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Flatwoods Citrus



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EL NIÑO/SOUTHERN OSCILLATION (ENSO) DIAGNOSTIC DISCUSSION

issued by

CLIMATE PREDICTION CENTER/NCEP/NWS
and the International Research Institute for Climate and Society
10 September 2020

ENSO Alert System Status: [La Niña Advisory](#)

Synopsis: [La Niña conditions are present and are likely to continue through the Northern Hemisphere winter \(~75% chance\).](#)

In August, La Niña conditions were present, with below-average sea surface temperatures (SSTs) extending across the central and eastern equatorial Pacific Ocean [[Fig. 1](#)]. In the last week, all Niño indices were negative, with the Niño-3.4 index at -0.9°C and the Niño-1+2 and Niño-3 indices cooler than -1.0°C [[Fig. 2](#)]. Equatorial subsurface temperature anomalies averaged across 180° - 100°W were negative [[Fig. 3](#)], with the largest departures observed in the east-central Pacific from the surface to 200m depth [[Fig. 4](#)]. Atmospheric circulation anomalies over the tropical Pacific were also generally consistent with La Niña, despite sub-seasonal variability during the month. The low-level and upper-level winds were near average for the month as a whole, but enhanced low-level easterly winds were prominent across the equatorial Pacific Ocean during early and late August. Tropical convection remained suppressed over the western and central Pacific, and was near average over Indonesia [[Fig. 5](#)]. Both the Southern Oscillation and Equatorial Southern Oscillation indices were positive. Overall, the coupled ocean-atmosphere system was consistent with La Niña conditions.

A majority of the models in the IRI/CPC plume predict the continuation of La Niña (Niño-3.4 index less than -0.5°C) through the Northern Hemisphere winter 2020-21 [[Fig. 6](#)]. The forecaster consensus supports that view, and favors a borderline moderate event (Niño-3.4 index near -1.0°C) during the peak November-January season. In summary, La Niña conditions are present and are likely to continue through the Northern Hemisphere winter (~75% chance; click [CPC/IRI consensus forecast](#) for the chance of each outcome for each 3-month period).

This discussion is a consolidated effort of the National Oceanic and Atmospheric Administration (NOAA), NOAA's National Weather Service, and their funded institutions. Oceanic and atmospheric conditions are updated weekly on the Climate Prediction Center web site ([El Niño/La Niña Current Conditions and Expert Discussions](#)). Forecasts are also updated monthly in the [Forecast Forum](#) of CPC's Climate Diagnostics Bulletin. Additional perspectives and analysis are also available in an [ENSO blog](#). The next ENSO Diagnostics Discussion is scheduled for 8 October 2020.

To receive an e-mail notification when the monthly ENSO Diagnostic Discussions are released, please send an e-mail message to: ncep.list.enso-update@noaa.gov.

Climate Prediction Center
National Centers for Environmental Prediction
NOAA/National Weather Service
College Park, MD 20740

NUTRITION OF CITRUS TREES

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. For citrus trees in the citrus greening (HLB) era, soluble fertilizer should be split into 6-10 applications per year with a complete balanced fertilizer. Besides nitrogen, phosphorus, and potassium, be sure that the fertilizer has magnesium, and micronutrients such as manganese, zinc, iron, and boron. The use of controlled release fertilizer or frequent fertigation is preferred. Late fall fertilizer applications may delay fruit color development and fruit maturity for early season tangerine cultivars. Foliar applications of micronutrients should be applied at least 3 times a year on the major spring, summer, and fall flushes when the new leaves are about fully expanded. Foliar spray applications of 3-5 lbs/acre of magnesium, manganese, zinc, and copper, and 0.25-0.50 lb/acre of boron and molybdenum are also recommended on each of the three major flushes of citrus trees to prevent nutrient deficiencies, cope with HLB, and improve production. Sulfate forms are less expensive and nitrate forms appear to facilitate the uptake of micronutrients.

Boron (B)

Boron is particularly necessary where active cell division is taking place. Boron plays an important role in flowering, pollen-tube growth, fruiting processes, nitrogen (N) metabolism, and hormone activity. Florida sandy soils are low in B, and a deficiency of this element in citrus occasionally occurs under field conditions. The deficiency may be

aggravated by severe drought conditions, heavy lime applications or irrigation with alkaline water, and by citrus greening. 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, low in juice content, and even 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. Affected fruit is low in sugar content. 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. Leaves of boron deficient citrus

trees exhibit vein corking and enlargement.



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 1/200 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 and in the fall. Boron does not move very readily from parts of the tree to others. 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.

MAGNESIUM NUTRITION

In Florida, magnesium (Mg) deficiency is commonly referred to as “bronzing”.

Trees with inadequate Mg supply may have no symptoms in the spring growth flush, but leaf symptoms will develop as the leaves age and the fruit expand and mature in the summer and fall.

Magnesium deficiency symptoms occur on mature leaves following the removal of Mg to satisfy fruit requirements. During the summer, when a rapid increase in fruit size occurs, the symptoms appear on leaves close to the developing fruit.

Magnesium deficiency symptoms appear as a result of translocation of Mg from the leaves to the developing fruit, although there may also be a translocation from older leaves to young developing leaves on the same shoot.

Disconnected yellow areas or irregular yellow blotches start near the base along the midribs of mature leaves that are close to fruit. They become gradually larger and eventually coalesce to form a large area of yellow tissue on each side of the midrib. This yellow area enlarges until only the tip and the base of the leaf are green, showing an inverted V-shaped area pointed on the midrib.



