.ifas.ufl.edu/SS421 [pdf]

Macronutrient Deficiencies in Citrus: Nitrogen, Phosphorus, and Potassium
Mongi Zekri and Thomas A. Obreza
http://edis.ifas.ufl.edu/SS420 [pdf]

Plant Nutrients for Citrus Trees
Mongi Zekri and Thomas A. Obreza
http://edis.ifas.ufl.edu/SS419 [pdf]

Nitrogen Fertilizer Sources: What Does The Future Hold for Citrus Producers?
Tom Obreza, Larry Parsons, and Kelly Morgan
http://edis.ifas.ufl.edu/SS457 [pdf]

Controlled-Release Fertilizers for Florida Citrus Production
Tom Obreza and Bob Rouse
http://edis.ifas.ufl.edu/SS433 [pdf]

Prioritizing Citrus Nutrient Management Decisions
Thomas A. Obreza
http://edis.ifas.ufl.edu/SS418 [pdf]

Managing Phosphorus Fertilization of Citrus using Soil Testing
Thomas A. Obreza
http://edis.ifas.ufl.edu/SS332 [pdf]

Effects of P and K Fertilization on Young Citrus Tree Growth
Thomas A. Obreza
http://edis.ifas.ufl.edu/SS331 [pdf]

Fertigation Nutrient Sources and Application Considerations for Citrus
Brian Boman and Tom Obreza
http://edis.ifas.ufl.edu/CH185 [pdf]

Citrus Fertilizer Management on Calcareous Soils
Thomas A. Obreza, Ashok K. Alva, and David V. Calvert
http://edis.ifas.ufl.edu/CH086 [pdf]

Boron (B)

Boron is particularly necessary where active cell division is taking place. Boron plays an important role in flowering, pollen-tube growth, fruiting processes, nitrogen (N) metabolism, and hormone activity. Florida sandy soils are low in B, and a deficiency of this element in citrus occasionally occurs under field conditions. The deficiency may be aggravated by severe drought conditions, heavy lime applications, or irrigation with alkaline water. Boron is very mobile in the soil profile of sandy soils and readily leaches by rainfall or excess irrigation.

Boron deficiency is known as "hard fruit" because the fruit is hard and dry due to lumps in the rind caused by gum impregnation. The chief fruit symptoms include premature shedding of young fruits. Such fruit have brownish discoloration in the white portion of the rind (albedo), described as gum pockets or impregnations of the tissue with gum and unusually thick albedo. Older fruit are undersized, lumpy, misshaped with an unusually thick albedo containing gum deposits. Seed fails to develop and gum deposits are common around the axis of the fruit.

The first visual symptoms of B deficiency are generally the death of the terminal growing point of the main stem. Further symptoms are a slight thickening of the leaves, a tendency for the leaves to curl downward at right angles to the midrib, and sometimes chlorosis. Young leaves show small water soaked spots or flecks becoming translucent as the leaves mature. Associated with this is a premature shedding of leaves starting in the tops of the trees and soon leaving the tops almost completely defoliated. Fruit symptoms appear to be the most constant and reliable tool for diagnostic purposes.

To treat citrus affected with B deficiency, B compounds can be applied either foliarly or in the fertilizer. As a maintenance program, apply B in the fertilizer at an annual rate equivalent to 1/300 of the N rate. In Florida, foliar spray applications have been found much safer and more efficient than soil application. Soil applications frequently fail to give satisfactory results during dry falls and springs and may result in toxicity problems if made during the summer rainy season. Boron solubility in the soil is reduced at soil pHs below 5 and above 7. Foliar spray may be applied during the dormant period through post bloom, but preferably during early flower development. Treating at this growth stage is important because boron does not move very readily from other parts of the tree to the buds. Applying boron at this time will assist in flower initiation and pollen production, satisfy the needs for pollen tube growth, and enhance fruit set. For maintenance spray application, 0.25 lb/acre of B may be used. Boron levels in the leaf tissue should not drop below 40 ppm or exceed 120 ppm (dry wt basis). Where deficiency symptoms are present, double the amount suggested. Use care not to apply more than the recommended amount because it is easy to go from deficiency to excess.

