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Institute of Food and Agricultural Sciences

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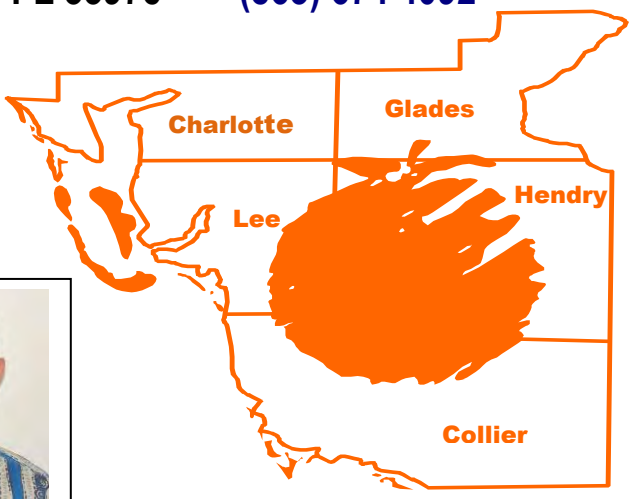
# Flatwoods Citrus




Vol. 14, No. 4 April 2011

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

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**Previous issues of the Flatwoods Citrus newsletter can be found at:**
**http://irrec.ifas.ufl.edu/flcitrus/**
**http://citrusagents.ifas.ufl.edu/agents/zekri/index.htm**

# I M P O R T A N T  E V E N T S

## CERTIFIED CROP ADVISER
## Educational Seminar and CEU Session

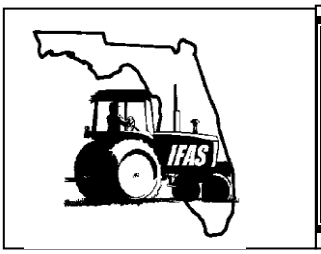
**Wednesday, April 13, 2011, 7:30 AM to 5:30 PM (See page 25)**

## MANAGEMENT OF CITRUS DISEASES

Date: Thursday, April 21, 2011, Time: 10:00 AM – 12:00 Noon
--Evaluation of products for the suppression of citrus canker on Valencia and Grapefruit, Dr. Pam Roberts
--A practical psyllid management program/schedule, Dr. Phil Stansly
--Economic considerations to treating HLB with the standard protocol or with an enhanced foliar nutritional program, Allen Morris
--Update on citrus black spot, Paul Mears and Rusty Noah
**2 CEUs for Pesticide License Renewal, 2 CEUs for Certified Crop Advisors (CCAs)**
Sponsor: **Ed Early, DuPont Ag. Products**
Free lunch will be served (Compliments of **DuPont Ag. Products**).
**RSVP is required**. To RSVP, call 863 674 4092 or send an e-mail to **maz@ufl.edu**

## ANNUAL CITRUS MECHANICAL HARVESTING & ABSCISSION FIELD DAY AND WORKSHOP

**"Getting Ready for Mechanical Harvesting With Abscission"**
**Wednesday, April 20, 2011, 7:30 AM – 2:00 PM, Immokalee IFAS Center**
**A sponsored lunch will be provided. Pre-registration or RSVP is required.**
**Please contact Barbara Hyman at (239) 658-3461 or hymanb@ufl.edu**




## FARM SAFETY DAY

**Saturday, May 21, 2011, Immokalee IFAS Center**
**Coordinator: Mongi Zekri**

## Florida State Horticultural Society

FSHS Annual Meeting - **Date:** June 5-7, 2011
**Location:** The Renaissance Vinoy Resort & Golf Club, St. Petersburg
**April 15, 2011** - Early Bird Registration ends
**May 11, 2011** - Hotel reservation deadline at FSHS discount rate

Special Thanks to 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 or maz@ufl.edu

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# WATER SHORTAGE DECLARED IN SOUTH FLORIDA

**March 23, 2011**

With regional water levels falling and no significant rainfall forecast in the coming weeks, South Florida Water Management District (SFWMD) Executive Director Carol Ann Wehle signed orders declaring a water shortage in South Florida. Lake Okeechobee, which is the backup water supply for South Florida, hit 11.76 feet NGVD, its water shortage management zone, on Friday, March 18. Also this month, the region has received only 45% of its historic average rainfall through Tuesday, or 0.95 inches for a deficit of 1.18 inches. This follows the driest October-to-February period in 80 years and a dry season deficit that reached 7.72 inches as of Tuesday, March 22.

**The water shortage orders, which are effective on Saturday, March 26, include**:

- A 15% cutback for all agricultural, nursery, and diversion and impoundment surface water users within the Lake Okeechobee Service Area (LOSA).
- Phase I water restrictions for agricultural, nursery, and diversion and impoundment permittees that use or divert surface and ground water in Broward and Palm Beach counties. Withdrawals from surface waters by specified users will be reduced 15%, and agricultural and nursery operations will limit the hours of irrigation.
- Phase I water restrictions for agricultural and nursery water users in the southern portion of Miami-Dade County. Users will limit the times and hours of irrigation operations.
- Cisterns and low-volume irrigation systems — such as drip, bubble and micro-jet systems that apply water directly to plant root zones — may be used at any time, although voluntary reductions are encouraged. Irrigation with reclaimed water is exempt.
- An Operational Order for District operation of certain bypass structures in the southern Indian Prairie Water Use Basin. This action is necessary to implement the LOSA cutbacks and ensure equitable distribution and delivery of water to the Seminole Tribe's Brighton Reservation pursuant to the Compact and to other users in the basin.
- A 15% cutback for golf course irrigation in Okeechobee, St. Lucie, Martin, Palm Beach, Broward, Miami-Dade, Monroe, Collier, Glades, Hendry and Lee counties.
- A two-day-a-week schedule for residential landscape irrigation throughout the District. Helping to relieve impacts on surface and groundwater sources, the order provides consistency for the District's 7.7 million residents. It is also consistent with Florida's neighboring water management districts and municipalities that are currently following a two-day watering schedule. Landscape irrigation accounts for half of all potable (drinking) water use in South Florida.