In acute deficiency, the yellow area may gradually enlarge until the entire leaf becomes yellow or bronze in color.

Leaves that have lost most of their green color due to Mg deficiency drop freely under unfavorable conditions. Defoliated twigs become weak and usually die by the

following spring. Severe defoliation will reduce the average size of individual fruit and cause a general decline in fruit production. In Florida, Mg deficiency in citrus is caused primarily by low levels of Mg on acid light sandy soils and on calcareous soils. Leaching of added Mg is particularly serious and substantially rapid when the soil pH is 4.5 to 5.0. Under such conditions, the use of dolomite to bring the pH to 6.0 will furnish Mg at the same time.

FIXING Mg DEFICIENCY

Soil application of Mg sulfate or oxide to provide 50-60 lbs of Mg per acre can be successful in correcting Mg deficiency when the soil pH is adjusted.

Under calcareous soils, the amounts of Mg applied must be greater than those applied on soils low in calcium or potassium. Foliar spray applications of Mg nitrate (3-5 gallons/acre) can be effective when applied on the spring and summer flush leaves when they are about fully expanded. Remember that Magnesium should be applied regularly at 1/5 (or 20%) of the N rate unless leaf analysis shows more than 0.50% Mg. If leaf Mg deficiency symptoms occur, Mg should be applied in the fertilizer, and the rate should be increased up to 30% of the N rate until symptoms are no longer present in mature leaves of subsequent flushes.

For more information on citrus nutrition, go to the following EDIS

publications: "Nutrition of Florida Citrus Trees, 3rd Edition" By Kelly T. Morgan and Davie M. Kadyampakeni <http://edis.ifas.ufl.edu/pdffiles/SS/SS47800.pdf>

[Increasing Efficiency and Reducing Costs of Citrus Nutritional Programs](#)

Mongi Zekri, Thomas Obreza and Arnold Schumann [[pdf](#)]

Zekri, M. and T.A. Obreza. Boron and chlorine for citrus trees.

<http://edis.ifas.ufl.edu/pdffiles/SS/SS61900.pdf>

Zekri, M. and T.A. Obreza. Molybdenum and nickel for citrus trees.

<http://edis.ifas.ufl.edu/pdffiles/SS/SS61800.pdf>

Zekri, M. and T.A. Obreza. Iron and copper for citrus trees.

<http://edis.ifas.ufl.edu/pdffiles/SS/SS61700.pdf>

Zekri, M. and T.A. Obreza. Manganese and zinc for citrus trees.

<http://edis.ifas.ufl.edu/pdffiles/SS/SS61600.pdf>

Zekri, M. and T.A. Obreza. Nitrogen (N) for citrus trees.

<http://edis.ifas.ufl.edu/pdffiles/SS/SS58000.pdf>

Zekri, M. and T.A. Obreza. Phosphorus (P) for citrus trees.

<http://edis.ifas.ufl.edu/pdffiles/SS/SS58100.pdf>

Zekri, M. and T.A. Obreza. Potassium (K) for citrus trees.

<http://edis.ifas.ufl.edu/pdffiles/SS/SS58300.pdf>

Zekri, M. and T.A. Obreza. Magnesium (Mg) for citrus trees.

<http://edis.ifas.ufl.edu/pdffiles/SS/SS58200.pdf>

Zekri, M. and T.A. Obreza. Calcium (Ca) and sulfur (S) for citrus trees.

<http://edis.ifas.ufl.edu/pdffiles/SS/SS58400.pdf>

History of Citrus Black Spot

Citrus black spot, caused by the fungal pathogen *Guignardia citricarpa* (sexual stage) and *Phyllosticta citricarpa* (asexual stage), was first found in southwest Florida in March 2010. Around the world, black spot can be found in Argentina, Australia, Brazil, China, Ghana, Mozambique, Philippines, South Africa, Sub-Saharan Africa, Taiwan and other regions of South America.



Fruit Symptoms

Black spot symptoms occur in several forms called hard spot, cracked spot, false melanose and virulent spot which are described below. Hard spot is the most common and diagnostic symptom. The lesions are small, round, sunken with gray centers and brick-red to chocolate brown margins. Green halos are often seen around hard spot lesions. Fungal structures appear as slightly elevated black dots in the center of lesions. They appear as fruit begins to color where light exposure is greatest. False melanose is observed as numerous small, slightly raised lesions that can be tan to dark brown. It may occur on green fruit and does not have pycnidia (fungal structures). False melanose may become hard spot later in the season. Cracked spot has large, flat, dark brown lesions with raised cracks on their surface. It is thought to be caused by an interaction between the pathogen and rust mites. It occurs on green as

well as mature fruit and can become hard spot later in the season.



Early virulent spot, also known as freckle spot, has small reddish irregularly shaped lesions. It occurs on mature fruit as well as post-harvest in storage. It can develop into either virulent spot or hard spot. Virulent spot is caused by the expansion and/or fusion of other lesions covering most of the fruit surface toward the end of the season. Many fungal structures can be found in these lesions. Severely affected fruit can drop before harvest causing significant yield loss.

Leaf and Stem Symptoms

Leaf and stem symptoms are not as common as fruit symptoms. They are most commonly found on lemons, a very susceptible species.

Regulations

Stipulations for Movement of Citrus Fruit from EAN Regulated Areas for Citrus Black Spot [PDF](#)
More information will be added as it becomes available. However, for most up-to-date information from regulatory agencies, please contact the [Florida Division of Plant Industry](#) 863-298-7777.