ASSESSING FREEZE DAMAGE

The first step in managing freeze-damaged trees is to assess the extent of damage. It is very difficult to make an immediate assessment of damage. Some ice formation in the top ¼ inch of the juice vesicles indicates mild damage, while solid ice formation in the center signifies severe damage and loss of a portion of the crop. Generally, 4 hours or more of temperatures of 28 ^{o} F or below will cause some mature fruit damage. If extensive fruit damage has occurred, some fruit abscission would occur within 1-2 weeks following a freeze. High daytime temperatures following a freeze will, in particular, accelerate fruit drop and segment drying. Fruit should be harvested as soon as possible after a freeze and processed quickly to minimize reduction in juice content and yield losses. After ice in the fruit has melted, water is transpired through the peel, thus decreasing juice content.

Leaf damage is difficult to assess during a freeze night. Water soaked or curled leaves may or may not be significantly damaged. The morning following a freeze, leaves may be rolled up and appear dry and dull green. These leaves will probably, but not always, abscise over the next week depending on temperature. Freeze-damaged leaves abscise between the petiole and the lamina (leaf blade) with the petiole dropping later. Within 1 week of a freeze, the extent of leaf damage should be quite apparent. Trees can recover even form total defoliation and in some cases, flowers and fruit will be produced in the next season, depending on when a freeze occurs, whether flower buds have already been initiated and the extent of wood damage.

The consequences of freeze-damage to twigs, stems and trunks are more difficult to assess than that to fruit or leaves. In general, small twigs will be damaged before larger limbs and trunks. Twig or limb dieback may not become visible for weeks after a freeze. It is common for large limbs to bud out in the spring following a freeze, only to die back in the summer due to latent freeze-damage to cambial tissues. Another indication of wood damage is when leaves turn brown but do not abscise following a freeze. This indicates more severe freeze-damage than defoliation alone, and usually indicates severe limb damage.

Because freeze-damage to the wood is so difficult to assess, freeze-damaged trees should not be pruned until late spring or early summer. After the extent of freeze-damage has been assessed by evaluating the extent of cambial discoloration, pruning should be done to minimize problems resulting from melanose (a fungus which is harbored in dead wood).

Cultural practices for freeze-damaged trees

Changes in cultural practices will probably have to be made depending on severity of the freeze-damage. It is important to assess freeze-damage accurately before altering cultural practices. In mild to moderate damage, partial or total defoliation with no wood damage, it is important to regrow the canopy as rapidly as possible. Trees should receive recommended fertilizer rates during the winter and spring and adequate but not excessive irrigation as new leaves develop. Most water loss is through the leaves and therefore it is unnecessary to apply heavy irrigation to defoliated trees. However, adequate soil moisture is important to promote uptake of nutrients and growth of new leaves. Weed control becomes a problem because the orchard floor receives more sunlight than a fully canopied orchard. Recommended rates of preemergence material should be applied.

Cultural practices should be modified when severe leaf and wood damage have occurred. In this case, the size of the canopy and roots has been reduced and the tree requires less water and nutrients. For example, if canopy size is reduced by one-third, fertilizer and irrigation rates should be reduced by that amount. Trees should receive more frequent light applications of water and fertilizer because of reduced tree size.

PESTICIDE SPRAY COVERAGE FOR CITRUS TREES

Obtaining the proper distribution of a spray or coverage is essential for efficient management of citrus pests. Sprayer air deflectors, nozzle orientation and number of nozzles should be adjusted to match the size and shape of the canopy in order to minimize spray wastage. Recommended coverage varies from pest to pest. For example, an outside coverage spray is sufficient for aphids, citrus leafminers, and citrus psyllid that are found mostly on the periphery of the tree, whereas rust mites, greasy spot, and relatively immobile pests such as scales will need a more thorough coverage. Obtaining the proper coverage can be difficult because of the dense canopy of citrus trees and involves a balance of varying droplet size, amount of spray, and ground speed.

