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Institute of Food and Agricultural Sciences

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Flatwoods Citrus

Vol. 24, No. 4 June 2021

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

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July 2021 Zoom Citrus Seminar
Wednesday, July 14, 2021

1 CEU for pesticide license renewal
1 CEU for certified crop advisors

10:00 AM – 10:30 AM
Title: **Fresh Fruit Options for Florida Growers in the 20s**
Many new fresh fruit cultivars have been released by various breeding programs in the past decade for Florida growers, and some of these have gone into production. Urgent demands from growers for opportunities to remain competitive in the marketplace have led to a situation where risk is high and questions are many. This presentation will cover what is known about some of the current options, as well as consideration of the unknowns. What to plant now is among the most difficult questions posed to researchers to answer in good conscience; no prescriptive advice will be given, but rather the focus will be on assessing risks and rewards in this current time.

By **Dr. Fred Gmitter**
Professor, Citrus Breeding
University of Florida/Institute of Food and Agricultural Sciences
Citrus Research and Education Center, Lake Alfred

10:30 AM – 11:00 AM
Title: **Processing Sweet Orange Options for Florida Growers in the 20s**

By **Dr. Jude Grosser**
Professor, Citrus Breeding
University of Florida/Institute of Food and Agricultural Sciences
Citrus Research and Education Center, Lake Alfred

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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 June 2021

ENSO Alert System Status: Not Active

Synopsis: ENSO-neutral is favored through the Northern Hemisphere summer (78% chance for the June-August season) and fall (50% chance for the September-November season).

ENSO-neutral conditions continued during May, with near-average sea surface temperatures observed across most of the equatorial Pacific Ocean (Fig. 1). In the last week, the Niño indices were all at -0.2ºC, except for the Niño-1+2 index, which was -0.4ºC (Fig. 2). Subsurface temperature anomalies remained positive but decreased slightly (Fig. 3) due to the weakening of above-average subsurface temperatures around the thermocline in the central Pacific Ocean (Fig. 4). Low-level easterly and upper-level westerly wind anomalies extended across most of the equatorial Pacific Ocean. At the Date Line, tropical convection was mostly near average, and enhanced rainfall was evident over the western Pacific Ocean (Fig. 5). Overall, the ocean and atmosphere system reflected ENSO-neutral conditions.

A majority of the models in the IRI/CPC plume predict ENSO-neutral to continue through the fall 2021 (Fig. 6). The forecaster consensus generally agrees with this model outlook, although lower probabilities are assigned to El Niño during this period (remaining less than 10%). By the late fall and winter, La Niña chances increase to near 50%, reflecting the historical tendency for a second winter of La Niña following the first, and also the predictions from the North American Multi-Model Ensemble. However, these cooler conditions are predicted to exist for a short duration (3 overlapping seasons) and these predictions are still over 6 months into the future. In summary, ENSO-neutral is favored through the Northern Hemisphere summer (78% chance for the June-August season) and fall (50% chance for the September-November season; click CPC/IRI consensus forecast for the chances in 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). Additional perspectives and analysis are also available in an ENSO blog. A probabilistic strength forecast is available here. The next ENSO Diagnostics Discussion is scheduled for 8 July 2021. 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

Neutralizing Excess Bicarbonates from Irrigation Water in Florida

By Gerald Kidder and Ed Hanlon, UF-IFAS

Many sources of irrigation water in Florida contain dissolved bicarbonates. Irrigation with such water can cause adverse plant growth by excessively raising the pH of the soil. The magnitude of the effect depends on the concentration of the bicarbonates in the water, the amount of the water applied, the buffering capacity of the soil, and the sensitivity of the citrus variety/rootstock being grown.

This publication addresses this important water quality problem and suggests management practices to minimize adverse effects on citrus tree growth and production.

1. Where in Florida is the problem most likely to occur?

The problem of high dissolved bicarbonates is likely to occur wherever water comes from a limestone aquifer, such as the Floridan or Biscayne, or from lakes or canals that cut into limestone. Thus, this is a potential problem in most of Florida.

2. How can I find out if I have high-bicarbonate water?

A water test is the surest means of determining if a problem exists.

3. Isn't it sufficient to just measure the water's pH?

If the pH of your irrigation water is below 7.0, then we may safely assume that it will not be a significant source of liming materials. However, if the pH is above 7.0, we know that the water contains bases but we don't know how much. For example, one water source may have a relatively high pH of 8 and yet contain a very low level of bicarbonates. Another water source, with the same pH, may have a very high bicarbonate level.

4. How are Ca and Mg analyses useful?

Multiplication of parts per million (ppm) Ca by 0.05 and ppm Mg by 0.083, and summing the two products, will give the milliequivalents of those cations per liter (me/L) of water. In many cases, Ca and Mg will be associated with bicarbonate and carbonate salts. Under those conditions, the me/L of Ca plus Mg will be a good estimate of the me/L of associated bases. However, if other non-basic ions such as sulfate are present, the calculation would overestimate the base content of the water. Thus, Ca and Mg analyses may be useful in estimating base content but should be used with caution.