The District has limited or suspended operation of five navigation locks on the north shore of Lake Okeechobee due to declining water levels in the lake and lock chambers. Lock tenders will not be on duty at locks that are closed.

**Low Rainfall and Current Conditions**

March continues a dry trend that began with a record rainfall deficit in October 2010, which signaled an early start to the 2010-2011 dry season along with moderate-strength La Niña conditions. La Niña is a weather phenomenon that often generates below-average rainfall during the dry season.

From October through February, the District's 16-county region received a total of 5.69 inches, less than half the average rainfall for that five-month period, or 6.54 inches below average. Eastern Palm Beach County faced the biggest deficit during that period with a shortfall of 12.53 inches, or only 32 percent of its average rainfall.

Lake Okeechobee is more than two feet below the historical average for this time of year. Lake levels are expected to dramatically decline as temperatures rise and evapotranspiration rates increase. Links to information about irrigation limits by area, current conditions are available at

**www.sfwmd.gov/waterwatch** ***Source: SFWMD news release***

# SWEET ORANGE SCAB QUARANTINE EXPANDS

**March 28, 2011**

Last week, USDA's Animal and Plant Health Inspection Service (APHIS) revised the Federal Order for sweet orange scab (SOS) to add the entire states of Florida and Arizona to the list of quarantine areas. The revised Order also adds conditions to allow the movement of regulated fruit from the quarantine areas.

SOS is a fungal disease of citrus that results in unsightly, scab-like lesions developing on fruit rinds. Fruit is not a vector of the disease, so fruit movement should not be an issue. The pathogen can be spread long distances within infected nursery stock and other plant parts.

On Dec. 23, 2010, the APHIS Molecular Diagnostics Laboratory (MDL) confirmed SOS in Florida from a grapefruit tree in a campground in Polk County and from a bitter orange tree at a residence in Broward County. On Jan. 10, 2011, MDL confirmed SOS from a residential tangerine tree from Sarasota County. One infected tree was removed and Federal Emergency Action Notifications were issued to the remaining property owners to prevent movement of potentially infested plant material. Subsequent surveys have positively detected SOS in the following Florida Counties: Charlotte, Hillsborough, Indian River, Manatee, Orange, Palm Beach, and Pinellas.

MDL also confirmed SOS on fruit collected from a tangerine grove in Maricopa County, AZ, on Jan. 10, 2011, and from a lemon sample from Yuma County, Arizona on Feb. 23, 2011. Delimitation surveys were conducted in citrus-producing regions of Arizona and EANs were issued to positive establishments. To date, SOS has been detected in Maricopa and Yuma Counties in Arizona.

Last summer, MDL confirmed the first U.S. detection of the fungal pathogen Elsinoë australis, causal agent of SOS, in Texas. SOS was detected and confirmed in Louisiana and Mississippi in August 2010 and October 2010, respectively. On Dec. 22, 2010, a Federal Order was issued to establish SOS quarantine areas for the entire States of Louisiana, Mississippi, and Texas.

**►Click here** to read the revised Federal Order as well as the APHIS-Approved Packinghouse Procedures for *Elsinoë australis*, and APHIS-Approved Fungicides for Elsinoë australis for Use in Plant Nurseries.

***Source: USDA-APHIS***

Hurricane experts Philip J. Klotzbach, William M. Gray, and their associates at Colorado State University issue forecasts of hurricane activity each year, separately from NOAA. On December 8, 2010, Klotzbach's team, formerly led by Gray, issued its first extended-range **forecast for the 2011** season, predicting well above-average activity with **17 named storms, nine hurricanes, and five major hurricanes.** That compares with 19 tropical storms, 12 hurricanes and five major hurricanes during the 2010 season that ended last November.

# WHAT'S HAPPENING WITH BLACK SPOT AND SWEET ORANGE SCAB?

**Megan M. Dewdney**
**[mmdewdney@ufl.edu]**
**Plant Pathologist, UF-IFAS**
**Lake Alfred CREC**

**Citrus black spot** has continued to be a problem in South West Florida in Collier and Hendry Counties. The number of finds and disease intensity are higher than in 2010. We were finding symptoms that were not present last year such as false melanose and virulent spot. So far most finds have been on Valencia and the symptoms have been visible in mid to late March. DPI tells me that there have been no new suspect finds in the last 2 weeks. The quarantine areas have expanded, but revisions from APHIS are expected as the most recent finds are taken into account. In our spore trapping efforts, we found *Guignardia* spp. ascospores, the spores responsible for the majority of infections, in all months except December 2010 and January 2011. Spores were first found in mid-February and by early March, moderate to large spore numbers were trapped. This means that the fungus is active at the moment but it is unclear what this means in terms of disease control at this time of year. The first year of spore trapping has yet to be completed. Applications for black spot should go out no later the beginning of May. See the Florida Pest Management Guide for further control details.

**Sweet orange scab** finds are spreading through the state with 11 counties considered positive. Most of the fruit have been from dooryards with only 2 finds in commercial groves, 1 in Sarasota and another in Indian River. The most recent find was in Polk County but not near commercial sites. Few suspect finds were submitted to DPI in the last few weeks. My lab and DPI continue to be unsuccessful in isolating a fungus but have been able to get a positive PCR test. We are not sure what is actually occurring in Florida yet. Despite this, APHIS had placed Florida under a state-wide quarantine along with Arizona, Texas, Mississippi and Louisiana. In Texas, there have been fungi isolated from fruit in commercial groves. We are working with Texas to determine if their isolates cause disease but this is on-going.