Aircraft applications typically use 5 to 20 gallons of water per acre. Low volume ground applications generally use 20 to 100 gallons of water per acre. To be effective and avoid phytotoxicity with oils and other chemicals, low-volume applications must be delivered in small droplets. Small droplet size can be obtained by providing high air velocities at the discharge outlet or by utilizing high spray pressure. Low-volume applications use between 75 and 100% of the amount of pesticide that would be applied per acre as a dilute spray. In order to achieve proper coverage, apply low-volume treatments only when it is relatively calm. It is not recommended to apply low-volume applications if wind speeds exceed 5 mph. In addition, extra precautions must be taken to protect handlers and applicators because of the high concentrations of chemicals used in low-volume applications.

Outside coverage applications use 50 to 150 gallons of water per acre to achieve thorough distribution of the spray to the outside or peripheral parts of the tree only. Larger trees and/or high-density plantings require the higher gallonage per acre. Relatively small trees can be sprayed with the same concentration of agrichemical, but using few nozzles. This should provide spray deposition approximately comparable to that of mature trees, with lower spray volume and active ingredient per acre. Because the spray distribution requirements are less stringent with outside coverage, ground speeds may increase up to 3 mph and the amount of spray/acre decreases, thus reducing the cost per acre.

Tips to Help Minimize Pesticide Spray Drift

Pesticide spray drift is the movement of pesticides away from the target area. Whether you do your own spraying or you contract somebody to do it for you, it is important to pay close attention to drift and to understand the serious problems it can cause. Pesticide spray drift is expensive, dangerous and illegal. It can result in increased insurance premiums, wasted product, increased production costs, claims, costly legal fees, and fines from government inspectors. The single most important step a grower can take to avoid pesticide drift is to make sure all ground and aerial applicators are skilled, careful, and fully trained.

Environmental conditions contributing to drift

Environmental conditions are one of the factors contributing to pesticide spray drift. Wind speed and direction, relative humidity, temperature and atmospheric stability affect drift. High wind speeds can carry pesticide particles out of the target area. High temperature and low relative humidity decrease particle size and increase drift potential. Spraying when it is too windy or when the wind is blowing toward a sensitive off-target area can cause serious problems. This is where having a skilled, well-trained applicator and monitoring conditions come into play. Be sure to check the wind speed and direction to ensure they are within the recommendations on the pesticide label. It is important that wind direction always be checked, even at very low wind speeds. A buffer should always be left between the spray application and sensitive off-target areas to allow for some drift downwind into the buffer.

Importance of the right droplet size

In the past, trees were drenched with high volumes and coarse droplets at 250–500 gallons per acre, resulting in trees dripping with excess pesticide. The belief that too much is better than too little is wrong. Dripping trees lead to environmental pollution such as soil contamination, and an excessive number of tank loads per acre results in poor time management and extra expense. Lower volumes must be used, which may result in smaller droplets, although there is a limit to droplet size because of concerns about drift. Droplets need to be small enough to cover the area, but not too small that the drift potential increases. When given a choice, always choose larger drops within the range that will give complete control as specified on the pesticide label. Droplets that are too small can be avoided by choosing appropriate nozzle types and/or orifice (opening) size, by adding recommended adjuvants to increase viscosity, by running sprayers at the lowest recommended pressure, and by avoiding high temperature conditions that can cause droplets to evaporate in mid-air, thus becoming smaller and prone to drift.

Importance of proper sprayer design and height

It is important that the height of sprayers is adjusted properly. The greater the distance between spray nozzles and target foliage, the greater the opportunity for air movement to carry droplets away. Wind speeds are higher with increasing height above the ground, so any increase in height causes an even greater increase in drift distance. In some cases, the pesticide label may give recommended heights. Otherwise, spray as close as possible to reduce drift but far enough away to still get proper coverage. Sprayers can be fitted with ultrasonic or laser canopy sensors. The sensors also detect the shape of a tree and adjust the spray pattern accordingly. The advantages include reduced drift, ground deposition, and reduced pesticide use. Herbicide drift from weed control practices should not be ignored. Shielded herbicide sprayers should be used to prevent drift from damaging citrus trees.