Spread

•Wind-borne ascospores are forcibly ejected from fungal fruiting bodies embedded in leaves

in the leaf litter under trees and are carried by air currents, approximately 75 feet (25 meters) from leaf litter.

- Rain splash may also move spores from infected fruit (conidia) and/or leaf litter (conidia and ascospores), but moves the spores only a few inches (centimeters).
- Live leaves that have latent infections (infections that are not visible) are common means of long distance spread. These often are moved as trash in loads of fruit.
- Infected nursery stock is another potential means of spread. This can occur very easily since these latent infections cannot be seen in otherwise healthy-looking trees.
- Leaf litter movement may be either by wind or human activities
- Humans are the main form of long distance movement

Diagnosics

If you suspect you may have black spot, please contact your local [CHRP office](#) for further diagnostic testing.

Management

- Always plant clean, certified nursery stock. Keeping nursery stock clean is much easier with the new covered nursery regulations but black spot is still a threat. This will help prevent movement of black spot and other diseases into newly established grove plantings.
- Increase air flow in grove to reduce leaf wetness where possible. *G. citricarpa* needs 24-48 hours of leaf wetness for spore germination and infection as do many other fungal diseases.
- Reduce leaf litter on grove floor to decrease ascospore load through enhanced microsprinkler irrigation.
- Fungicides registered for citrus in Florida that have been found effective in other countries:
 - Copper products (all formulations have been found to be equivalent)
 - Strobilurins fungicides are also useful and approved.
- The best fungicide application method is with air blast sprayer. Aerial applications are not likely to get adequate canopy penetration for control. It is important that the leaves and fruit are covered with fungicide.
- For enhanced coverage, increase the gallons used to 250 gallons/acre for applications to ensure full coverage.

•Strategies for Effective Eradication of Citrus Black Spot in Collier and Hendry Collier

Links

Florida Division of Plant Industry Citrus Black Spot Updates [website](#)

USDA Press Release-English [PDF](#)

USDA Press Release-Spanish [PDF](#)

Florida Division of Plant Industry Pest Alert [PDF](#)

Fungicide resistance: Why it happens and how it may affect you. Citrus Industry, March 2010 [PDF](#)

Citrus black spot. Citrus Industry, January 2010 [PDF](#)

- It is important to get good canopy coverage with fungicides for black spot control. To ensure complete coverage consider using a spray volume of 250 gallons per acre.
- Leaf litter management is also an important tool for black spot management since the primary spores are produced in the litter like greasy spot. The measures described below have shown to effectively reduce greasy spot inoculum, although not enough to eliminate fungicide applications.
- Urea (20.8 lb/treated acre) through the herbicide boom or ammonium sulfate (561 lb/acre) application will reduce the number of fungal structures and spore production.
- Enhanced irrigation with microsprinkler five times a week starting mid-March and continuing until litter is decomposed.

Resources

If you would like to obtain laminated identification sheets or copies of the other various educational materials, please contact your citrus extension agent or Jamie Yates, 863-956-1151 ext. 1302 or jd Yates@crec.ifas.ufl.edu.
Citrus Black Spot ID Sheet [PDF](#)
Citrus Black Spot Management Timing Schedule [PDF](#)
Citrus Black Spot Poster for Growers (18 x 27) [PDF](#)
Citrus Black Spot Poster for Packinghouses (32 x 26) [PDF](#)

Recommended Chemical Controls

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. Our fungicide recommendations have been based on efficacy data from trials in other countries with black spot and products registered for use on citrus in Florida. Field testing in Florida of fungicides including Abound, copper-based products, Enable, Gem, Headline, Pristine, and Amistar Top indicate that all of these fungicides can be useful in a fungicide program. 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 >94°F). For processing fruit, strobilurins can be used earlier in the season and applications combined for greasy spot and melanose. It is recommended that strobilurin fungicides not be applied in two consecutive sprays to manage pathogen resistance and rotated with a fungicide containing another mode of action. 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.
Enable 2F ⁴	3	8.0 fl/oz. Do not apply more than 3 applications or 24 fl oz/acre/season
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.
Amistar Top (formerly Quadris Top) ^{3,4}	11 + 3	15.4 fl oz. Do not apply more than 61.5 fl oz/acre/year
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.
Pristine ^{3,4}	11 + 7	16-18.5 oz. No more than 74 oz/acre/season

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) 2016. Refer to ENY624, Pesticide Resistance Management, in the 2018-2019 Florida Citrus Production 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 (FRAC MOA 11).

⁴ Do not make more than 4 applications of Pristine or Amistar Top/season. Do not make more than 2 sequential applications of Pristine or Amistar Top before alternating to a non-strobilurin, SDHI (FRAC MOA 7) or DMI (FRAC MOA 3)

<http://www.crec.ifas.ufl.edu/extension/pest/PDF/Citrus%20Black%20Spot.pdf>



SOIL ACIDITY & LIMING

The optimum soil pH range for citrus trees is 6.0 to 6.5. Trifoliolate hybrid rootstocks such as citrumelos and citranges do better at the low end of this pH range. For sandy soils, one ton of liming material such as dolomite will raise the soil pH by about one unit. Liming acidic soils is economically sound and essential for profitable crop production. Soil pH must be monitored every year through soil testing because development of soil acidity is a continuous process that requires repeated applications of liming materials. Always test your soil before liming. Do not assume that lime is needed.



