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Institute of Food and Agricultural Sciences

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Flatwoods Citrus

Vol. 18, No. 2 **February 2015**

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://citrusagents.ifas.ufl.edu/agents/zekri/index.htm
http://irrec.ifas.ufl.edu/flcitrus/

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

Growing citrus trees undercover, and citrus nutrition and irrigation including BMPs and the 4Rs concept

Speakers: Dr. Barrett Gruber and Dr. Kelly Morgan
Date & time: Wednesday, **March 18th, 2015, 10:00 AM – 12:00 Noon**
Location: Immokalee IFAS Center

Program Coordinator: Dr. Mongi Zekri, UF-IFAS
Program Sponsors: Mark White and Chris Kamberg from G.P. Solutions, LLC

Agenda

----10:00 AM - 11:00 AM

1. citrus nutrition and irrigation including BMPs and the 4Rs concept, Dr. Kelly Morgan, UF-IFAS

11:00 AM – 11:10 AM Break

----11:10 AM – 12:00 Noon

2. Growing citrus trees undercover, Dr. Barrett Gruber, UF-IFAS

2 CEUs for Certified Crop Advisors (CCAs)
2 CEUs for Pesticide License Renewal

Pre-registration is required. No registration fee and lunch is free Thanks to **Mark White** & **Chris Kamberg** with ***G.P. Solutions, LLC***.
To reserve a seat, call 863 674 4092, or send an e-mail to Dr. Mongi Zekri at: maz@ufl.edu

No pre-registration = No lunch

Mark your calendar and plan to attend

2015 ANNUAL FLORIDA CITRUS GROWERS' INSTITUTE

Date & Time: Tuesday, 7 April 2015, 8:00 AM – 3:35 PM
Location: Avon Park Campus of South Florida Community College

Coordinators: Citrus Extension Agents, UF-IFAS

Agenda and information on registration will be available next month

Topics to be presented

--Understanding Bicarbonates and the Impact on Tree Health

--Nutritional Programs for Citrus

--Psyllid Management

--Are CHMA Working as Expected

--Funded Projects to Aid Growers in the HLB Battle

--Neutralizing Psyllids to Incapacitate their Abilities to Host the Greening Bacteria or Transmit the Disease

--Antimicrobial Therapies for HLB and Canker – What is Available Now and What's the Pathway for Future Therapies

--Chemotherapy or Antibiotic Treatments of HLB Infected Trees

--Efficiency and Advances in Thermotherapies Against HLB

--Breeding to Mitigate HLB in Citrus

--HLB Tolerant Rootstocks

--Reasons for Poor Control of Citrus Canker in the 2014-15 Year

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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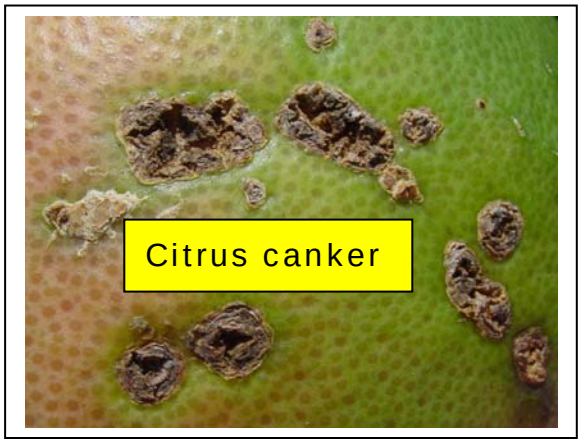
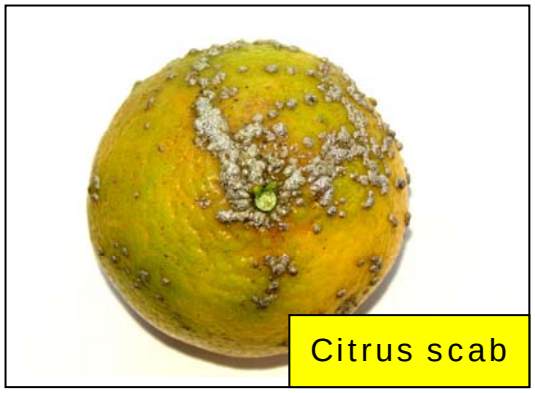
Fungicide effectiveness