# FOR INFORMATION AND ACTION DA-2011-14

March 23, 2011

SUBJECT: APHIS Revises Federal Order for Sweet Orange Scab (*Elsinoë australis*)

TO: STATE AND TERRITORY AGRICULTURAL REGULATORY OFFICIALS

Effectively immediately, the Animal and Plant Health Inspection Service (APHIS) revised the Federal Order for sweet orange scab (SOS) to add the entire States of Florida and Arizona to the list of quarantine areas. The revised Order also adds conditions to allow the movement of regulated fruit from the quarantine areas. The Federal Order, as well as the APHIS-Approved Packinghouse Procedures for *Elsinoë australis,* and APHIS-Approved Fungicides for *Elsinoë australis* for Use in Plant Nurseries are attached for your reference.

On July 23, 2010, the APHIS Molecular Diagnostics Laboratory (MDL) confirmed the first U.S. detection of the fungal pathogen *Elsinoë australis,* causal agent of SOS, in Texas. SOS was detected and confirmed in Louisiana and Mississippi in August 2010 and October 2010, respectively. On December 22, 2010, a Federal Order was issued to establish SOS quarantine areas for the entire States of Louisiana, Mississippi, and Texas.

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For additional information, you may contact Leon Bunce, Eastern Regional Program Manager, at (919) 855-7360 or Deborah McPartlan, National Program Manager, at (301) 734-5356.

Rebecca A. Bech
Deputy Administrator
Plant Protection and Quarantine

# THIRD MEDITERRANEAN FRUIT FLY FOUND IN POMPANO BEACH

**March 24, 2011**

The Florida Department of Agriculture and Consumer Services has positively identified the presence of an egg-bearing female Mediterranean fruit fly (Medfly), *Ceratitis capitata,* collected by an agriculture technician at the U.S. Department of Agriculture (USDA) during ongoing Medfly eradication activities in Pompano Beach, Broward County.

In February, two male Medflies were discovered in Pompano Beach and, in response, the Department initiated an eradication program. Eradication efforts include adding more fruit fly traps in the immediate area and establishing a quarantine area to certify fruits or other host materials moving in and out of the quarantine zone. In addition, the Department is applying the Sterile Insect Technique, a biologically-based reproduction control method that releases large quantities of sterile male Medflies in numbers great enough to outnumber the potential for mating by wild males. Wild female insects that mate with sterile males do not produce offspring. It has not been determined whether the female wild fly collected in Pompano was mated with a sterile or fertile male fly.

Eradication program activities will increase with this latest find. The Department is working to set additional traps and will expand the regulated quarantine boundary approximately one mile to the south and one mile to the west to include properties around the new discovery. The area, outlined on the attached map, will be treated and fruit will be stripped to remove food sources of any other wild flies that may be present. The public will be notified 24 hours in advance of any treatment or fruit stripping activities.

The Mediterranean fruit fly is considered the most serious of the world's fruit fly pests due to its potential threat to the food supply and economic harm. It attacks more than 250 different fruits, vegetables and nuts, including citrus, mangos, guava, tomatoes and peppers. The flies' eggs are laid in the fruit and develop into maggots causing the fruit to rot. They emerge as adults once the fruit falls to the ground. Medflies breed continuously when host fruits are available. Population growth may be explosive, as females are capable of producing hundreds of eggs.

Residents whose property falls within the regulated area should follow these guidelines:

- Do not move any fruits and vegetables off your property.
- Pick up any fallen fruits and vegetables from your yard.
- Double-bag in plastic any fruits and vegetables that are being thrown out as garbage. Securely tie the plastic bags and leave them out for household garbage pickup, not yard waste.
- Allow state and federal representatives access to your property for survey, trapping or treatment activities.

State and federal agencies will work with local governments to keep the public involved and notified with accurate information. Residents with questions or concerns can call the Department's toll free number at 888-397-1517 or visit www.freshfromflorida.com/pi/medfly to find additional information.

Regulatory Boundary Map

# FOLIAR FEEDING

Foliar feeding is becoming very common on many horticultural crops including citrus. Economic and environmental considerations require the utilization of more efficient methods for nutrient applications.

It is usually assumed that foliar feeding refers to nutrient applications to the plants' leaves. In fact, it has been shown that all aboveground parts of a plant can absorb nutrients, including twigs, branches, buds, fruit, flowers, and stems. However, since leaves usually represent the largest surface area, they are the most important structures.

Foliar feeding is not intended to completely replace soil-applied fertilization of the macronutrients (nitrogen, potassium, and phosphorous). However, macronutrients can be foliarly applied in sufficient quantities to influence both fruit yield and quality. Some crops, such as citrus, can have a large part of the nitrogen, potassium, and phosphorous requirements met through foliar applications.

Foliar applications of other plant nutrients (calcium, magnesium, and sulfur) and micronutrients (zinc, manganese, copper, boron, and molybdenum) have proven for many crops to be an excellent means for supplying the plants' requirements.

Foliar feeding should be used as an integral part of the annual nutritional program. It can be used in other situations to help plants through short, but critical periods of nutrient demand, such as fruit set and bud differentiation. Foliar nutrition may also prove to be useful at times of soil or environmentally induced nutritional shortages. Foliar application of nutrients is of significant importance when the root system is unable to keep up with crop demand or when the soil has a history of problems that inhibit normal growth.

Foliar feeding is proven to be useful under prolonged spells of wet soil conditions, dry soil conditions, calcareous soil, cold weather, or any other condition that decreases the tree's ability to take up nutrients when there is a demand. Foliar feeding may be utilized effectively when a nutritional deficiency is diagnosed. A foliar application is the quickest method of getting the most nutrients into plants. However, if the deficiency can be seen, the crop might have already lost some potential yield.