Problems in very acid soils

- *Aluminum (Al) toxicity to plant roots
- *Copper toxicity in soils that have received repeated Cu fungicide applications
- *Manganese toxicity to plants in continuously wet soils
- *Calcium & magnesium deficiencies
- *Molybdenum deficiency
- *Phosphorus tied up by iron (Fe) & Al
- *Poor bacterial growth
- *Reduced conversion of ammonium to nitrate

Problems in alkaline (high pH) soils

- *Iron deficiency

- *Manganese deficiency
- *Zinc deficiency
- *Excess salts (in some soils)
- *Phosphorus tied up by calcium (Ca) and magnesium (Mg)
- *Bacterial diseases and disorders

Fertilizers. Both organic and non-organic fertilizers may eventually make the soil more acid. For example, transformations of ammonium- (NH_4^+) and urea-based fertilizers into nitrate (NO_3^-) release H^+ that increases soil acidity. Therefore, fertilization with materials containing ammonium or even adding large quantities of organic matter to a soil will ultimately increase the soil acidity and lower the pH.

Raising soil pH (liming acid soils).

Soils are limed to reduce the harmful effects of low pH and to add calcium and magnesium to the soil. Lime reduces soil acidity (increases pH) by reducing the H^+ concentration through neutralization with carbonate (CO_3^{2-}) or hydroxide (OH^-). A Ca^{++} ion from the lime replaces two H^+ ions on the cation exchange complex. The hydrogen ions (H^+) are then reduced and changed into water (H_2O). An acid soil can become more acid as basic cations such as Ca^{2+} , Mg^{2+} , and K^+ are removed, usually by crop uptake or leaching, and replaced by H^+ .

Benefits of liming to correct soil acidity

- *Increased nutrient availability
- *Improved fertilizer use efficiency
- *Increased soil microbial activity
- *Higher nitrogen fixation by legumes
- *Reduced toxicity of copper
- *Solving molybdenum deficiency

*Provision of additional amounts of calcium and magnesium

*Improved soil physical conditions

*Increased cation exchange capacity

*Improved herbicide activity

*Increased growth and crop yield

Lime placement. Since ground limestone is relatively insoluble in water, maximum contact with the soil is necessary to neutralize the soil acidity. Lime will not quickly move into the soil like water-soluble fertilizers. Even though it is usually recommended to thoroughly mix lime with the topsoil, it is not practical to incorporate it in a citrus grove.

Therefore, it will take lime longer to raise soil pH in a grove compared with a field where it is incorporated. As soon as moisture is present, the lime will begin to react. Coarse lime particles react more slowly than very fine particles. Therefore, using very finely ground limestone is necessary to

achieve the desired soil pH change within 4 to 6 months after application.

Overliming. While a correct liming program is beneficial for plant growth, excessive liming can be detrimental because deficiencies and imbalances of certain plant nutrients may result. The practice of estimating lime requirement without a soil test is risky because it can lead to overliming.

Liming materials. The most common liming materials are calcitic or dolomitic agricultural limestone. Calcitic limestone is mostly calcium carbonate (CaCO_3). Dolomitic limestone is made from rocks containing a mixture of calcium and magnesium carbonates. Dolomitic limestone also provides magnesium. Not all materials containing calcium and magnesium are capable of reducing soil acidity. Gypsum (CaSO_4) does not reduce soil acidity.

Lime may be applied at any time during the year to Florida citrus groves.

Calcium sources

Source	Chemical formula	Calcium carbonate equiv. (pure form)
Burned lime (Quicklime)	CaO	179
Hydrated lime (Builder's lime)	Ca(OH)_2	135
Dolomitic lime	$\text{CaCO}_3 \bullet \text{MgCO}_3$	109
Calcitic lime	CaCO_3	100
Basic slag (by-product)	CaSiO_3	80
Marl (soft carbonates)	CaCO_3	70 to 90
Gypsum	CaSO_4	0
Calcium nitrate	$\text{Ca(NO}_3)_2$	20
Ordinary superphosphate	$\text{Ca(H}_2\text{PO}_4)_2 + \text{CaSO}_4$	0
Concentrated superphosphate	$\text{Ca(H}_2\text{PO}_4)_2$	0

MANAGING EXCESSIVE BICARBONATES WITH ACIDIFICATION

By Dr. Jim Graham and
Dr. Kelly Morgan
UF-IFAS

HIGH BICARBONATES AND HLB

Irrigation water in Florida that comes from wells in a limestone aquifer or from lakes or canals that cut into limestone contain dissolved bicarbonates, which is a liming material.

Irrigation with such water can increase soil pH with time and cause adverse effects on tree growth, reduce yields and may cause plugging of irrigation emitters. The effect of irrigation on soil pH depends on the concentration of bicarbonates in the water, the amount of the water applied, the buffering capacity of the soil and the sensitivity of the rootstock being grown. A water test is the surest means of determining if a problem exists. If the pH of the irrigation water is below 7.0, then we may safely assume that it will not be a problem. However, if the pH is above 7.0, the water contains bases such as bicarbonates, and a sample should be sent to a laboratory with a request to specifically test for bicarbonates.

The growers we cooperate with were the first to observe that groves most affected by HLB and fruit drop are irrigated with water high in bicarbonates applied to the wetted zone where fibrous roots are concentrated. Greater HLB symptom expression is also associated with grove soils that have a history of excessive dolomite liming to manage high residual soil copper. Groves with high water and/or soil bicarbonates have off-color foliage, thinning canopies due to excessive leaf drop, twig dieback and more severe HLB symptoms in leaves and fruit. Leaf and soil nutrient analysis in these groves suggests that bicarbonate

stress reduces root uptake of calcium (Ca), magnesium (Mg), potassium (K) and iron (Fe). For example, even when soil Ca status is very high, associated leaf Ca levels are moderate. Severity of HLB symptoms for trees on different rootstocks follows rootstock susceptibility to bicarbonates: Swingle citrumelo > Carrizo citrange > sour orange > Cleopatra mandarin.