Products	Canker	Greasy Spot	Alternaria	Scab	Melanose
Copper	**Good**	**Good**	**Good**	Moderate	**Good**
Oil	None	**Good**	None	None	None
Ferbam	None	Weak	Moderate	Moderate	Weak
Headline	None	**Good**	**Good**	**Good**	**Good**
Abound	None	**Good**	**Good**	**Good**	**Good**
Gem	None	**Good**	**Good**	**Good**	**Good**
Pristine	None	**Good**	**Good**	**Good**	**Good**
Quadris Top	None	**Good**	**Good**	**Good**	**Good**
Enable	None	Moderate	Poor	Moderate	Weak





POSTBLOOM FRUIT DROP (PFD) has been most severe on Navel and Valencia oranges.

Most spores of this fungus are produced directly on the surface of infected petals. Spores are splash-dispersed by rain to healthy flowers where they infect within 24 hours and produce symptoms in 4-5 days. The fungus survives between bloom periods as resistant structures on the surface of leaves, buttons, and twigs.
Groves with persistent calyxes (buttons) from the previous year should be closely examined once the bloom begins. Groves with a history of PFD should be checked twice weekly during the bloom period. Ground and aerial applications are effective for control of PFD. The removal of declining trees, where off-season blooms may provide a site for fungal spore buildup should reduce disease severity.
Of the products recommended for control of PFD, Abound, Gem, and Headline are effective but do not have a long residual effect. Ferbam is less effective and should not be used alone, but it can be combined with low rates of other products to maximize protection and reduce the risk of resistance development. No resistance has been detected to date. Neither Abound, Gem, nor Headline should be used alone more than once per season, but can be used more than once if combined with Ferbam.
For more information go to:
http://www.crec.ifas.ufl.edu/extension/pest/PDF/2015/Postbloom%20Fruit%20Drop.pdf

Recommended Chemical Controls

READ THE LABEL.
Rates for pesticides in Table 1 are given as the maximum amount required to treat mature citrus trees unless otherwise noted. To treat smaller trees with commercial application equipment, including handguns, mix the per-acre rate for mature trees in 125 gallons of water. Calibrate and arrange nozzles to deliver thorough distribution and treat as many acres as this volume of spray allows.

Table 1. Recommended Chemical Controls for Postbloom Fruit Drop

Pesticide	FRAC MOA[2]	Mature Trees Rate/Acre[1]
Abound[3]	11	12.0-15.5 fl oz. Do not apply more than 92.3 fl oz/acre/season for all uses.
Abound[3] + Ferbam	11, M3	12.0 fl oz + 5 lb. Maximum 3 ferbam applications a year and do not apply more than 6 lb ai/acre in a single application.
Gem 500 SC[3]	11	1.9-3.8 fl oz. Do not apply more than 15.2 fl oz/acre/season for all uses. Do not apply within 7 days of harvest.
Gem[3] + Ferbam	11, M3	1.9 fl oz + 5 lb. Maximum 3 applications a year and do not apply more than 6 lb ai/acre in a single application.
Headline SC[3]	11	12-15 fl oz. Do not apply more than 54 fl oz/acre/season for all uses.
Headline[3] + Ferbam	11, M3	12fl oz + 5 lb. Maximum 3 applications a year and do not apply more than 6 lb ai/acre in a single application.

[1]Lower rates can be used on smaller trees. Do not use less than the minimum label rate.
[2]Mode of action class for citrus pesticides according to the Fungicide Resistance Action Committee (FRAC). [3]Do not use more than 4 applications of strobilurin fungicides/season. Do not make more than 2 sequential applications of strobilurin fungicides.

CITRUS BLACK SPOT fungal disease causes fruit blemishes and fruit drop especially on sweet oranges.

Lemons are the most susceptible, but sweet oranges, especially mid to late maturing types such as Valencia, are highly susceptible to this disease. Hamlin sweet oranges and tangerine/mandarin types are moderately susceptible. Grapefruit is thought to be moderately susceptible and symptoms have been seen in Florida.