Foliar fertilization is also efficient since it increases the accuracy of fertilizer application. Applications made to the soil can be subject to leaching and volatilization losses and/or being tied up by soil particles in unavailable forms to citrus trees.

While foliar feeding has many advantages, it can burn plants at certain rates under certain environmental conditions. It is important, therefore, to foliar feed within the established guidelines. There are a number of conditions that can increase the chances of causing foliar burn. A plant under stress is more susceptible to damage. Stressful conditions include drying winds, disease infestations, and poor soil conditions. The environmental conditions at the time of application are also important factors. Applications when the weather is warm (above $80^0$F) should be avoided. This means that during warm seasons, applications should be made in the morning or evening. Additionally, applications should not be at less than two-week intervals to give the plant sufficient time to metabolize the nutrients and deal with the added osmotic stress.

Another important factor when applying nutrient foliarly is to ensure that the pH of the material is in the proper range. The pH range of the spray solution should be between 6 and 7. Attention should be paid to the pH of the final spray solution. This is significant in areas where water quality is poor.

Foliar applications of low-biuret urea or phosphite in late December-early January are known to increase flowering, fruit set, and fruit production. **Postbloom foliar applications of potassium nitrate ($KNO_3$) or mono-potassium phosphate (MKP) have been found to increase fruit yield and size.**

## FOLIAR POTASSIUM APPLICATIONS

**BRIEF SUMMARY FROM A POWERPOINT PRESENTATION**

**By Dr. Brian Boman at the University of Florida, IFAS**

### Potassium (K) in Citrus

**•A primary component in cell walls**
**•K accounts for over 40% of ash from fruit**
**•70% of fruit size is related to number of cells**
**•Cell division ceases by late April**
**•Size changes after April is mainly from cell enlargement**
**•Post-bloom K (applied in April) may increase cell numbers plus help cell enlargement**
**•Absorption of K into leaves after foliar application is very rapid**

### Grapefruit Summary

**•Post bloom most important**
**•Late summer/fall applications successful in half of years**
**•8 lb $K_2O$ per acre per application**
**•1/2 to 1 size increase due to foliar K applications**
**•Smaller fruit increased more than larger fruit**

### Foliar K Advantages on Valencia

**25% more fruit**
**28% more boxes/acre**
**33% more size 80 and larger fruit**
**28% higher gross returns for packed fruit**
**23% more TSS/acre**

### SUMMARY

**Foliar K applications can increase fruit size and help return higher $$**
**• K source is not critical**
**• Salt index should be considered when using low gal/ac applications (MKP or DKP)**
**• Coverage is not as critical as for fungicides or insecticides**
**• At least 8 lb/ac $K_2O$ per application recommended**
**• Foliar applications not a substitute for good nutrition program**
**• Potential results:**
**Grapefruit: ½ to 1 size increase**
**Valencia: Significantly more solids/acre**
**Sunburst: More larger-sized fruit**

# MICRONUTRIENTS IN CITRUS NUTRITION

**Iron (Fe)**: One of the functions of Fe is to act as a catalyst in the production of chlorophyll. Iron deficiency has been of importance on calcareous soils in certain areas of Florida where the soil contains high amount of calcium carbonate and has a pH of 8.0. Iron deficiency is attributed to low Fe content in white sandy areas near lakes and places known locally as "sand soaked areas". Iron deficiency can be induced by high levels of P and accumulations of heavy metals, primarily Cu, in the soil. In Florida, Fe deficiency is commonly associated with Zn and Mn deficiencies.

The symptoms of Fe deficiency are also known as "iron chlorosis". They occur on new growing leaves which are very light in color and sometimes almost white but with the veins greener than the remainder of the leaf. In acute cases, the leaves are reduced in size, very thin, and shed early. The trees die back severely on the periphery and especially in the top. Fruit set, yield, and fruit size will be reduced.

Iron deficiency is usually associated with high soil alkalinity, but it is also associated with over irrigation, prolonged spells of wet soil conditions or poor drainage and low soil temperature. Several areas affected with Fe chlorosis in south Florida have been materially helped or completely cured by careful control of irrigation and drainage. Iron deficiency sometimes occurs where excess salts are present in the soil.

Iron deficiency has been found to be one of the most difficult deficiencies to correct especially on calcareous soils. Foliar applications of Fe are not recommended because of their lack of effectiveness and risk of leaf and fruit burn. At their best, foliar sprays of Fe produce a spotted greening of the leaves rather than an overall greening. The most reliable means of correcting Fe chlorosis in citrus is by soil application of iron chelates. Iron sulfate has not given satisfactory control on either acid or alkaline soils. Citrus rootstocks vary in their ability to absorb Fe. Trifoliate orange and its hybrids (Swingle citrumelo and Carrizo citrange) are the least able to do so.

| Iron Chelates | Effective pH Range |
|---|---|
| Fe-EDTA | 4 to 6.5 |
| Fe-HEDTA | 4 to 6.5 |
| Fe-DTPA | 4 to 7.5 |
| Fe-EDDHA | 4 to 9.0 |

**Zinc (Zn)**: Zinc is essential for the formation of chlorophyll and function of normal photosynthesis. Zinc is also needed for the formation of auxins which are growth-promoting substances in plants.

Zinc deficiency symptoms are characterized by irregular green bands along the midrib and main veins on a background of light yellow to almost white. The relative amounts of green and yellow tissue vary from a condition of mild Zn deficiency in which there are only small yellow splotches between the larger lateral veins to a condition in which only a basal portion of the midrib is green and the remainder of the leaf is light yellow.