5. In which crop situations am I likely to have a problem with high pH water?

Trifoliate and most trifoliate hybrid rootstocks are particularly sensitive to high pH soil, are trees budded onto them usually exhibit ill effects of high bicarbonate water through micronutrient deficiency symptoms. Trees budded on Swingle rootstock are well-known for their sensitivity to pH-induced iron chlorosis. Trees budded on citrange rootstocks have shown manganese and zinc deficiencies when the soil pH has been raised by heavy or prolonged use of "hard" water (i.e., water with lots of Ca and Mg bicarbonates).

6. Which irrigation situations are most problematic?

Heavy irrigations applied to soils of low buffering capacity will present the most problems to citrus trees.

7. What can I do to minimize the adverse effects of high-bicarbonate water?

Be careful not to over-irrigate. Know the water holding capacity of your soil and apply only enough water without exceeding the root zone water-holding capacity. Over-irrigation is costly in many ways -- the cost of pumping, of leached nutrients, of wasted water resources and, in this case, of accelerating the increase in soil pH. Avoid these with good irrigation management.

Apply acids or acid-forming materials to the soil to counteract the bases applied in the water.

Neutralize the liming effect of the water by adding acid to the water before it is applied to the trees.

8. What can be done if the trees are already suffering from water-induced high pH?

Where high levels of bicarbonates in the water have caused soil to be too high for proper tree performance, it may be necessary to lower the soil pH. This may be accomplished by addition of extra acid in the irrigation water, use of acid-forming fertilizer in certain cases, or application of elemental sulfur to the soil.

It is important to note that the acid-producing effect of sulfur comes from the formation of sulfuric acid when soil bacteria act on the elemental sulfur. The sulfate form of sulfur applied in fertilizers such as potassium sulfate, magnesium sulfate, or gypsum (calcium sulfate) does not have the acid-producing effect of elemental sulfur.

Sulfur application rates of 300 to 500 pounds per acre should not be exceeded. This rate is equivalent to between 0.7 and 1.1 lbs/100 square feet of treated surface area. Over-application of sulfur or acid can cause damage to trees, an effect you certainly want to avoid. Monitor changes carefully.

Remember the pH will increase again as you continue to irrigate with high bicarbonate water. Water or soil acidification will be a continuing effort.

9. Can acid-forming fertilizers keep the soil pH from getting too high?

Under many circumstances, the quantity of bases that is being supplied in the irrigation water far exceeds the quantity of acid formed by addition of fertilizers. Under those conditions acid-forming fertilizer will not control the problem of increasing soil pH.

10. How can I neutralize the bicarbonates in my irrigation water?

Injection of acid into the irrigation water is a direct way of neutralizing the bases present. Acid may be injected in much the same way as fertilizer. You must take precautions to avoid injuring yourself and your trees and to avoid contamination of the aquifer. These points are discussed below.

11. How much acid should I apply?

The amount of acid that you mix with the irrigation water will depend on the quantity of bases your water contains and on the strength of the acid you use. The base content of the water is determined in the water test and the strength of the acid is given on the container. One milliequivalent (me) of acid completely neutralizes one milliequivalent of base. For example, if an irrigation water contains 5.2 me of bases per liter, it would take 5.2 me of acid to completely

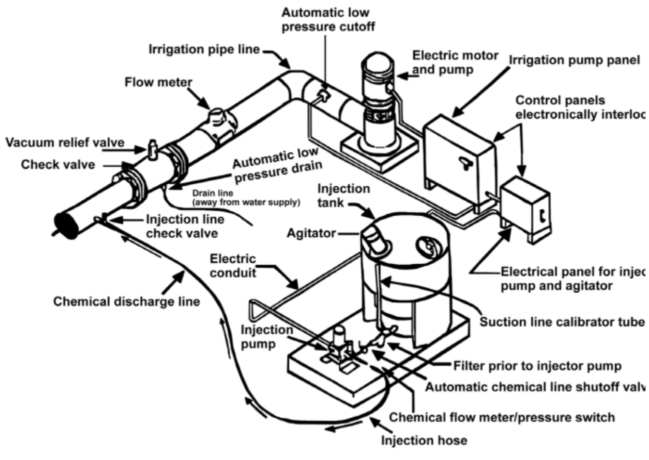
neutralize the liter of water. Neutralization of 80 to 90% of the bases in water is a reasonable goal for most irrigation situations.
Multiply the factor by the milliequivalents of base per liter (me/L) which your water contains. This value is determined in the laboratory test of your water or is estimated from its Ca and Mg contents. The result is the milliliters of your acid which you should apply to each 100 gallons of your water. The factor is calculated to neutralize 80% of the bases in the water. There are 29.6 ml in one U.S. fluid ounce. Divide the number of ml by 29.6 to convert to U.S. fluid ounces.

$$80\% \times \frac{me\ base}{L\ water} \times \frac{378\ L}{to\ be\ neutralized} \times \frac{1}{34.7\ N\ acid} = 8.7 \times \frac{me\ base}{L\ water}$$

NOTE: When calculating your rates for larger volumes, be careful not to round off too soon when making conversions.