BICARBONATE STRESS, FIBROUS ROOT DENSITY AND YIELD

We found a relationship between fibrous root density and reduction in fruit yields for blocks where irrigation water is in excess of 100 parts per million (ppm) bicarbonates and soil pH is greater than 6.5. The greatest decline occurred in Flatwoods groves, which had a 20 percent decrease in yield compared to Ridge groves under low bicarbonate stress, which had a 6 percent increase in production over a time period when HLB incidence was rapidly accelerating. Greater yield loss under bicarbonate stress was correlated with lower fibrous root density compared to the non-stress condition.



RIDGE AND FLATWOODS DIFFERENCES

Experience in California citrus and observations in Florida confirm that acidification of the soil or water reduces root zone pH and may promote release of Ca, Mg and Fe for root uptake. Conditioning of irrigation water with acid

works quickly to lower root zone pH, but does not work during the rainy season when irrigation is less frequent. Soil conditioning with prilled elemental sulfur applied to the wetted zone creates acidity that releases all season long. When soil pH rises to near the initial pH, the prilled sulfur is reapplied. In the central Ridge (Highlands County), we sampled four low-bicarbonate groves without acidification of the irrigation water and four high-bicarbonate groves with acidification of the irrigation water. Root mass density was similar for groves with or without acidification. Soil pH in the low-bicarbonate and acidified groves ranged from low 5.0 to mid 6s. Leaf analysis confirmed the improved color and absence of twig dieback of the acidified groves, which are associated with optimum leaf nutrient levels. In contrast, the Flatwoods groves (Hardee County) with high bicarbonate irrigation water had a root mass density five to 10 times lower than in the Ridge groves. Soil pH in the acidified groves at the beginning of the survey was in the low 6s, but rebounded to high 6s during the rainy season. Foliage improved in color and vigor, but not as much as for Ridge groves, and was associated with low leaf manganese (Mn) and zinc (Zn) levels.



MANAGEMENT RECOMMENDATIONS

Observations confirm that trees respond well to reducing soil stresses with a balanced, lower and more frequent application of water and nutrients, i.e.

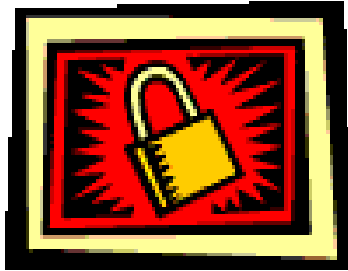
“spoon feeding”. Where excess bicarbonates in irrigation water or soil have been identified by water and soil testing, the goal is to reduce soil bicarbonate stress to sustain root functioning in nutrient uptake and root longevity. To assess bicarbonate stress, check soil pH in the wetted zone and test well water for pH, bicarbonates, salinity, cations and anions. Conditioning the irrigation water can be achieved by injection of acids (e.g., sulfuric or phosphoric) or combinations of acids and urea to reduce bicarbonates in irrigation water to below 100 ppm. Injecting products that combine acids and urea reduces corrosion of injection equipment, makes the acids safer to use and supplies a small amount of nitrogen. After correcting water and soil bicarbonate stress, then consider management of root pathogens.



SUMMARY

Surveys of groves after 1 to 1 ½ years of treatment indicate that acidification reduces HLB-induced fruit drop and improves tree appearance. Soil pH/bicarbonate management of irrigation water and soil may reduce stress on fibrous roots and increase nutrient uptake and root longevity. Growers are advised to check soil pH (wetted zone) and test well water for pH, bicarbonates, salinity, cations and anions. Acidification of the rhizosphere will release Ca and Mg from bicarbonate and make soil Mn, Zn and Fe more available for root uptake.

Suggested Facility Security Practices



Awareness

- Conduct a security assessment of your facility.
- Use opening and closing security check lists; note any discrepancies or irregularities.
- Initiate or join your local “crime watchers” program.

Access

- Escort all customers or visitors in storage yards or near loading docks.
- Establish a uniform or ID badge system to distinguish employees.

Alarms

- Install alarms and use a security alarm monitoring service.
- Ensure that phone lines are protected or have a service interruption alarm.
- Locate exterior strobe lights with alarms where neighbors and law enforcement can see them.

Barriers

- Construct structural barriers, including steel doors and barred windows.
- Install fencing as a deterrent where appropriate; fencing should be such that law enforcement and passers-by can view the property.
- Install access gates where fencing is not appropriate.
- Install bollards and chains across driveways or block with trucks and other equipment during off-hours.

Community

- Establish a process for including neighbors and the community as part of facility security and emergency response planning.

Inventory Control

- Know your inventory.
- Establish an ongoing process for inventory control of materials stored at the facility.
- Do not allow unattended, loaded trailers on site.
- Record stored nurse tanks by identification number and weight of remaining product.
- Inspect tanks visually each morning.
- Keep bills of lading, blank forms and all shipping/receiving paperwork secured.

Law Enforcement

- Establish and maintain relationships with local law enforcement and emergency responders. Provide them with your emergency plans and keys to locked gates.
- Provide law enforcement dispatchers with current emergency contact information for the facility. Keep this information current.
- Immediately report unusual or suspicious persons, vehicles or activity to local law enforcement.

Lighting

- Contact your local power company for a lighting assessment and information on leasing lights for your property.
- Install sufficient exterior lighting for law enforcement and passers-by to see your property.
- Discuss your lighting plan with local law enforcement.