In less acute stages, the leaves are almost normal in size, while in very acute

cases the leaves are pointed, abnormally narrow with the tendency to stand upright, and extremely reduced in size. In mild cases, Zn deficiency symptoms appear on occasional weak twigs. Fruit formed on these weak twigs are drastically reduced in size and have an unusually smooth light-colored thin skin and very low juice content. Zinc deficiency symptoms can be so severe that they may mask or noticeably alter the symptoms of other deficiencies or disorders. Deficiency in Zn can develop due to soil depletion or formation of insoluble compounds. Excessive P or N has also been found to induce or aggravate Zn deficiency.

A spray solution containing 2 to 4 lbs of elemental Zn per acre from Zn sulfate, oxide, nitrate, chelate, or other source can correct Zn deficiency. Under severe deficiency conditions however, application of Zn sprays may be necessary on each major flush of growth to keep the trees free of deficiency symptoms because Zn does not translocate readily to successive growth flushes. Foliage injury can be reduced by adding 2 to 3 lbs of hydrated lime to the spray. Maximum benefit is obtained if spray is applied to the young growth when it is two-thirds to nearly fully expanded and before it hardens off. Treatment on the spring flush is preferable. Soil application of Zn in the fertilizer is neither an economical nor an effective way to correct Zn deficiency. One of the early diagnostic symptoms of a disorder known as young tree decline or "blight" is a Zn deficiency pattern in the leaves. Correction of the symptoms will not alleviate the disorder, and trees will never recover form the disease.

**Manganese (Mn)**: Manganese is involved in the production of amino acids and proteins. It plays a role in photosynthesis and in the formation of chlorophyll.

Manganese deficiency occurs commonly in Florida. It is particularly evident in the spring after a cold winter. Manganese deficiency leads to a chlorosis in the interveinal tissue of leaves but the veins remain dark green. Young leaves commonly show a fine pattern or network of green veins on a lighter green background but the pattern is not so distinct as in Zn or Fe deficiencies because the leaf is greener. By the time the leaves reach full size, the pattern becomes more distinct as a band of green along the midrib and principal lateral veins with light green areas between the veins.

In more severe cases, the color of the leaf becomes dull-green. Interveinal leaf areas may develop many whitish opaque spots which give the leaf a whitish or gray appearance. The leaves are not reduced in size or changed in shape by Mn deficiency, but affected leaves prematurely fall from the tree. No particular twig symptoms have been related to Mn deficiency. In cases of acute Mn deficiency, the growth is reduced giving the tree a weak appearance.

Manganese deficiency may greatly reduce the crop and the color of the fruit. Manganese deficiency is frequently associated with Zn deficiency. This combination of the two deficiency symptoms on leaves is characterized by dark green veins with dull whitish green areas between the veins. In such combinations, the Mn deficiency is acute and the Zn deficiency is relatively mild.

In Florida, Mn deficiency occurs on both acid and alkaline soils. It is probably due to leaching in the acid soils and to insolubility in the alkaline soils. For deficient trees on alkaline soils, treatments by sprays of Mn compounds are recommended. On acid soils, Mn can be included in the fertilizer. Foliar spray application quickly clears up the pattern on young leaves but older leaves respond less rapidly and less completely. When Mn sprays are given to Mn-deficient orange trees, fruit yield, total soluble solids in the juice and pounds solids per box of fruit increase. Foliar spray of a solution containing 2 to 3 lbs of elemental Mn on two-third to fully expanded spring or summer flush leaves is recommended. If N is needed, adding 7 to 10 lbs of low biuret urea will increase Mn uptake.

**Boron (B)**: Boron is particularly necessary where active cell division is taking place. Boron plays an important role in flowering. 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, mis-shapen 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.

Borax and other B compounds are generally used in treating citrus affected with B deficiency. They 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 (1.25 lbs of soluble borate containing 20% 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.

**Copper (Cu)**: Copper also has a role in photosynthesis and chlorophyll formation. The functions of Cu in the mineral nutrition of plants are numerous. Heavy fertilization with N tends to increase the severity of Cu deficiency.

If Cu in citrus leaves falls below 4 ppm in dry matter, severe Cu deficiency will develop. In the range of 4 to 5 ppm, mild to moderate deficiency symptoms may occur. Copper deficiency rarely occurs when the Cu concentration in leaves is 6 ppm or above.

Excessive applications of nitrogenous fertilizers have been considered for years a contributing cause for this trouble giving rise to the term "ammoniation". The cause might be an unbalanced N/Cu ratio.

The first symptom is the formation of unusually vigorous large dark green foliage with a "bowing up" of the midrib. The twigs are also unusually vigorous, long, soft, angular, frequently "S" shaped and more or less drooping.

Fruit symptoms are most pronounced on oranges. Brown stained areas of hardened gum on the rind of the fruit may precede the appearance of leaf and twig symptoms. In severe cases, dieback of young twigs will occur and the twigs will be covered by reddish brown droplets of gums.

Insufficient available Cu in the soil is believed to be the primary cause of the symptoms described. Copper deficiency is more of a problem on newly planted flatwoods land than the ridge. Prevention or cure of Cu deficiency is accomplished by either foliar sprays or soil applications of Cu compounds. A Cu spray of solution containing 2 to 3 lbs of elemental Cu applied during bloom time commonly causes an almost immediate recovery and results in a good setting of normal fruit. Copper deficiency can be a controlling factor in fruit production, and acute Cu deficiency may put trees entirely out of production. Foliage sprays are often valuable emergency treatments when symptoms of Cu deficiency are first observed.