Importance of sprayer calibration and timing

Applying the correct product to the correct target at the correct time with the correct equipment is the key to good spraying. Correct calibration will ensure that all the nozzles are discharging the correct amount of liquid at the correct distance and angle to the target and at the correct forward speed. Operators must set the air deflectors correctly to confine airflow, spray and disturbance to the tree canopy. Choose the correct size sprayer with good backup support to ensure that spraying is done in a timely manner. Far too often, growers are racing around the clock in an attempt to apply pesticides. Planning in advance is the key to good management. Continuing development of spray application techniques will improve the efficiency of spraying. Investment in modern technology must be maintained if the grower is to remain competitive.

Importance of written records

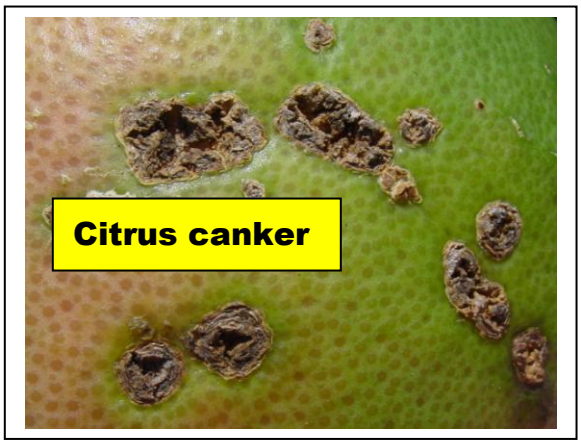
Be sure to keep accurate, written records to remember exactly what was done the last time you or your applicator sprayed. Some items that are useful to include may or may not be required by law: the date (of the pesticide spray), accurate start and end times, weather conditions (temperature, humidity, wind speed and direction), materials and amounts applied (including adjuvants), and target pests. Also, be sure to keep maintenance records (including the dates of calibration, and nozzle and tip replacement) on all sprays.

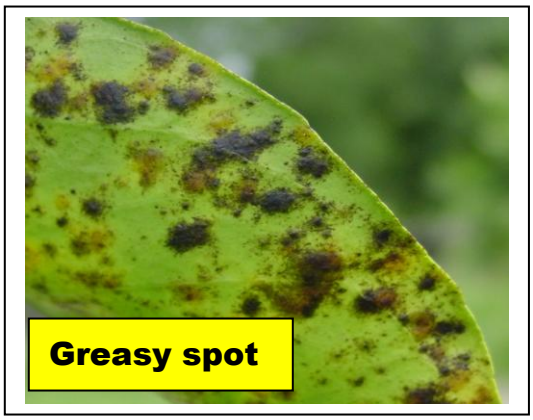
MANAGEMENT STRATEGIES TO REDUCE DRIFT

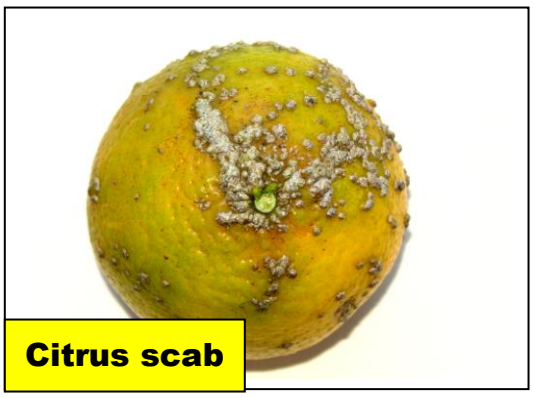
1. Train the operator to use the sprayer correctly in your grove under your conditions.
2. Don't dismiss the importance of well-trained, skilled pesticide applicators.
3. Plan in advance the spraying operation.
4. Read and follow the pesticide label thoroughly.
5. Select the correct nozzle for the target. Adjust the position of the nozzles to achieve proper coverage.
6. Check that air deflectors are set properly to confine disturbance to the target.
7. Calibrate the sprayer with water to ensure that everything is working correctly.
8. Consider spray additives to reduce drift.
9. Only spray when weather conditions are ideal; avoid spraying on days when conditions are favorable for atmospheric inversion or wind drift and keep monitoring environmental conditions.
10. Ensure the spray is not drifting on non-target areas and watch for changes in wind speed and direction.
11. Run sprayers at the lowest recommended pressure and ensure an accurate gauge is used.
12. Maintain a constant speed and pressure.
13. Keep accurate written records.