Locks

- Establish a procedure and responsibility for locking up at close of business.
- Use high-security locks for doors, enclosures and gates, following local fire code requirements. Keep padlocks locked on hasps while not in use to prevent your lock from being replaced by someone else’s.
- Use deadbolt locks on doors with a minimum of 1.5-inch throw.
- Implement key control for locked containers, equipment, hoppers, vehicles and vessels.

Signage

- Post alarm monitoring service signs in highly visible locations. Include signage for:
 - No trespassing
 - Private property
 - Closed circuit TV surveillance
 - Patrolled
 - No vehicles beyond this point
 - All visitors must check-in with front office
 - All visitors must be escorted

Surveillance

- Install CCTV surveillance cameras to monitor less visible or high-risk areas.

Training

- Involve employees in security planning.
- Train employees to spot suspicious individuals and behavior.
- Conduct periodic emergency drills, e.g. fire, evacuation and security, with employees.

Vendors

- Know vendors that service your facility.
- Require all vendors to check in.
- Escort vendors.

Visibility

- Assure an open area around the facility, unlimited by shrubs, trees, large signs or other barriers to open sight.

SUGGESTED CUSTOMER TRANSACTION PRACTICES

Awareness

- Heighten employee awareness of what constitutes an unusual customer and sales transaction.
- Heighten customer awareness of potential for criminal misuse of agricultural chemicals.
- Advise customers to contact law enforcement immediately with any concerns about unusual persons, vehicles or activities in the vicinity of your facility or theirs.

Sales Transaction

- Know your customer.
- Follow all requirements for verification when selling restricted use pesticides.
- For all sales, record customer's name, address, telephone number. If in doubt ask for a driver's license.
- Make deliveries only when the customer or agent is available to take custody and sign for the material.
- Do not deliver tanks or other products to empty fields or other unattended locations.
- Make follow-up calls to verify receipt of materials by customer in quantity ordered.
- Be alert to those who:
 - ☐ Pay in cash;
 - ☐ Won't take delivery;
 - ☐ Behave in an unusual manner;
 - ☐ Hesitate when asked for ID to complete the sale;
 - ☐ Don't know the product;
 - ☐ Insist on certain products, such as ammonium nitrate, and will not consider other suggestions;
 - ☐ Ask questions about product manufacturing;
 - ☐ Aren't familiar with farming, pesticides or fertilizer products.
- If in doubt:
 - ☐ Write down vehicle color, make, license number and state and a physical description of the individual;
 - ☐ Retain papers the customer may have touched for fingerprints;
 - ☐ Save this information in the event that it needs to be provided to law enforcement.

Certain agricultural inputs stored at your facility may warrant special security measures, such as anhydrous ammonia, ammonium nitrate, bulk urea and insecticides.

Alarms

- Install alarms near tanks.
- Install explosion-proof alarm systems near combustible material.

Awareness

- Be alert to those attempting to buy ammonia if they cannot state a legitimate, agronomic need for the product.
- Inspect tank and bulk storage areas daily.
 - Check for fresh tracks in mud or snow or disturbed ground around tanks and bulk storage areas;
 - Check to see if tank valves are closed tightly;
 - Look for suspicious items near tanks such as duct tape, garden hose, bicycle inner tubes, buckets and coolers;
 - Check for broken or missing wire ties or seals that you may have placed on valve wheels as markers.
- Make customers aware of the potential for theft or tampering with tanks and bulk ag chemicals.
- Remove hoses between tool bars and nurse tanks; relieve pressure with the bleed valves when left overnight. Encourage end-users to do the same.

Law Enforcement

- Work with local law enforcement to encourage frequent nighttime patrols.
- Contact local law enforcement immediately if you suspect tampering or theft at your facility or the presence of unusual persons, vehicles or activities.
- Do not disturb a potential crime scene.

Locks for Tanks

- Use brightly colored plastic ties or wire seals between the valve wheel and the roll cage to ease visual checks and to identify tampering.
- Use tamper resistant seals and locks.
- Use high-security locks.
- Use specialized tank locks for nurse tanks containing anhydrous ammonia.
- Paint tank locks red so law enforcement can identify anhydrous ammonia tanks.

Visibility

- Store tanks in well-lit areas with a clear line-of-sight.
- Store tanks with flow valves facing outward to speed visual inspections.
- Do not leave tanks in remote areas.

SUGGESTIONS FOR PARTNERING WITH YOUR CUSTOMERS ON SECURITY AND SAFETY

- Take delivery of tanks as close to time of application as possible.
 - Position tanks in open, visible areas.
 - Don't take delivery of tanks to unattended locations.
 - Don't store tanks and tool bars inside buildings, near the farmhouse or livestock confinement houses.
 - Remove hoses between tool bars and nurse tanks and relieve pressure with the bleed valves if tanks are left overnight. Store hoses and tool bars away from tanks.
 - Don't leave tanks unattended for long periods of time.
 - Inspect tanks every day, especially after a weekend when most thefts occur.
 - Return tanks immediately after use.
 - Inspect and record the condition of each nurse tank upon delivery and return.
 - Store all agricultural chemicals, e.g. bulk, bagged, in a secured area.
 - Where appropriate, use alarm systems to protect secured storage areas and chemicals.
 - Be aware of and maintain inventory control.
 - Lock any containers, equipment, hoppers, tanks and vessels containing product whenever possible.
 - Be aware of signs of theft of anhydrous ammonia, ammonium nitrate or bulk urea.