## CONCLUSION

**Most micronutrient deficiencies may be recognized by visual symptoms. However, leaf analysis is helpful in verifying deficiencies particularly when non-typical symptoms or multiple nutrient deficiencies appear. Leaf analysis also provides information on low, but not yet deficient, amounts of an element so that treatment may be applied to prevent a deficiency.**

**For more details and more information on citrus nutrition, go to Nutrition of Florida Citrus Trees at:**

**http://edis.ifas.ufl.edu/pdffiles/SS/SS47800.pdf**

# INCREASING EFFICIENCY AND REDUCING COST OF NUTRITIONAL PROGRAMS

## Economics, nutrition, and Florida soils

- To maintain a viable citrus industry, it is necessary to produce large, high quality crops of fruit economically.
- Good production of high quality fruit will not be possible if there is a lack of understanding of soils and nutrient requirement of the grown trees.
- Most Florida citrus is grown on soils with inherently low fertility and low CEC and thus unable to retain enough amount of soluble plant nutrient against the leaching action of rainfall and irrigation.

## Importance of N & K

- N & K are the most important nutrients for Florida soils and citrus.
- An adequate level of N is required for vegetative growth, flowering, and fruit yield.
- K also plays an important role in determining yield, fruit size, and quality.
- Fertilizer ratios of N to $K_2O$ are usually 1:1. However, a ratio of 1:1.25 is recommended for high pH or calcareous soils.

## Management practices to improve fertilizer efficiency

They include:

♦ Evaluation of leaf analysis data

♦ Adjustment of N rates to the level based on expected production and IFAS recommendations

♦ Selection of fertilizer formulation to match existing conditions

♦ Careful placement of fertilizer within the root zone

♦ Timing to avoid the rainy season

♦ Split application

♦ Irrigation management to maximize production and minimize leaching

## Tissue and soil analysis

- Leaf sampling and analysis is a useful management tool for fertilizer decisions.
- The best indication of successful fertilizer management practices for citrus trees is having leaf nutritional standards within the optimum ranges.
- Trends in leaf N and K over several years provide the best criteria for adjusting rates within the recommended ranges.
- Soil analysis is useful for determining the pH and concentrations of P, Ca, and Mg.

## N requirements for mature trees

- In a mature grove where there is little net increase in tree size, N used for leaf growth is largely recycled as leaves drop, decompose, and mineralize. Replacement of the N removed by fruit harvest becomes the main requirement, and nutrient requirements should vary as the crop load changes.

## Fertilizer Sources

- Inorganic and synthetic organic nitrogen fertilizers are high-analysis materials and are generally most economical to use in citrus groves. They are rapidly available, unless they have been formulated in a controlled-release form.
- The use of high analysis fertilizers eliminates much of the filler. A great deal of the mixing, transportation, and application cost is reduced.
- The use of controlled-release fertilizers for resets in established groves is a feasible option.

## Timing and frequency of application

- 2/3 of the tree's nutritional requirements should be made available between January and early June, with most of it in place during flowering and fruit-setting period. The remaining 1/3 can be applied in September or October.
- Split fertilizer application or fertigation combined with sound irrigation management increase fertilizer efficiency by maintaining a more constant supply of nutrients and by reducing leaching if unexpected rain occurs. Less fertilizer will be required.
- Less fertilizer may also be required if fertilizer is confined to the root zone and if timing is adjusted to avoid rainy periods.

## Foliar feeding

- Foliar feeding is useful under calcareous soil or any other condition that decreases the tree's ability to take up nutrients when there is a demand.
- Foliar applications of low-biuret urea (25-28 lbs N/acre) or phosphorous acid (2.6 quarts/acre of 26-28% $P_2O_5$) in late Dec.-early Jan. are known to increase flowering, fruit set, and fruit yield.
- Postbloom foliar applications of potassium nitrate or mono-potassium phosphate (8 lbs/acre $K_2O$) in late April have been found to increase fruit size and yield.

## Phosphorus

- P applied to established groves had not leached but had accumulated in the soil at high levels and is available slowly so that P application may be reduced or omitted in established groves.
- P does not leach readily where the soil pH is 6 or higher and the fruit crop removes very little.
- Therefore, regular P applications are not necessary.
- However, some soils used for new citrus plantings may have low native P and P fertilizers should be applied for several years.

## Micronutrients

- Copper should not be included in fertilizers if Cu sprays are used and if the grove soil test show adequate Cu (5-10 lbs/acre).
- Molybdenum (Mo) deficiency occurs on soils that have been allowed to become very acid. Liming those soils should fix the problem.
- Foliar spray applications of micronutrients (Mn, Zn, Cu, B, and Mo) are more effective and economically practical than soil applications when included with postbloom and summer foliar sprays after full expansion of the new flush.

## Soil pH & liming

- Soils should have a pH ranging from 5.5 to 6.5 with the higher values used for soils containing high Cu levels.
- Under normal conditions, a clear advantage of pH 6 over pH 5 has been demonstrated in several studies. A pH of 7 was no better than a pH of 6.
- Soil pH can be increased by application of either calcite or dolomite. Dolomite supplies both Ca and Mg. Therefore, the choice of dolomite would be more appropriate to supply Mg and have a good balance between Ca and Mg.

## Overliming

- Liming soils having a pH at or above 6 will be costly and not useful. In groves, where soils have adequate pH but low Ca levels, gypsum ($CaSO_4$) can be used as a source of Ca without affecting the soil pH.
- Applying dolomite as a source of Mg is not recommended if the soil pH is in the desired range. Under these conditions, soil application of either $MgSO_4$ or MgO and foliar application of $Mg(NO_3)_2$ are effective for correcting Mg deficiency.

## Nutritional balance

- Correct ratios of nutrients are critical to fertilizer management and sustainability.
- If an element is below the critical level, yield production will fall even though the other elements are kept in good supply.
- Too much N with too little K can reduce fruiting and result in lost crop yield and quality.
- High K with low N and P supply will induce luxury consumption of K, delay fruit development and reduce juice content.