12. Why not neutralize 100 percent of the bases?

Some of the reasons for not attempting to neutralize 100% of the bases are:
It is not necessary to neutralize all of the bases in order to reduce the problem to insignificant levels. Not trying for 100% neutralization allows some room for error in acid application rates, variability in water, etc. The risk of over-acidifying is not worth the benefit of neutralizing the last 10 or 20 % of the bases. It is poor management to spend money and effort creating new problems by over-reacting to the initial problem.



13. In what kind of irrigation system can I practically inject acid?

Neutralization is relatively easy to accomplish in microirrigation systems. The system must allow careful addition of known volumes of acid to known volumes of water. Since acids can be quite corrosive to metals, the system must be able to withstand this possible adverse effect.
NOTE: It is illegal to inject any chemicals into irrigation systems without appropriate safety devices which will automatically prevent the backflow of water and chemicals to the water supply. This is done to protect our water resources.

14. What kind of acid can I use?

The most commonly used acids are sulfuric, hydrochloric, and phosphoric acid. Other acids could be used but cost and availability usually limit the choices to these three. Phosphoric and sulfuric acids may have some nutritional value but this should be a minor consideration in choosing an acid for water neutralization.

15. What are the dangers of using acids for water neutralization?

Hydrochloric, sulfuric and phosphoric acids are highly toxic materials irritating to the skin, eyes, nose, throat, lungs, and digestive tract. Always wear goggles and chemical resistant (rubber, neoprene, vinyl, etc.) gloves, apron and boots whenever handling these acids. Acid must be poured into water, never vice

versa, and should be done in a well-ventilated area.
Should a spill or splash occur, remove all clothing and shower immediately. Immediately irrigate eyes with large quantities of water. Seek immediate medical attention.
It is generally advisable to dilute concentrated acid in a nonmetal mixing tank prior to injection into the irrigation system, rather than injecting concentrated acid directly. Most metal fittings, tanks, and other parts of the irrigation system will be damaged by acid, so proper precautions must be taken. Flushing the system after application is frequently sufficient to avoid significant damage.
In addition to the dangers involved with handling strong acids there is also the danger of over-application of acid. Excess acid addition could result in injury to tree parts, which come in direct contact with the water, such as leaves. Also, an excessive acidification of the soil could result in tree injury or death. These problems can be avoided by (1) determining the proper amount of acid to apply and (2) monitoring the irrigation system to ensure that the correct amount is applied.

16. How can I assure that I'm adding the correct amount of acid to my water?

Monitoring the pH of the acid-treated water is one way of checking on a daily operational basis. You can do this with a pH meter. Add acid to bring the water pH to between 4.5 and 5.0. Because the neutralization reaction continues slowly over a period of a day or two, the measured pH of the water immediately after acid addition will usually be lower than that measured once the reaction is complete. For monitoring purposes during acid additions, use the pH measured immediately after acid addition as a guide to avoid over-acidifying.
If the pH after treatment is very different from that calculated from the chemical analysis, you may want to have another water sample analyzed.

Summary

1. Have your irrigation water tested.
2. Select an acid of known strength.
3. Determine how much of your acid is needed to neutralize 80% of the bases in your water.
4. Add the calculated amount of acid to your water.
5. Measure the pH of the water as it comes out of the irrigation line.
6. If the pH is not between 4.5 and 5.0, increase or decrease the amount of acid.
7. If the amount of adjustment in Step 6 is more than 15 to 20% of the calculated value, consult a specialist before extended use of the system.
8. Retest the well water and irrigated soil about once a year and keep a record of the test results.

CITRUS RUST MITES

The citrus rust mite (CRM) is an important pest of fruit grown for the fresh market. On some specialty varieties (such as Sunburst tangerine), damage may be particularly severe on stems and foliage, causing leaf injury and possible abscission. Fruit damage is the main concern with other varieties. CRM feeds on green stems, leaves, and fruit. Egg deposition begins within 2 days after the female reaches sexual maturity and continues throughout her life of 14 to 20 days. The female lays one to two spherical transparent eggs per day and as many as 30 during her lifetime. Eggs hatch in about 3 days at 81°F. The newly hatched larva resembles the adult, changing in color from clear to lemon yellow (CRM). After about 2 days at 81°F, molting occurs. The first nymphal stage resembles the larval and requires about 2 days to molt to an adult at the above temperature. The CRM adult has an elongated, wedge-shaped body about three times longer (0.15 mm) than wide. CRM usually is straw to yellow in color. CRM population densities increase in May-July and then decline in late August, but can increase again in late October or early November. Mite densities in the fall rarely approach those early in the summer. During the summer, CRM are more abundant on fruit and foliage on the outer margins of the tree canopy. Generally, the north bottom of the tree canopy is preferred and supports the highest mite populations. The least favorable conditions for CRM increase are found in the south top of the tree canopy.