Fungicide effectiveness (By Dr. Timmer)

	Canker	Greasy Spot	Alternaria	Scab	Melanose	PFD
Copper	Good	Excellent	Good	Moderate	Excellent	Poor
Oil	None	Good	None	None	None	None
Ferbam	None	Weak	Moderate	Good	Weak	Moderate
Topsin	None	Excellent	None	Excellent	Weak	Good
Headline	None	Good	Very good	Excellent	Good	Moderate
Abound	None	Good	Very good	Excellent	Good	Moderate
Enable	None	Excellent	Poor	Good	Weak	?
Gem	None	Good	Good	Excellent	Good	Moderate
Trilogy	None	Weak	Fair	None	None	None







PESTICIDES MANAGEMENT IN CITRUS PRODUCTION

New pesticides being registered today are much safer to people and the environment. Natural products such as petroleum oils and copper compounds are effective and widely used in citrus pest management to control insects, mites and diseases.

Biological pesticides are generally more environmentally friendly, but often lack residual effect and can be strongly influenced by weather factors. Many insects and mites found in Florida citrus groves are under biological control. Growers should select pesticides that are least disruptive to natural enemies. All foliar and soil applied pesticides registered for citrus affect natural enemy abundance.

Concern for pesticide resistance suggests a more conservative approach. Products with similar modes of action should be applied only once per season where alternative products are available.

Copper is the most widely used fungicide in Florida citrus. Multiple applications of copper annually, year after year, may result in soil accumulation of toxic levels of copper. Copper can disrupt the action of certain natural enemies on occasion. Therefore, growers are cautioned to use copper products only for disease control at the recommended rates and frequencies.

Grower use of soil-applied pesticides with high potential for leaching should be avoided when possible or used with caution. Proper timing of application with good irrigation management will reduce the potential for groundwater contamination.

Tank mixing chemicals is an accepted practice that can reduce production costs. Growers should determine the compatibility of each pesticide, growth regulator, nutritional element, and surfactant before tank mixing. The practice of using partial rates of two compounds with similar activity instead of the recommended rate of one is questionable in terms of efficacy and is not recommended.

The pH and Total Dissolved Solids (TDS) of the water supply and the finished tank mix should be monitored routinely. Certain nitrate-based nutritionals are known to greatly reduce the pH, affect the performance of other compounds in the tank mix (e.g., solubility of copper), and thereby contribute to fruit burn and fruit drop.

Tank mixes should be kept simple as the potential for leaf and fruit burn increases with the number of products in the tank particularly under conditions of water stress, high temperature and low humidity.

The suggested mixing order of various formulations of agricultural chemicals is: water, wettable powders and dry flowables, water-soluble concentrates or solutions, emulsifiable concentrates and oil. Check with your chemical supplier for information regarding special chemicals and foliar nutritionals.

PESTICIDE RESISTANCE MANAGEMENT

There are many examples of pests that have developed resistance to one or more pesticides. Pesticide resistant individuals are those that have developed the ability to tolerate doses of a toxicant that would be lethal to all individuals. The mechanisms of resistance can vary according to pest species and/or to the class of chemical to

which the pest is exposed. Resistance mechanisms include an increased capacity to detoxify the pesticide once it has entered the pest's body, a decreased sensitivity of the target site that the pesticide acts upon, or a decreased penetration of the pesticide through the cuticle. A single resistance mechanism can sometimes provide defense against different classes of chemicals and this is known as cross-resistance. When more than one resistance mechanism is expressed in the same individual, this individual is said to show multiple resistance.

The key to delay the onset of pesticidal resistance, and therefore prolong the effective life of a compound: 1. Never rely on a single pesticide class. 2. Integrate chemical control with effective, complementary cultural and biological control practices. 3. Always use pesticides at recommended rates and strive for thorough coverage. 4. When there is more than one generation of pest, alternate different pesticide classes. 5. Do not use tank mixtures of products that have the same mode of action. 6. If control with a pesticide fails, do not re-treat with a chemical that has the same mode of action.