# Plant Growth Regulators (PGRs)

Plant growth regulator sprays can provide significant economic advantages to citrus growers when used in appropriate situations. Many citrus growers routinely use PGRs to enhance crop profitability. Depending on variety and timing, PGRs may improve fruit set, increase fruit size by reducing cropload, extend the harvest season by delaying rind aging, and reduce preharvest fruit drop. Excessive rates, improper timings, untested surfactants or tank mixes, and inappropriate environmental conditions can result in phytotoxicity, erratic results, and/or greatly reduced cropping. Growers are urged to become familiar with PGRs through application to small plots before treating significant acreage. To avoid drift onto susceptible crops in surrounding areas, products containing 2,4-D (2,4-Dichlorophenoxyacetic acid) have stringent requirements for application conditions. Consult with your County Extension Office.

Since PGRs function by directly influencing plant metabolism, plant response can vary considerably with concentration, making sprayer calibration and accurate material measurement especially important. Studies show that variability in spray deposition increases as spray volume is reduced below 250 gallons/acre in mature citrus groves. At lower water rates, canopy closest to the sprayer manifold tends to retain much more material than other plant surfaces. Because material concentration is especially important in PGR use, water volumes below 125 gallons/acre are not generally recommended.

Unlike most agrichemicals applied to crop, efficacy of PGRs depends on entry of materials into plant tissues. Uptake is influenced by a number of factors: amount of PGR applied, concentration of PGR, presence of surfactants, solution pH, environmental conditions during and after application, foliage condition, and plant stress level. Application of PGRs is recommended only on healthy citrus blocks. Even when properly applied, some PGRs may cause leaf curling, especially when sprayed on young leaves.

# Chemical thinning of tangerines with NAA to increase fruit size and reduce branch breakage and alternate bearing

**NAA (naphthalene acetic acid) encourages greater physiological-drop (usually in May for Florida citrus). Sunburst and Murcott are especially likely to benefit from judicious use of NAA.**

## NAA rate

Since concentration is so important, growth regulator treatments are usually expressed on a concentration basis (part per million or ppm) rather than ounces per acre. Rates of 250-500 ppm NAA have been most effective in thinning citrus varieties. For mature groves of large trees, 125-150 gallons per acre is probably adequate and lower volumes should be used for smaller trees by turning off some sprayer nozzles. Growers uncomfortable with calculations on a ppm basis can use the ounces of NAA/125 gallons, at appropriate ppm, as a rate per acre when applying at 125 gallons/acre. All NAA applications should include a surfactant at 0.05% and should not be tank mixed with other materials, unless you confirm that it is compatible with NAA.

**For most healthy, unstressed groves, NAA should be applied at 120 ounces Fruit Fix 200 (or similar product, NOT Citrus Fix, which is 2,4-D rather than NAA plus 6.5 ounces of surfactant per 100 gallons, at 125 gallons per acre. Murcott should receive a lower rate 60-96 oz NAA/100 gallons.**

## Timing

**NAA should be applied near the beginning of physiological drop, when most fruitlets are about 1/2 inch in diameter,** which typically occurs 6 to 8 weeks postbloom**. Rain within six hours of treatment, drought stress, or very hot or cool conditions may affect response.**

**Environmental conditions can greatly influence uptake and activity of NAA. Higher temperatures and delayed drying of spray solution both contribute to greater thinning action. Best results are likely to occur when applied between 75° and 85° F. Higher temperatures may cause excessive thinning. Since uptake continues for several hours after the spray dries, heavy rain within six hours of application may significantly reduce NAA action.**

# SPIDER MITES

The Texas citrus and citrus red mites occur on citrus throughout the year and usually are most abundant in groves between March and June. They are found most commonly on the upper leaf surface of recently mature flush, and all stages of the mites orient along the mid-vein.

Spider mites feed primarily on mature leaves and differ from rust mites by feeding beneath the epidermal layer of cells. They are capable of removing cellular contents, causing cell destruction and reducing photosynthesis. Mesophyll collapse and leaf drop can result when trees are stressed by high spider mite infestations alone or in combination with sustained dry, windy conditions that may occur in the late fall, winter or early spring months. When populations of Texas citrus mite or citrus red mites are high, they will also feed on developing fruit. Spider mites prefer dry weather and low relative humidities in the range of 30 to 60% and generally do not pose a sustained problem in the higher humidity conditions that occur between June and September.

Spider mites are suppressed to low densities by several species of predacious mites, insects, and entomopathogens in some groves. However, when populations averaging 5 to 10 motile spider mites per leaf develop between September and May it would be reasonable to apply a miticide, especially if the trees are stressed. However, infestations comprised predominantly of adults, particularly males, are in decline and would not require control. Adult mites are recognized by their large size relative to immatures and females distinguished by their round shape and shorter legs compared to males.

Need for controlling spider mites is based on temperature and humidity conditions, spider mite population levels, tree vigor, and time of the year. Petroleum oil provides some ovicidal activity against spider mite eggs. None of the other miticides provide ovicidal activity, and their residual activity must be sufficiently long-lasting to kill subsequently emerging larvae.

Selection of a miticide should be based on the target pests to be controlled, avoiding risks of phytotoxicity, products that will be tank mixed, the time of year, treatment to harvest interval, and prior use of a product. All miticides except petroleum oil should be used only once a year to minimize resistance development.

Recommended Chemical Controls.