Law Enforcement

- Urge customers to contact local law enforcement immediately if tampering or theft is suspected or suspicious persons or vehicles are seen.
- Do not approach or confront suspicious individuals.
- Do not disturb the area around a possible crime scene.

CITRUS LEPROSIS, **NOT HERE YET IN FLORIDA, BUT IN MEXICO**

Leprosis is one of the most important citrus diseases in Brazil. This problem is caused by the *Citrus leprosis* virus and is transmitted by mites of *Brevipalpus* spp. It also occurs in other South American countries and has been recently identified in Central America. This northbound spread of leprosis is being considered a serious threat to the Florida citrus industry.

Prior to 1925, leprosis had a negative impact on citrus production in Florida. Then about 1926, the incidence of leprosis in Florida drastically declined, with the decline coinciding with the introduction of sulfur as an effective miticide for controlling citrus rust mite. The last time leprosis was reported in Florida was in the mid-1960s.

This disease alone is responsible for approximately \$60 to 100 million per year losses in Brazil. It is quite difficult to work with the citrus leprosis virus, which has hindered much of the progress regarding its accurate detection. Symptoms require field experience and can be confused with those caused by other plant pathogens. On the other hand, laboratory analysis of lesions is time-consuming, requires experience, and is not always very accurate, leading to some false negatives.



Leprosis produces symptoms on leaves, branches and fruit. It causes lesions in the fruit skin, premature drop of leaves and fruits, and twigs dieback, with the possible death of

the tree. The damage to the branches can decrease the plant productivity after some years because the damaged branches prevent the normal flow of plant sap. With effective mite control, it might take two years for a citrus tree with leprosis to fully recover. Citrus leprosis infects all varieties of sweet orange, and has been reported on lemon and mandarin. Tangerines and tangor are also susceptible to the disease. Grapefruit is reported to be tolerant.




Dissemination of the disease occurs only when infected citrus trees and vectors are present. In citrus, the population of the leprosis mite is low and usually occurs in clusters of trees, which should be monitored carefully. When the trees are contaminated with the leprosis virus, the number of diseased trees will increase as the contaminated mites disperse.

Leprosis control is based mainly on the elimination of the sources of inoculum by pruning the affected trees and by using miticides to reduce the vector. Additional control procedures are also recommended, such as:

- Planting of young trees free from leprosis mites and from leprosis virus
- Controlling the leprosis mites host weeds
- Disinfection of equipment, boxes and vehicles
- Use of mite non-host species as windbreak
- Developing and using procedures that favor the increase of the population of natural enemies of the leprosis mite.

Pesticide Application Recordkeeping Facts

FDACS recommends recordkeeping for **all** pesticide applications regulated by Chapter 487, F.S., using this form or similar format. When properly completed, this form meets restricted use pesticides and the Central Posting requirements for the federal Worker Protection Standard.

Requirement	Florida Pesticide Law (Restricted Use Pesticide Licensed Applicators)	Worker Protection Standards (All Agricultural Use Pesticides)
<ul style="list-style-type: none"> Record Location 	Applicator Records	Central Location 
<ul style="list-style-type: none"> Recordkeeping Time 	2 yrs after application date (Section 487.160)	30 days after the REI expiration time and/or application time (for pesticides without an REI) (Sections 170.122 & 170.222)

Other WPS Pesticide Application Record Timing Considerations for Central Location

If field warning signs are posted for a treated area *before* an application, the pesticide record application information for that application shall be posted at the same time or earlier. The information shall be posted **before** the application takes place, if workers will be on the establishment during application. Otherwise, the information shall be posted at the **beginning** of any worker's first work period.



REMEMBER

Use warnings signs correctly. it's the Law!

The signs shall be posted no sooner than **24 hours** before the scheduled application of the pesticide, remain posted throughout the application and any restricted entry interval. They must be removed within **3 days** after the end of the pesticide application, restricted-entry interval expiration time and before agricultural workers entry is permitted.

QUICK SPANISH TRANSLATION OF PESTICIDE APPLICATION RECORD TERMS:

(Definición en español de términos encontrados en el récord de aplicación de pesticidas)

1. Fecha (R/W) 2. Hora de comienzo (R/W) 3. Hora final (R)	Nombre del aplicador actual si es diferente al mencionado arriba (incluya el número de licencia si aplica) (R)	1. Lugar / Descripción del área tratada (R y W) 2. Cultivo Tratado (R)	Tamaño total del área tratada	4. Nombre del Pesticida (R & W) 5. Núm de Registro de "EPA" (R y W) 6. Ingrediente(s) Activo (W)	Cantidad total del pesticida aplicado (R)	Método de Aplicación (R)	Intervalo de entrada restringida (W)
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Claves-

(R)- Requisito para aplicadores certificados utilizando pesticidas de uso restringido agrícola.

(W)- Requisito bajo las Normas para la Protección al Trabajador Agrícola ("Worker Protection Standard (WPS)" en inglés)



ADAM H. PUTNAM
COMMISSIONER

Florida Department of Agriculture and Consumer Services
Division of Agricultural Environmental Services

SUGGESTED PESTICIDE RECORDKEEPING FORM

Telephone Number (850) 617-7880

FDACS recommends recordkeeping for all pesticide applications regulated by Chapter 487, F.S., using this form or similar format. When properly completed, this form meets the recordkeeping requirements for restricted use pesticides and the central posting requirements for the federal Worker Protection Standard.