To aid in the selection of chemicals by growers wanting to rotate materials within a season or from year to year, the pesticides listed below are grouped by chemical class. Products with broad-based activity such as sulfur, copper, and oil are not included in this list because the development of resistance to them is not likely.

Insecticides and Acaricides:

- Aluminofluoride
  Kryocide (cryolite)
- Carbamates
  Sevin, Temik
- Chlorinated Hydrocarbons
  Kelthane
- Insect Growth Regulators
  Micromite
- Macrocyclic Lactone
  Agri-Mek
- Organo-phosphates
  Ethion, Guthion, Malathion, Lorsban, Supracide, Dimethoate, Orthene
- Organo-tin
  Vendex
- Pyridazinone
  Nexter
- Sulfite Ester
  Comite
- Synthetic Pyrethroids
  Capture, Danitol
- Chloronicotinyl
  Admire

Fungicides:

- Benzimidazoles
  Benlate, Thiabendazole, Topsin
- Dithiocarbamates
  Ferbam
- Strobilurins
  Abound, Gem, Headline

FERTIGATION

It is the application of soluble fertilizers through irrigation systems.

Some advantages of fertigation:

♦ Fertilizer is placed in the wetted area where feeder roots are extensive,
♦ Fertilizer may be applied more frequently in small amounts so that it is available when the tree needs it,
♦ Increased fertilizer application frequency can increase fertilizer efficiency and reduce leaching,
♦ Application cost is much lower than that of dry or foliar fertilizer application.

For microirrigation to be most effective, water and nutrients should be applied simultaneously.

Fertilizer efficiency and fertilizer cost savings of fertigation are greatest for young trees.

Fertigation is not recommended for non-uniform, poorly designed irrigation systems.

It should be kept in mind that fertilizer and water is wasted when fertigating a very wet soil to keep up with a programmed fertigation schedule. Water and nutrient uptake are drastically reduced under waterlogged soil conditions.

It is essential that backflow prevention devices be used to prevent fertilizers to contaminate the water supply.

It is very important to determine how long it takes for the fertilizer to travel to the farthest emitter because the system has to be flushed for at least that length of time.

Some disadvantages of fertigation:

♦ Extra equipment (filter, injection device, tank, backflow prevention system) must be added to the irrigation system,
♦ Soluble fertilizers are more expensive than granular fertilizers,
♦ Fertilizer application uniformity and coverage depend on the proper design and accuracy of the irrigation system,
♦ Fertilizers injected into an irrigation system may contribute to its plugging.

Caution should be taken when applying solutions containing phosphorus. Phosphorus can combine with dissolved calcium and magnesium in the irrigation water to form insoluble precipitates that clog the irrigation lines.

To avoid emitter plugging, a properly designed microirrigation system should include:

♦ A method of filtering irrigation water,
♦ A means of injecting chemicals into the water,
♦ Equipment for flushing the system,
♦ And in some cases a settling basin to allow aeration and the removal of solids.

MICROIRRIGATION AND FERTIGATION

Microirrigation

Microirrigation is an important component of citrus production systems in Florida. Microirrigation is more desirable than other irrigation methods for several reasons. Three important advantages are:
(1) water conservation,
(2) the potential for significantly improving fertilizer management and
(3) for cold protection.
Research has shown that when properly managed (no overirrigation), water savings with microirrigation systems can amount to as much as 80% compared to subirrigation and 50% compared to overhead sprinkler irrigation.

Microirrigation provides for precise timing and application of fertilizer nutrients in citrus production. Fertilizer can be prescription-applied during the season in amounts that the tree needs and at particular times when those nutrients are needed. This capability helps growers increase the efficiency of fertilizer application and should result in reduced fertilizer applications for citrus production. Research has also shown the important advantage of microsprinklers for freeze protection of citrus.