Black spot fruit symptoms are wide ranging and have many different names. Hard spot is the most diagnostic symptom of black spot. Lesions are nearly circular, depressed, with gray necrotic tissue at the middle, and a brick-red to black margin that can be cracked around the edges. Significant fruit drop is a common symptom in heavily infected groves. Airborne ascospores produced in decomposing leaf litter on the grove floor are the source of the primary inoculum for black spot. They are blown into the canopy by wind. These spores germinate and directly infect the leaves and fruit. Major ascospore release usually occurs from April to early September, with favorable infection conditions from May through September. Fruit remains susceptible most of the growing season. Monthly fungicide applications of copper and/or strobilurins (Abound, Gem, or Headline) will be needed from early May to mid-September to control black spot. If there is substantial rain in April, starting fungicide applications in April is advised. Since only four strobilurin fungicides can be used in a season for any purpose, it is recommended for fresh fruit to reserve strobilurin fungicides for times when phytotoxicity from copper applications is a concern (temperatures >90°F). For processing fruit, strobilurins can be used earlier in the season, and applications for greasy spot and melanose can be combined. It is recommended that strobilurin fungicides not be applied in two consecutive sprays to manage pathogen resistance. Currently, we do not have any other rotational fungicides for resistance management.

In addition to chemical control measures, practices to accelerate leaf litter decomposition beneath the trees to reduce the ascospore inoculum may be beneficial. Enhancing leaf litter degradation should commence in mid-March. There are three methods that have reduced the ascospore inoculum of *Mycosphaerella citri*, the fungus that causes greasy spot. The first is to increase the microsprinkler irrigations to at least 5 times a week for approximately a ½ hour per irrigation period for 1.5 months. The leaf litter decomposition will be greater compared to that with the

traditional irrigation frequency. A drawback is that leaf litter reduction will be confined to the areas where the microsprinklers reach. A second method is to apply urea (187 lb/treated acre) or ammonium sulfate (561 lb/acre) to the leaf litter. The final method is to apply dolomitic lime or calcium carbonate (2226 lb/treated acre) to the leaf litter. The decay rate is greater for litter treated with lime and inoculum production is reduced. All treatments worked equally well with *M. citri* and there is no indication that one method is better than another. Lime or irrigation methods should not be used in conjunction with the high N treatments, since they have opposite methods of action.

Care must be exercised in handling and moving citrus fruit, leaves, twigs and debris from citrus black spot (CBS) Quarantined Areas, since the disease may be easily and unwittingly spread to other citrus trees, nurseries or groves.

There are many rules and regulations that **Growers, Harvesters, Haulers, Processing, Packing Facilities and Haulers have to be aware of with relation to the black spot disease in Florida. For more information, go to:** http://www.crec.ifas.ufl.edu/extension/pest/PDF/2015/Citrus%20Black%20Spot.pdf

READ THE LABEL.

See Table 1.

Rates for pesticides are given as the maximum amount required to treat mature citrus trees unless otherwise noted. To treat smaller trees with commercial application equipment, including handguns, mix the per-acre rate for mature trees in 250 gallons of water. Calibrate and arrange nozzles to deliver thorough distribution and treat as many acres as this volume of spray allows.

Table 1.
Recommended Chemical Controls for Citrus Black Spot

Pesticide	**FRAC MOA[2]**	**Mature Trees Rate/Acre[1]**
copper fungicide	M1	Use label rate.
Abound[3]	11	9.0-15.5 fl oz. Do not apply more than 92.3 fl oz/acre/season for all uses. Best applied with petroleum oil.
Gem 500 SC[3]	11	1.9-3.8 fl oz. Do not apply more than 15.2 fl oz/acre/season for all uses. Best applied with petroleum oil. Do not apply within 7 days of harvest.
Headline SC[3]	11	12-15 fl oz. Do not apply more than 54 fl oz/acre/season for all uses. Best applied with petroleum oil.
[1]Lower rates can be used on smaller trees. Do not use less than minimum label rate.		
[2]Mode of action class for citrus pesticides from the Fungicide Resistance Action Committee (FRAC). Refer to ENY624, Pesticide Resistance and Resistance Management, in the 2015 Florida Citrus Pest Management Guide for more details.		
[3]Do not use more than 4 applications of strobilurin fungicides/season. Do not make more than 2 sequential applications of strobilurin fungicides.		