Licensed Applicator (R) _____ License No. (R) _____ Property Owner Authorizing Application (R) _____

1. Date 2. Start Time 3. End Time All R/W	Actual applicator if different from above (include license no. if licensed) (R)	1. Location/Description of Treatment Site (R/W) 2. Target Site or Crop (R)	Total Size of Treatment Area (R)	1. Pesticide Brand Name (R & W) 2. EPA Reg. No. (R/W) 3. Active Ingredients (W)	Total Amt. of Pesticide Applied (R)	Application Method (R)	Restricted Entry Interval (W)

(R) = For Restricted Use Pesticides (W) = For Worker Protection Standard Requirement (Vea dorso para definición de términos en español)

FLATWOODS CITRUS NEWSLETTER EVALUATION FORM

Please take a moment to rate the quality and usefulness of the information presented in the Flatwoods Citrus newsletter. Please send back the form to:

Dr. Mongi Zekri
University of Florida, IFAS
Hendry County Extension Office
P.O. Box 68
LaBelle, FL 33975

or **Fax to 863 674 4636** or E-mail to maz@ufl.edu Thank you for your input!!!

Please circle or **bold** your answer

- | | | | | |
|---|---|------------------------------------|----|--------------|
| 1 | Was the information up to date and accurate? | Yes | No | Uncertain |
| 2 | Was the information delivered on time to be useful? | Yes | No | Uncertain |
| 3 | Was the information relevant to your situation? | Yes | No | Uncertain |
| 4 | Was the information easy to understand? | Yes | No | Uncertain |
| 5 | Have you had an opportunity to use the information? | Yes | No | Uncertain |
| 6 | Have you shared the information with someone else? | Yes | No | Uncertain |
| 7 | Overall, how do you feel about the Flatwoods Citrus Newsletter? | | | |
| | Satisfied | Neither Satisfied Nor Dissatisfied | | Dissatisfied |

8 Do you have any suggestions that might improve the newsletter?

(Please write in any comments)

9. How many years have you been using the Extension Service? _____ Years

10. What is your employment status?

- | | | |
|--------------------------|-------------------------|------------------------|
| _____ Grower | _____ Chemical Industry | _____ Service Provider |
| _____ Production Manager | _____ Regulator | _____ University |
| _____ Consultant | _____ Association | Other _____ |

We appreciate your reactions and the time you have given us. Thank you, and please contact us when we may be of service to you.

Citrus Spray Programs

Dr. Jawwad Qureshi and Dr. Phil Stansly, UF IFAS- Immokalee

Asian citrus psyllid (ACP) control has been the main objective of Florida citrus growers for more than 10 years. While some may question the value of controlling ACP in trees with high HLB incidence, replicated field studies have shown the economic benefit of maintaining young flush pathogen free. Good ACP control starts with effective dormant sprays that will control ACP when populations are low, reducing ACP infestation and thus HLB infection of the all-important spring flush. Pyrethroids (Danitol, Baythroid or Mustang) and organophosphates (dimethoate, chlorpyrifos, or Imidan) provide great winter season control of ACP. Best not to use pyrethroids or OPs again during the year except for border sprays which will reduce the need for whole block applications. Follow up with bloom sprays of labeled products to clean up stragglers. Subsequent whole block sprays should target ACP as well as other pests like rust mites and leafminers that may be problematic. The table below offers alternative products for different months, depending on which pests are of major concern at the time. Neonicotinoids like imidacloprid, thiamethoxam or clothianidin have not been included as spray options due to their importance for controlling ACP in young trees. Superscripts after the pesticide name are now in sequential order to facilitate use and correspond to superscripts after pests controlled. Make choices based on: (1) effectiveness against ACP and other pests that may be problematic, (2) avoiding repetition of any insecticide mode of action in the interest of resistance management, and (3) rebuilding and maintaining an effective natural enemy complex in the grove. Confining the broad-spectrum insecticides (pyrethroids and organo-phosphates) to the winter season and border sprays during growing season will help conserve these products as well as populations of beneficial insects and mites.

Spray Options for Citrus Pest Management

Dormant Season

Growing Season

Months	Nov-Dec	Jan	Feb-Mar	Apr	May - June	July - Aug	Sep-Oct
Products * Labeled for bloom	OP ¹ (e.g. Imidan, Dimethoate, chlorpyrifos)	Pyrethroid ² (Mustang, Danitol, Baythroid)	*Sivanto ³ *Movento ⁴ *Portal ⁵ *Micromite ⁶ Intrepid ⁷ Exirel ⁸	Portal ⁵ Micromite ⁶ Exirel ⁸ Apta ⁹ Sivanto ³ Oil ¹³	Movento ⁴ Delegate ¹¹ Abamectin ¹² Knack ¹⁴ Exirel ⁸ Apta ⁹ Sivanto ³ Oil ¹³ MinectoPro ¹⁰	Sivanto ³ Apta ⁹ OP ¹ MinectoPro ¹⁰ Oil ¹³	Movento ⁴ Delegate ¹¹ Apta ⁹ Sivanto ³ Oil ¹³
Pests	ACP Weevils	ACP Weevils	ACP Mites Leafminer Weevils Scales Aphids	ACP Mites Leafminer Weevils Aphids	ACP Rustmite Leafminer Scales	ACP	ACP Rustmite Leafminer
<p>ACP⁺⁺⁺ 1,2,3,4,8,9,10 ACP⁺⁺ 5,11 ACP⁺ 6,12 Leafminer^{6,7,8, 9,11, 12} Rustmite^{4, 12} Scales^{4,13} Aphids^{3,4} Mealybugs^{3,4} (+++ excellent, ++ good, + fair)</p>							

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