Visible characteristics of injury differ according to variety and fruit maturity. When rust mite injury occurs on fruit during exponential growth, before fruit maturity (April to September), epidermal cells are destroyed resulting in smaller fruit. Early season rust mite injury is called "russeting." Rust mite injury to mature fruit (after September) differs significantly from early "russeting." Unlike "russeting" on fruit, fall damaged fruit will polish since the natural cuticle and wax layer remain intact. This condition is known as "bronzing." While the primary effect of fruit damage caused by rust mites appears to be a reduction in grade, other conditions have been associated with severe fruit injury that include reduced size, increased water loss, and increased drop.

Leaf injury caused by feeding of CRM exhibits many symptoms on the upper or lower leaf epidermis. When injury is severe, the upper cuticle can lose its glossy character, taking on a dull, bronze-like color, and/or exhibit patchy yellowish cells in areas of "russeting" that have been degreened by ethylene release during the wounding process. Lower leaf surfaces often show "mesophyll collapse" appearing first as yellow degreened patches (collapsed spongy mesophyll cells) and later as necrotic spots. With the exception of upper leaf epidermal injury to some specialty varieties, such as Ambersweet, Fallglo, and Sunburst, defoliation caused by CRM is rarely severe.

The need for chemical treatments to control rust mites is dictated by numerous biological attributes of the mites, marketing objectives for the fruit, and horticultural practices. These key biological factors include: 1) inherent ability of mites to quickly increase to injurious densities on fruit and sustain the potential for reproductive increase over time; and 2) small size, which makes it difficult to monitor population densities in the field and detect injurious levels until visible injury has occurred on the fruit. The marketing objective for fruit is particularly important. Cosmetic appearance is a priority for fruit grown for the fresh market. Fruit growth and abscission are not affected until 50% to 75% of the surface has been injured. Thus, there is reduced justification for chemical control of rust mites on fruit grown for processing. Citrus groves producing fruit designated for the fresh market may receive three or four miticides per year, typically during April, June, August, and October. In contrast, groves producing fruit designated for processing receive zero to two treatments per year. Miticides applied for the control of rust mites on fresh fruit varieties are often combined with compatible fungicides in the spring and summer. An alternative approach is using FC 435-66, FC 455-88, or 470 petroleum oil as a fungicide for greasy spot control and to suppress pest mites.

From a horticultural perspective, canopy density has an effect on rust mite populations and their ability to increase over a short period of time. The denser the canopy, the less favorable conditions are for a rapid rust mite increase. Since most registered miticides have no ovicidal activity and short residual activity on fruit and foliage, residual control is generally better if the miticide is applied when rust mite adult and egg population densities are low for fresh market varieties.

Since external blemishes caused by rust mites, fungal diseases, and wind are less important when fruit are grown for processing, the chemical control strategy for rust mites can be modified significantly. A summer spray is often required for greasy spot control. Use of petroleum oil in place of copper will reduce the likelihood of requiring a subsequent miticide treatment. Further miticide treatment may be unnecessary. However, a second petroleum oil application may be required for greasy spot control on summer flush.

Many scientific methods for sampling or scouting rust mite populations have been described. Of these, three general approaches are in widespread use: 1) determining the percentage of fruit and/or leaves infested with rust mites, 2) qualitative rating scales and 3) individual adult mite counts taken from fruit on randomly selected trees. These sampling approaches are similar in that they are designed to avoid bias by randomly selecting different representative areas within a grove for sampling, avoiding border rows, and selecting fruit and/or leaves within a tree randomly.

One sampling method based on rust mite density (rust mites/square centimeter [cm^2]) is described.

Processed Fruit: Initiate rust mite monitoring in April on leaves and fruit through casual observations and continue every 2 to 3 weeks throughout the fruit season. Select trees at random and within uniformly distributed areas throughout a 10- to 40-acre block representing a single variety with uniform horticultural practices. Avoid sampling adjacent trees. Fruit should be sampled at random representing the four quadrants of the tree and taken midway in the canopy (between interior and exterior). One fruit surface area should be examined midway between the sun and shade areas. The number of rust mites per cm^2 should be recorded and averaged for the 10 acres, represented by 20 trees with four fruit per tree or 80 readings per 10 acres. Six rust mites/cm^2 would be a planning threshold where pesticide intervention may be required within 10 to 14 days. Ten rust mites/cm^2 would be an action threshold where treatment would be required as soon as possible.

Fresh Fruit: Similar to above except monitor every 10 to 14 days with an average of 2 CRM/cm^2 as an action threshold.