ALTERNARIA BROWN SPOT

Alternaria fungal disease can cause severe leaf and fruit drop particularly in Minneola (Honeybell) and Orlando tangelos, Dancy tangerine, and Murcott (Honey tangerine). Alternaria must be controlled on these cultivars to obtain high yields of good quality fruit. The spores of this disease are air borne, but require moisture for germination and infection. Leaf tissue is susceptible until it is fully expanded and fruit is susceptible for about 3 months after bloom. When new groves of the above cultivars are planted, only disease-free nursery stock should be used. Trees should be spaced more widely than oranges to promote rapid drying of the canopy. It is best to locate susceptible varieties in high areas where air drainage and ventilation are good so that leaves dry more rapidly. Irrigation, fertilization, hedging, topping, and skirting should be carefully monitored so that excessive vegetative growth is minimized. Copper fungicides, Abound, Gem, Ferbam, Headline, Pristine, Quadris Top are the materials registered for the control of this disease. The first spray should be applied when the spring flush leaves are ¼-1/2 expanded. In severe cases, another spray should be applied when the leaves are near full expansion to reduce the infection on the fruit. Another spray should be scheduled shortly after petal fall. Abound, Ferbam, Gem, Headline, Pristine, or Quadris Top may be the best choice for one or both applications especially if the grove has problems with both scab and Alternaria. From April through June, spray applications may be needed as often as every 10 days or as infrequently as once a month depending on the frequency and amount of rainfall and the rate of infection in the grove. Copper fungicides can be used from April through May, but can produce fruit blemishes if applied during hot weather. Therefore, Abound, Gem, Ferbam, Headline, Pristine or Quadris Top may be substituted for copper in June or July applications. Abound, Gem, Headline, Pristine, and Quadris Top are strobilurin fungicides and Alternaria has the potential to develop resistance to these products. Strobilurin should not be used for Alternaria control more than 3 times in a season and never more than 2 applications in a row. Gem is not highly effective for control of Alternaria. Trilogy and Ferbam are less effective for Alternaria control than copper, Abound or Headline.

For more information, go to:
http://www.crec.ifas.ufl.edu/extension/pest/PDF/2015/Alternaria.pdf

CITRUS SCAB

This fungal disease affects grapefruit, Temple orange, Murcott, tangelos, and some other tangerine hybrids. If leaves from the previous season are heavily infected by citrus scab, 3 applications should be scheduled to control this disease. The first spray should be applied at about ¼ expansion of the spring flush leaves, the second at petal fall and the third about 3 weeks later. Fruit becomes resistant to scab about 2 months after petal fall. Ferbam, Enable, Abound, Gem, or Headline are good choices for the first application because they are able to kill the fungus in old lesions and thus reduce the inoculum and protect the foliage. Whichever of these products was not used in the first spray may then be used in the petal fall spray. Copper fungicides, Abound, Gem, or Headline are good choices for the third spray since they will protect fruit from early melanose as well as from scab. On tangelos and Murcott, Alternaria brown spot and scab occur together. Under this circumstance, either copper fungicides, Abound, Gem, or Headline should be selected for the 3 sprays. Copper products are less effective for scab and should not be selected where scab pressure is high. Ferbam is less effective against Alternaria. If used more than once a year, resistance of the scab fungus to Abound, Gem, or Headline may develop.

For more information, go to:
http://www.crec.ifas.ufl.edu/extension/pest/PDF/2015/Scab.pdf

•<u>Spring flush</u>
Abound, Gem, Headline,
Ferbam, Enable

•<u>Petal fall</u>
Abound, Gem, Headline,
Ferbam

•<u>3 weeks later</u>
Cu fungicides, Abound,
Gem, Headline

•Do not use Abound, Gem, or Headline more than once.

DO NOT APPLY ABOUND, GEM, or HEADLINE IN NURSERIES.