Fertigation

Fertigation is the timely application of small amounts of fertilizer through irrigation systems directly to the root zone. Compared to conventional ground application, fertigation improves fertilizer efficiency. Subsequently, comparable or better yields and quality can be produced with less fertilizer. To effectively fertigate crops, growers must properly maintain microirrigation systems to apply water and fertilizer uniformly. In addition, growers must determine:
(1) which fertilizer formulations are most suitable for injection,
(2) the most appropriate fertilizer analysis for different age trees and specific stages of growth,
(3) the amount to apply during a given fertigation event, and
(4) the timing and frequency of applications.
Properly managed applications of plant nutrients through irrigation systems significantly enhance fertilizer efficiency while maintaining or increasing yield. On the other hand, poorly managed fertigation may result in substantial yield losses. Fertigation involves deciding which and how much nutrients to apply, selecting the most effective formulations and scheduling injections to ensure that essential nutrients are available as needed.

Injection Duration

A minimum injection time of 45 to 60 minutes is recommended. This time is sufficient for uniform distribution of nutrients throughout the fertigation zone. Limit injection time to prevent the application of too much water, because excessive water leaches plant nutrients below the root zone.

HLB Laboratory at the Immokalee IFAS Center
Procedure for Sampling and Shipping Plant Material

Please follow the instructions below to submit citrus samples to be screened for the presence of *Candidatus* Liberobacter asiaticus, the causal agent of HLB.

1. Collect **leaves with stems intact** from live branches with fully expanded leaves. Samples should be collected from symptomatic branches if present.
2. Submit **a minimum of 10 leaves**. Please do not submit fruit samples.
3. Place the sample into a re-sealable plastic bag (e.g., Zip-lock), squeeze the air from the bag and seal it.
4. Assign and record on the bag a **unique sample identification number** (Grower's sample ID).
5. Complete a corresponding **HLB Sample Submission Form**. Forms are available at: **http://swfrec.ifas.ufl.edu/hlb/hlb.pdf** Please make sure the Sample Submission Form is complete, providing the exact sample location. We will not process samples lacking sample location and/or client information.
6. Place the form and the bagged sample into a second resealable bag. **Keep samples cool** (on ice) until shipment. Do not freeze the samples.
7. Samples should be **submitted in person** or **shipped overnight** either on the day collected or before noon the following day (samples will deteriorate if delayed in transit).

Please submit samples Monday through Thursday only to:
HLB Lab
2686 SR 29 N
Immokalee, Fl 34142
Phone: 239-658-3400

Additional information

Sampling Procedure:
Additional, detailed information about sampling procedures can be found at
http://www.flcitrusmutual.com/content/docs/issues/canker/sg_samplingform.pdf
Sample quantity:
If you intend to submit numerous samples, please give us a call at 239-658-3400, we will be glad to coordinate the best time to process your samples. We are open Monday through Friday from 8:00 AM to 5:00PM.
Results
Results will be submitted to the client in a timely manner. Results will be reported as positive, negative or inconclusive:
A positive result indicates the presence of *Candidatus* Liberobacter asiaticus in the sample under our testing conditions. Positive samples will be reported to USDA-APHIS and FDACS as required by rule*.
A negative result indicates that *Candidatus* Liberobacter asiaticus was NOT DETECTED in the sample under our testing conditions, but does not unequivocally indicate that the sample is free of *Candidatus* Liberobacter asiaticus. If an HLB sample result is negative, resubmission at a later time should be considered.
An inconclusive result indicates that another sample should be resubmitted and retested.
***Disclaimer**
As a diagnostic laboratory receiving samples and performing PCR assays to detect a Select Agent, we must abide by the requirements under the Agriculture Bioterrorism Protection Act of 2002 (7CFR 331). Under that legislation any unregistered diagnostic laboratory that identifies a select agent must report it to USDA Animal and Plant Health Inspection Service (APHIS). We will also report to the Florida Department of Agriculture and Consumer Services (FDACS).

Flatwoods Citrus

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☐ If you wish to be removed from our mailing list, please check this box and complete the information requested below.

Please send: Dr. Mongi Zekri
Multi-County Citrus Agent
Hendry County Extension Office
P.O. Box 68
LaBelle, FL 33975

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Racial-Ethnic Background

__American Indian or native Alaskan
__Asian American
__Hispanic
__White, non-Hispanic
__Black, non-Hispanic

Gender

__Female __Male