For more information, go to:

https://crec.ifas.ufl.edu/media/crecifasufledu/production-guide/production-guide-20202021/Rust-Mites.pdf

TABLE 1. Control Thresholds and Appropriate Sample Sizes for 10 Acres

If the control threshold is:	**Sample size** (Sample trees should be uniformly scattered across a 10-acre block. Do not sample adjacent trees.)
5 mites/leaf	Examine 4 leaves/tree from 6 trees/area from 4 areas/10 acres = 96 leaves on 24 trees/10 acres
8 mites/leaf	Examine 4 leaves/tree from 6 trees/area from 3 areas/10 acres = 72 leaves on 18 trees/10 acres
10 mites/leaf	Examine 4 leaves/tree from 5 trees/area from 2 areas/10 acres = 40 leaves on 10 trees/10 acres
15 mites/leaf	Examine 4 leaves/tree from 4 trees/area from 2 areas/10 acres = 32 leaves on 8 trees/10 acres

TABLE 2. Citrus Miticide Selection*

Supplemental (early Spring)	Post Bloom	Summer	Fall	Supplemental Fall
--	--	Agri-mek + oil	--	--
Apta	Apta	--	Apta	Apta
--	--	--	Comite	Comite
Envidor	Envidor	Envidor	Envidor	Envidor
--	Petroleum oil	Petroleum oil	Petroleum oil	--
--	--	--	Sulfur	Sulfur
--	--	Micromite	Micromite	--
--	--	--	Nexter	Nexter
Movento	Movento	Movento	--	--
Vendex	Vendex	--	Vendex	Vendex

*Except for petroleum oil, do not use the same miticide chemistry more than once a year.

GREASY SPOT FUNGAL DISEASE

Management of greasy spot must be considered in groves intended for processing and fresh market fruit. Greasy spot is usually more severe on leaves of grapefruit, pineapples, Hamlins, and tangelos than on Valencias, Temples, Murcotts, and most tangerines and their hybrids.

Greasy spot spores germinate on the underside of the leaves and the fungus penetrates through the stomates (natural openings on lower leaf surface). Warm humid nights and high rainfall, typical of Florida summers, favor infection and disease development.

On processing Valencias, a single spray of oil (5-10 gal/acre) or copper + oil (5 gal/acre) should provide acceptable control when applied from mid-May to June. With average quality copper products, 2 lb of metallic copper per acre usually provide adequate control. The strobilurin fungicides (Abound, Gem, Headline or Quadris), as well as Enable 2F, are also suitable with or without petroleum oil. On early and mid-season oranges and grapefruit for processing, two sprays may be needed especially in the southern part of the state where summer flushes constitute a large portion of the foliage. Two applications also may be needed where severe defoliation from greasy spot occurred in the previous year. In those cases, the first spray should be applied from mid-May to June and the second soon after the major summer flush has expanded. Copper fungicides provide a high degree of control more consistently than oil sprays. Control of greasy spot on late summer flushes is less important than on the spring and early summer growth flushes since the disease develops slowly and defoliation will not occur until after the next year's spring flush. Thorough coverage of the underside of leaves is necessary for maximum control of greasy spot, and higher spray volumes and slower tractor speeds may be needed than for control of other pests and diseases.

The program is essentially the same for fresh fruit. That is, a fungicide application in May-June and a second in July should provide control of rind blotch.

A third application in August may be needed if rind blotch has been severe in the grove. Petroleum oil alone is less effective than other fungicides for control of greasy spot rind blotch (GSRB). Heavier oils (455 or 470) are more effective for rind blotch control than are lighter oils (435).

Copper fungicides are effective for control of GSRB, but may result in fruit spotting especially if applied at high rates in hot, dry weather or if applied with petroleum oil. If copper fungicides are applied in summer, they should be applied when temperatures are moderate, at rates no more than 2 lb of metallic copper per acre, without petroleum oil or other additives, and using spray volumes of at least 125 gal/acre. Enable 2F can be applied for greasy spot control at any time but is especially indicated in mid to late summer for rind blotch control.

The strobilurin fungicides (Abound, Gem, Headline, Pristine or Quadris Top) or Enable 2F can be applied at any time to all citrus and provide effective control of the disease on leaves or fruit. Use of a strobilurin (Abound, Gem, Headline, Pristine or Quadris Top) is especially indicated in late May and early June since it will control both melanose and greasy spot and avoids potential fruit damage from the copper fungicides at that time of year. A strobilurin fungicide should not be applied more than once a year for greasy spot control. Addition of petroleum oil increases the efficacy of these products.