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. For more information, go to **"Nutrition of Florida Citrus Trees, 2nd Edition"** By Thomas A. Obreza and Kelly T. Morgan http://edis.ifas.ufl.edu/pdffiles/SS/SS47800.pdf

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 220 lbs/acre may be considered for orange groves producing over 500 boxes/acre and up to 170 lbs/acre for grapefruit groves producing over 600 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]

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, Mongi Zekri, and David V. Calvert
http://edis.ifas.ufl.edu/CH086 [pdf]

Nitrogen (N) for Citrus Trees
Mongi Zekri and Tom Obreza
edis.ifas.ufl.edu/ss580

Phosphorus (P) for Citrus Trees
Mongi Zekri and Tom Obreza
edis.ifas.ufl.edu/ss581

Potassium (K) for Citrus Trees
Mongi Zekri and Tom Obreza
edis.ifas.ufl.edu/ss583

Magnesium (Mg) for Citrus Trees
Mongi Zekri and Tom Obreza
edis.ifas.ufl.edu/ss582

Calcium (Ca) and Sulfur (S) for Citrus Trees
Mongi Zekri and Tom Obreza
edis.ifas.ufl.edu/ss584

IMPORTANCE OF FERTILIZER SPREADER CALIBRATION AND MAINTENANCE

Properly calibrated and maintained equipment ensures a more uniform distribution of nutrients. This, combined with other conservation practices, reduces production costs, soil surface runoff, and nutrient movement to nearby surface waters. Spreaders that have not been properly maintained and calibrated will have problems delivering accurate rates and evenly distributed fertilizer amounts to the grown crop.

Calibration

Calibration is the process used to help ensure that the equipment applies proper rates of the selected product. Proper calibration is the key to successful fertilizer use efficiency. Failure to calibrate equipment can result in ineffective applications. Applying too much is costly, unlawful and may cause crop injury. Applying too little can result in poor crop growth and production. It is important to calibrate equipment on a regular basis to compensate for variations. The equipment will become worn or damaged with use and result in inaccurate output and spread pattern.

Two items must be considered when calibrating a spreader. The first is the distribution pattern of the spreader. The second is the product application rate, which is the amount of product applied per acre. There are many factors that affect the distribution pattern of a rotary spreader and some of them relate directly to the product. For this reason, it is recommended that the spreader be calibrated separately for every product to be applied. Spreader calibration should be checked more often when the spreader is used frequently.

Product & application

Choose a product according to the need of the crop. Before applying the product, read the spreader manual. The spreader manual will usually indicate proper settings for various application rates. However, calibration still needs to be performed to ensure the settings are accurate and to compensate for wear and variations in equipment. Be sure that the proper procedures and application rates are followed. Check the ‘spread pattern’ and amount being applied. The physical properties of dry fertilizer can vary widely. Since larger particles are thrown further than small particles, a product of uniform size should be used to achieve a consistent application pattern. It is essential to maintain a constant speed when using a rotary spreader to obtain uniform and accurate distribution.

Maintenance and Cleaning

Proper care and maintenance will help retain precise applications and prolong the life of spreaders. Manufacturer’s directions on cleaning and lubricating should be followed. With the shutter or gate wide open, remove all granules from the spreader at the end of each application. Then, the spreader should be thoroughly washed and allowed to dry. Hot water may help break lose fertilizer which is caked on. Finally, lubricate the spreader according to instructions. Spreaders should be stored in a clean, dry place out of direct sunlight.

FOLIAR FEEDING

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. Citrus trees 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 to be an excellent means for supplying the plants' requirements. Soil application of magnesium, manganese, zinc, boron, and molybdenum is not as economical and not as effective as foliar application to supply those nutrients to citrus trees. Applications made to the soil can be subject to leaching, volatilization, and/or being tied up by soil particles in unavailable forms to plants.

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.

Several Florida citrus growers and production managers are using foliar nutritional sprays, mainly micronutrients, to slow down tree decline and maintain adequate fruit productivity of citrus greening-infected trees. Supplemental, balanced foliar nutrition has positive effects on plant diseases by inducing naturally occurring plant resistance mechanisms. It is always important to maintain the balance between nutrients because having one nutrient significantly out of balance can be as bad as a deficiency.

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 80^0F) 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.