READ THE LABEL.

| |
|---|
| Agri-Mek 0.15 EC + Petroleum Oil 97+% (FC 435-66, FC 455-88 or 470 oil) |
| Comite 6.55 EC |
| Dicofol |
| Envidor 2 SC |
| Kelthane MF |
| Micromite 80WGS |
| Movento 240 SC + Petroleum Oil 97+% (FC 435-66, FC 455-88 or 470 oil) |
| Nexter 75 WP |
| Petroleum Oil 97+% (FC 435-66, FC 455-88 or 470 oil) |
| Sulfur |
| Kumulus 80 DF |
| Microthiol 80 DF |
| Thiolux 80 DF |
| Vendex 50 WP |

**From:**
**http://www.crec.ifas.ufl.edu/extension/chmas/PDF/CHMA_spray%20plan_10_11_10.pdf**

## Citrus Health Management Areas (CHMA's): Developing a psyllid management plan

Michael E. Rogers, Philip A. Stansly and Lukasz L. Stelinski

Effective control of the Asian citrus psyllid (*Diaphorina citri* Kuwayama) is an important component of Huanglongbing (HLB) management programs. Over the past several years, experience in Florida has shown that the most efficient way to control psyllids is for citrus growers to work together on an area-wide basis. The need for area-wide control of psyllids is due to the dispersal behavior of this pest which has been shown to move repeatedly between commercial citrus groves. When differences in timing of psyllid control programs exist within an area, the back and forth movement of psyllids could result in rapid re-infestations, despite the repeated attempts of individual growers to maintain psyllid populations at low levels.
***Successful psyllid management is a team effort with all citrus growers as participants.***
Establishment of Citrus Health Management Areas (CHMAs) has been proposed as an important strategy for reducing the spread of HLB. The primary goal of the formation of CHMAs is to coordinate psyllid control efforts to reduce the effect of psyllid movement between commercial citrus operations and thus reduce the need for repeated back-to-back insecticides applications for maintaining psyllid populations at low levels. Due to the limited number of pesticide modes of action available for controlling psyllids, CHMAs could also serve an important function in slowing pesticide resistance development in psyllid populations by coordinating applications of pesticides with similar modes of action.
Below, an example template (Table 1) is provided to aid in the development of a CHMA psyllid control program. Two key time slots and two more possible time slots are identified where grower coordination of psyllid control efforts are likely to be most effective in reducing overall psyllid populations. The first coordinated spray identified is during the month of November, just after the fall flush period has ended. Use of an organophosphate insecticide is recommended which would be appropriate for growers who do not plan on harvesting fruit during this time of the year. Blocks that will be harvested within 7 days of the coordinated spray could be treated with a pyrethroid. The next coordinated spray in January would be made in those blocks with an OP while the rest of the area would be rotated to a pyrethroid. For any additional coordinated sprays conducted, growers are encouraged to rotate between these two pesticide modes of action. Use of organophosphate and pyrethroid insecticides for coordinated sprays is suggested because of 1) their general effectiveness in controlling all life stages of psyllids present when applications are made 2) there are multiple product choices within each mode of action and 3) these products can applied using various application methods. As a result, these products provide flexibility to growers with different financial constraints making widespread participation in the program more likely to occur. Between the two optimal and two additional times identified for coordinated sprays, guidance is given for selecting additional products for psyllid control where growers choose to incorporate additional products into their overall psyllid management program.
The purpose of this example template is to help guide growers in the development of a psyllid control plan for their CHMA. This template is intended to provide suggestions that growers can

take into consideration. Ultimately, ***growers must decide how many sprays they can realistically coordinate in their CHMA and the timing of those applications.*** These decisions can be complicated by a number of factors that vary by region including citrus variety and harvest date, fresh fruit for export versus juice fruit, and other ongoing cultural practices.
In Table 2, additional information is provided for all insecticides that might be incorporated into a psyllid management program. Insecticides are grouped by chemical class (or mode of action) to aid in the rotation of products with different modes of action, the recommended rates of product that should be applied, the appropriate application methods for each product that have been demonstrated to be efficacious, restricted entry intervals (REIs) and pre-harvest intervals (PHIs), and additional comments for most effective use of a product.

## Citrus Health Management Areas (CHMA's): Guide to developing a psyllid management plan

**Table 1:** Planning template for CHMAs where most fruit harvesting expected in the months of Jan, Feb, Mar, May or June

| Month | Timing | Product |
|---|---|---|
| **November / December** | **After last flush of the season** | **Organophosphate** |
| **January / February** | **Prior to first flush of season** | **Pyrethroid** |
| March (bloom period) | Depending on pest pressure | Micromite and Portal but should only be applied when new flush is present since these products only control psyllid nymphs (not adults) |
| April | Immediately post bloom | Organophosphate |
| May | Depending on pest pressure | Could use a pyrethroid since not previously used. Other options include Movento, Delegate (if leafminer present) or carbaryl. |
| June | 1st summer oil spray | Depending on the product used in the previous spray, numerous products could be added to the summer oil sprays as well as tank mixed with other products |
| July | 2nd summer oil spray | |
| August / September | Prior to fall flush | Pyrethroid |
| October | Depending on pest pressure | Do not use pyrethroid since previously used. Do not use an organophosphate which is planned for next application. Options include Movento, Delegate, and carbaryl. |

**Organophosphate** insecticides (Dimethoate, Imidan, Lorsban, Malathion and various generic formulations of these products.
**Pyrethroid** insecticides (Danitol and Mustang)

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# Certified Crop Adviser

## Educational Seminar and CEU Session

**Wednesday, April 13, 2011**

**7:30 AM to 5:30 PM**

**Pest Management (5 CEUs)**
**Nutrient Management (5 CEUs)**

**On site at the UF/IFAS Citrus Research and Education Center in Lake Alfred, and offered by videoconference only at:**

- **Gulf Coast REC in Wimauma**
- **Southwest Florida REC in Immokalee**
- **Indian River REC in Ft. Pierce**
- **University of Florida main campus in Gainesville**
- **Lake County Extension Office in Tavares**

**Regular registration is $100.**
**Lunch will be provided at all sites.**

**For the latest version of the program and for registration, visit the CCA Seminar website at www.crec.ifas.ufl.edu/cca**

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Hendry County Extension Office
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LaBelle, FL 33975

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Address:_____

City:_____State:_____Zip:_____

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Fax:_____

E-mail:_____

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## ***Racial-Ethnic Background***

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

## ***Gender***

__Female __Male