•Processed fruit

May-June

- Petroleum oil (455, 470) 5-10 gal
- Cu fungicides 2-4 lb metal
- Abound, Gem, Headline + 5 gal oil
- Pristine
- Amistar Top
- Enable

July

- Petroleum oil (455, 470) 5-10 gal
- Cu fungicides 2-4 lb metal
- Abound, Gem, Headline + 5 gal oil
- Pristine
- Amistar Top
- Enable

•Fresh fruit

May-June

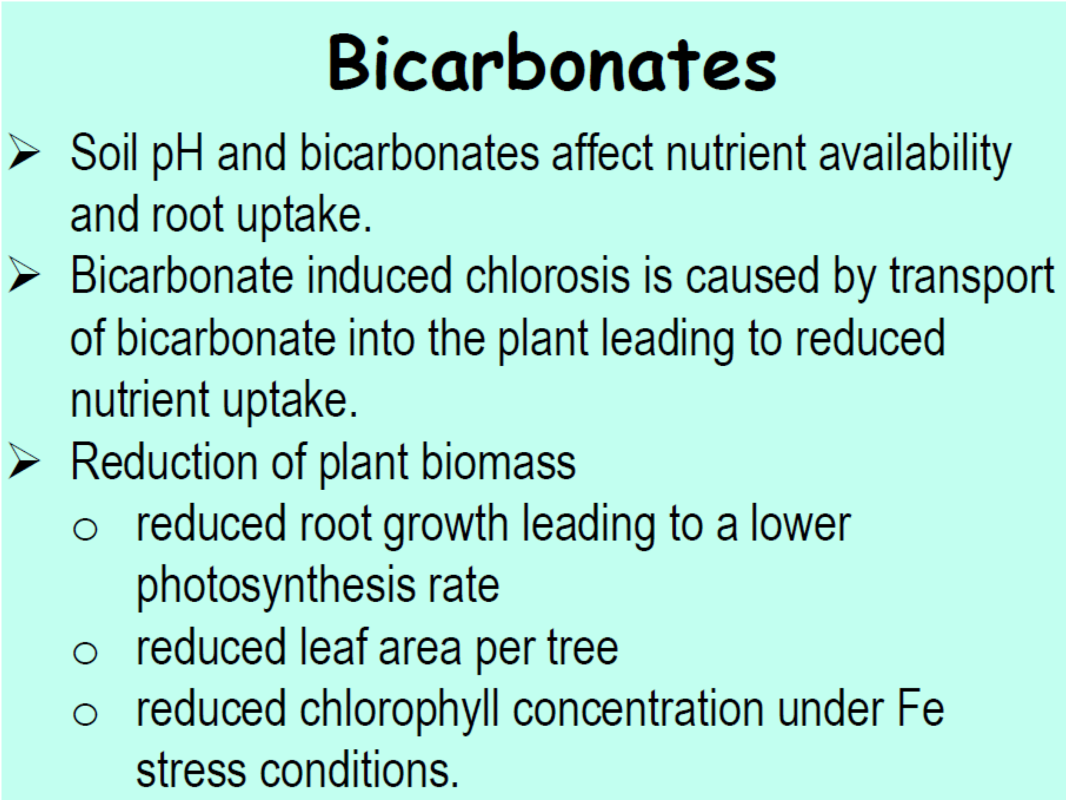
- Petroleum oil (455, 470) 10 gal
- Cu fungicides < 2 lb metal, No oil
- Abound, Gem, Headline + 5 gal oil
- Pristine
- Amistar Top
- Enable