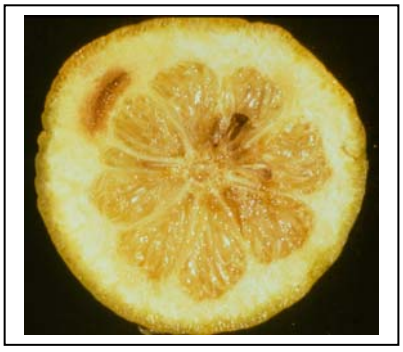
Another important factor when applying nutrient foliarly is to ensure that the pH of the material is in the proper range. The pH range of the spray solution should be between 6 and 7. Attention should be paid to the pH of the final spray solution. This is significant in areas where water quality is poor.

Post-bloom foliar applications (applied in April when the spring flush leaves are about fully expanded) of potassium nitrate or mono-potassium phosphate have been found to increase fruit yield and size.

- **8 lb K_2O per acre per application**
- **Foliar applications are not a substitute for a good soil nutritional program.**

Boron (B) 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.

MICROSPRINKLER IRRIGATION & FERTIGATION

Microsprinkler irrigation 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: water conservation, the potential for significantly improving fertilizer management and 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 with subirrigation and 50% compared with 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 is the timely application of small amounts of fertilizer through irrigation systems directly to the root zone.

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.

Through fertigation, comparable or better yields and quality can be produced with less fertilizer. Microirrigation systems must properly maintain to apply water and fertilizer uniformly. 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.

MOBILE IRRIGATION LAB

The Agricultural MIL is a FREE service that serves Florida. For an Agricultural MIL evaluation in Southwest Florida call **(239) 455-4100**

Assisting the agricultural community by improving irrigation efficiency and conserving water.

The Mobile Irrigation Lab program is an ongoing joint effort between the District, the U.S. Department of Agriculture–Natural Resources Conservation Service (USDA–NRCS) and the agricultural community. The program began in 1987 to assist the District in meeting its statutory responsibilities and to assist growers with water conservation.

The Mobile Irrigation Lab is a free volunteer service to the agricultural community. Any grower can contact the District to arrange a free evaluation. It was expanded to help growers meet water use permit conditions. District staff has used high pumpage reports to identify users who might wish to voluntarily reduce water use before a resource problem or permit violation occurs.

A trained technician is invited to a grower's field and collects irrigation system and specific field data. System pressure and irrigation uniformity data are then reviewed and computer-analyzed. A report provides recommendations for improvements and irrigation schedules. If needed, the technician assists the local NRCS office in the redesign of the system.

An irrigation schedule offers a general guide to determine when and how much to irrigate based on system efficiency, crop requirements and soil characteristics.

In addition to the benefits of free irrigation evaluations, water conservation and water quality improvements, the program shares valuable technology and information with growers.

Mobile Irrigation Lab data suggests that most evaluated systems are already at or above permitted efficiency standards. With only minor improvements, about half the sites below these standards could easily meet them. Typically, if all recommendations are implemented, overall system irrigation efficiency can improve by an estimated 17 percent — helpful to any grower's bottom line, as well as the region's water resources.

FREEZE PROTECTION

Critical Temperatures for Florida Citrus

It is very important to know the critical temperature at which freezing temperatures can damage citrus. Minimum temperature indicating thermometers are a wise investment for any grower concerned with freeze/frost protection. Thermometers should be installed in the coldest grove locations. They should be placed at a height of 42 inches (4.5 ft) on a stand, sheltered at the top and facing north. In citrus trees, there can be a great deal of variation in the minimum temperature at which plant damage will occur.

The reference temperature and duration for the initiation of the freezing process in round oranges is 28^0 F for four hours. Tangerines and fruit with smaller mass would receive freeze damage after shorter durations, while grapefruit would require longer durations.

Minimum temperatures of 26^0 F will damage fully mature, harden-off leaves that have not received any acclimation. Minimum temperatures of 30^0 F can significantly damage unhardened new flush leaves. Leaves that have received extensive acclimation have been shown to survive temperatures as low as 20^0 F in Florida.