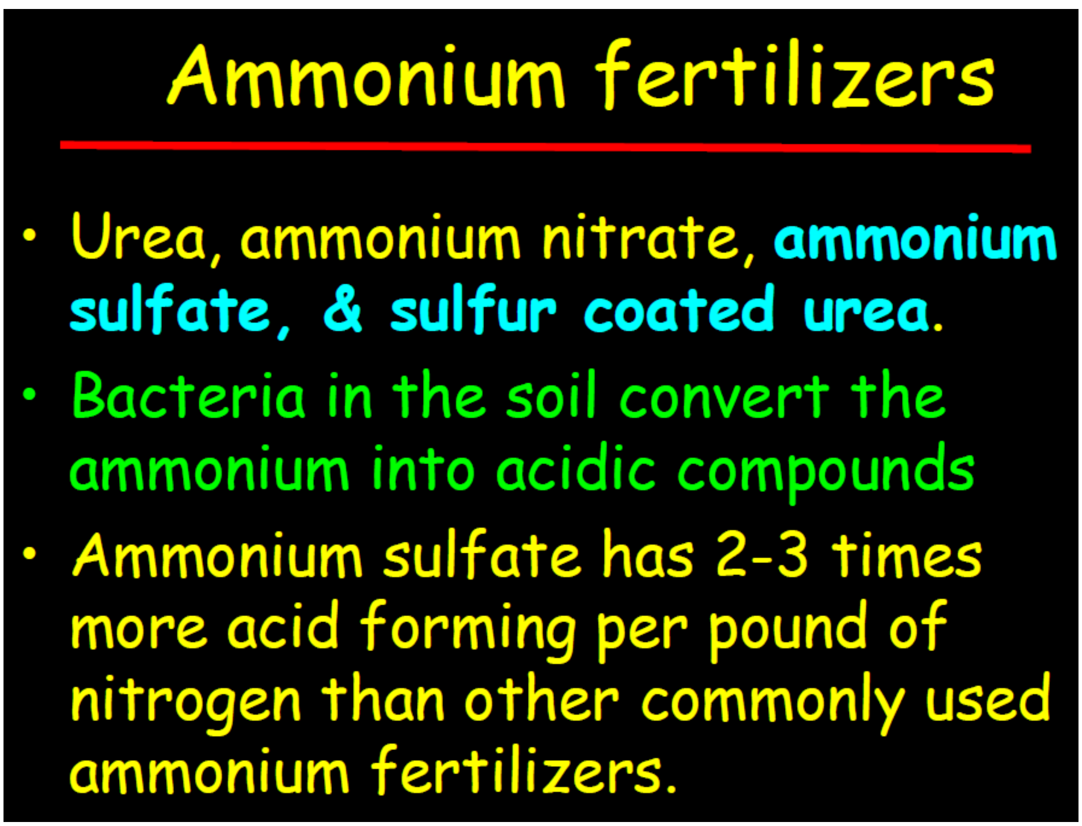
July

- Petroleum oil (455, 470) 10 gal
- Cu fungicides < 2 lb metal
- Abound, Gem, Headline + 5 gal oil
- Pristine
- Amistar Top
- Enable 8 oz

For more information on greasy spot, go to:
https://crec.ifas.ufl.edu/media/crecifasufledu/production-guide/production-guide-20202021/Greasy-Spot.pdf

A few important slides from Dr. Brian Boman (Professor Emeritus, UF-IFAS) presentation





Sulfur Fertilization

Sulfate sulfur (SO_4)

- Often contained in mixed fertilizers
- Will not acidify soils

Elemental Sulfur (S)

- Used for soil acidification
- Not available to plants until oxidized by soil bacteria to sulfate form
- Takes several months

Water quality (meq/L or ppm $CaCO_3$)	Approximate pounds of pure $CaCO_3$ added per acre by 15 ac-in of water	Approximate amount of acid-producing materials per *wetted* acre to neutralize 100% of the bases from the water				
		46% Sulfuric acid (gallons)	Elemental sulfur (pounds)	Tiger 90 (lbs)	Ammonium sulfate (pounds)	Ammonium nitrate (pounds)
1 (61)	169	23	56	63	150	281
2 (122)	338	45	113	125	300	563
3 (182)	506	69	169	188	450	844
4 (244)	675	93	225	250	600	1125
5 (305)	844	116	281	313	750	1406
6 (366)	1013	138	338	375	900	1688
7 (417)	1181	162	394	438	1050	1969
8 (488)	1350	185	450	500	1200	2250
9 (549)	1519	207	506	563	1350	2531
10 (610)	1688	231	563	625	1500	2813

150 tree/ac x 25 gal/day x 110 days = 15 ac-in
(21,154 gal/ac-in)

bicarbonate in meq/l $CaCO_3$ x 61 = ppm

Adapted from: Kidder and Hanlon, UF/IFAS Exten. Pub. SL142

Lbs elemental S needed to lower soil pH of a sandy soil to a depth of 6 in.

Existing soil pH	Desired soil pH 6.5	6.0	5.5	5.0
8.0	876	1167	1459	1751
7.5	584	876	1167	1459
7.0	292	584	876	1167

adapted from: http://www.ipm.iastate.edu/ipm/hortnews/1994/4-6-1994/ph.html

For pH of 7.8, S needed to reduce soil to pH of 6.5

= 292 + 8*(876-292)/10 = 759 lb

Only wetted area needs to acidified, so assume 50% of area

759 lb S/ac x 50% = 380 lb/ac S

Summary

- **Bicarbonates form salts with Ca, Mg, Na, and K.**
- **Higher calcium carbonate in soils increases pH making many nutrients less available.**
- **Bicarbonates have a physiological affect on roots reducing nutrient absorption.**
- **Standard water treatment is to lower pH by adding acid. Lowering the pH to 6.5 neutralizes about half the bicarbonate in the water.**
- **Soil treatments:**
  - **calcium or gypsum (calcium sulfate) to increase calcium availability to plants and soil,**
  - **elemental sulfur can be used to reduce soil pH,**
  - **applications of acidified water or acidic fertilizer**

HOW TO REDUCE DRIFT?

■ Avoid high spray pressure, which create finer droplets. Use as coarse a spray as possible and still obtain good coverage and control.
■ Don't apply pesticides under windy or gusty conditions; don't apply at wind speeds over 10 mph. Read the label for specific instructions.
■ Maintain adequate buffer zones to insure that drift does not occur off the target area.
■ Be careful with all pesticides. Insecticides and fungicides usually require smaller droplet sizes for good coverage and control than herbicides; however, herbicides have a greater potential for nontarget crop damage.
■ Choose an application method and a formulation that is less likely to cause drift.
■ Use drift reduction nozzles.
■ Use wide-angle nozzles, lower spray boom heights, and keep spray boom stable.
■ Use drift control/drift reduction agents. These materials are designed to minimize the formation of droplets smaller than 150 microns. They help produce a more consistent spray pattern and aid in deposition. Drift control additives do not eliminate drift. Therefore, common sense is still required.
■ Apply pesticides early in the morning or late in the evening; the air is often more still than during the rest of the day.
■ Don't spray during thermal inversions, when air closest to the ground is warmer than the air above it. When possible, avoid spraying at temperatures above 90° F.
■ Know your surroundings! You must determine the location of sensitive areas near the application site. Some crops are particularly sensitive to herbicides, which move off-site.
■ Be sure you are getting the spray deposition pattern you think you are; service and calibrate your equipment regularly.
■ Whenever possible, cut off the spray for missing trees in the row. Spray that does not enter the tree canopy is wasted and contributes significantly to drift problems.
■ Keep good records and evaluate pesticide spray results.