Protecting citrus trees from cold damage

Cultural practices can have a major influence on the cold hardiness of citrus trees. A clean, hard-packed soil surface intercepts and stores more solar radiation during the day and releases more heat at night than a surface covered with vegetation or a newly tilled area. Irrigation should be applied minimally during the fall and winter. Reducing irrigation results in an increase in the cold tolerance of citrus trees and enhances tree stress resulting in an increase in the formation of flower buds. Excessive application of nutrients should be avoided late in the fall especially with young citrus trees. Heavy hedging or topping during the winter can reduce citrus cold hardiness by reducing canopy integrity that would trap heat released by the soil. This should be avoided.

Water from micro sprinkler irrigation protects young trees by transferring heat to the tree and the environment. The heat provided is from two sources, sensible heat and the latent heat of fusion. Most irrigation water comes out of the ground at 68° to 72°F, depending on the depth of the well. The major source of heat from irrigation is provided when the water in the liquid form changes to ice (latent heat of fusion).

As long as water is constantly changing to ice, the temperature of the ice-water mixture will remain at 32°F. The higher the rate of water application to a given area, the greater is the amount of heat energy that is applied. When expecting a freeze, turn on the water early before the air temperature reaches 32^0F. Remember that in cold pockets, the ground surface can be colder than the air temperature reading in a thermometer shelter. Once irrigation has begun, the system must run for the duration of the time plant temperatures are below the critical temperature. Growers are recommended to use the information at the FAWN website (http://fawn.ifas.ufl.edu) to determine when it would be safe to turn off or on their micro-sprinkler irrigation system. For more details, go to http://edis.ifas.ufl.edu/HS179, http://edis.ifas.ufl.edu/CH182, http://edis.ifas.ufl.edu/CH054

In bedded groves to provide additional cold protection, water should also be pumped high in the ditches the day before and during the time of freezing weather.

FAWN (Florida Automated Weather Network)

Go to http://fawn.ifas.ufl.edu/

Click on Tools, then click on Cold Protection Toolkit or go directly to
http://fawn.ifas.ufl.edu/tools/coldp/

Then Select a Tool.

New! **Graphic Forecast data for FAWN sites**

National Weather Service (NWS) forecast data for next 96 hours. Updated hourly.

Fruit Frost Station Forecasts

With the demise of the NWS agricultural program in April of 1996 the minimum temperature forecast and winter summaries went away. An opportunity now exists to once again provide temperature forecasts for the old Fruit Frost locations with the development of the Point forecast by NWS.

Minimum Overnight Temperature

Estimates based on the Brunt equation and the air & dew point temperatures at sunset.

Forecast Tracker for FAWN sites

Plots the actual temperature and forecasted temperature for the previous twenty four (24) hours and the forecasted temperature for the next twenty four (24) hours in order to show how well the forecast is tracking the actual temperature. The Forecast Tracker is easy to use with a drop down menu to select the desired FAWN site.

FAWN does not make weather forecasts, but utilizes the National Weather Service products, especially the pin point forecasts. For more information see **JETSTREAM, an online weather school, Pinpoint Forecasts.**

Evaporative cooling potential

Determining the risk of using irrigation for cold protection, and see the risk calculated at FAWN stations.

There is always a risk when using water systems, micro-sprinkler or conventional sprinkler, for cold and/or frost protection. Low humidity and wind can produce evaporative cooling which can chill plant surfaces to the wet bulb temperature. Dry and windy conditions can result in wet bulb temperatures 5F to 6F degrees lower than air temperature. Therefore, wetted plant surfaces that experience evaporation would be 5F to 6F degrees cooler than air temperature. Evaporative cooling may result in plant damage when water is used for cold protection during dry windy conditions. Evaporative cooling should always be taken into consideration.

It is possible that, on nights when temperatures are close to critical levels, introduction of water could produce more damage than would result if no action was taken!

Wet-Bulb Based Irrigation Cutoff Temperature

The safe cutoff temperature based on current FAWN conditions.

Flatwoods Citrus

☐ If you did not receive the ***Flatwoods Citrus*** newsletter and would like to be on our mailing list, please check this box and complete the information requested below.

☐ 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

Subscriber's Name:_____

Company:_____

Address:_____

City:_____State:_____Zip:_____

Phone:_____

Fax:_____

E-mail:_____

Racial-Ethnic Background

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

Gender

__Female
__Male