Remember,
ALWAYS read and follow label directions.

WEED MANAGEMENT

Weeds can reduce the growth, health and survival of young trees, or the time to come into bearing and ultimately fruit production. The more competitive the weeds, the more adversely they alter tree physiology, growth, fruit yield and quality. The attainment of early crop production requires controlling the growth of weeds. Weeds alter economic status by competing with trees, particularly young trees, for water, nutrients and even light in the case of climbing vines, which can easily cover trees if left uncontrolled.

Weeds also have various effects on tree performance including reduced efficacy of low volume irrigation systems, and interception of soil-applied pesticides.

Management Methods

Cultural & mechanical

Cultural methods include off-target irrigation and fertilizer applications. Mechanical methods include cultivation in row middles. However, **constant cultivation results in the destruction of citrus fibrous roots, which normally would grow in the undisturbed portion of the soil.**

Mowing is practiced between the tree rows and away from the trees in combination with herbicide applications in the tree row over the major root zone of trees. It is appropriate where a cover crop is desired in bedded groves to prevent soil erosion. Weeds can also be spread by seed and vegetatively during mowing operations, reinfesting tree rows where herbicides have been applied. **Mowing before seedhead formation is necessary to reduce seed dissemination and reinfestation.**

Chemical mowing

Chemical mowing, utilizing Low Rate Technology (LRT) postemergence herbicide spray applications and wiping in combination with mechanical mowing, is used for the suppression of vegetation in row middles. With the high frequency and cost of mechanical mowing required to maintain vegetation control in row middles, chemical mowing and wiping with low rates of glyphosate has increased. Weed management in Middles by chemical applications results in the elimination of tall growing species and establishment of more manageable sod type species such as Bermuda and Bahia grasses.

Chemical

Generally speaking, all weed species listed as susceptible on the herbicide product label will be controlled by that herbicide at the appropriate rate, time of application and stage of growth. Environmental and plant conditions before, during and following the application are also important including moisture in the form of rainfall and/or irrigation.

Poor control can sometimes be expected from postemergence applications to weeds under stress conditions due to poor uptake and translocation of applied herbicides. Assuming that the appropriate herbicide or herbicide mixtures are selected for the weed species present, failures in the program will usually be due to one of the above factors or to the actual application including calibration and/or equipment design and operation.

Herbicides may be classified as foliar or soil-applied. Foliar applied materials may have systemic or contact activity. Soil applied preemergence herbicides are absorbed through weed root systems, being most effective during germination and early seedling growth stages. Systemic herbicides are those that are absorbed by either roots or aboveground plant parts and are translocated throughout the plant. Contact herbicides act as desiccants, damaging or killing all plant parts actually sprayed with little if any translocation.

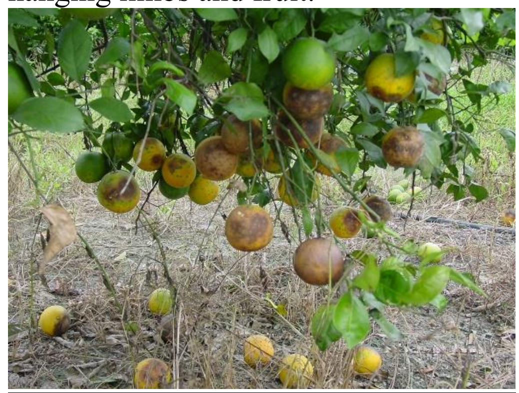
For the control of well-established perennial weeds, a postemergence herbicide with systemic metabolic activity should be used with preemergence soil residual products.

Timing and frequency of application are the keys to good vegetation management. **Increased application frequency of lower rates of soil residual herbicides is more effective in young groves where vegetation presence is greater due to more exposure of the grove floor to sunlight and where a greater herbicide safety factor is required**.

Application Technology

Rapid advances in herbicide application technology have resulted in the development of sophisticated equipment. Application equipment is now capable of selective delivery of multiple herbicide products, each directly injected into booms. In a single application, tree rows and row middles may be treated with soil residual and postemergence products with selectivity for tree age, soil type and vegetation species.

Well-maintained, accurately calibrated equipment with good filtration and agitation systems capable of uniform distribution of prescribed spray volumes and droplet size is essential for efficiency, cost-effective vegetation management. Worn nozzle tips result in increased spray delivery rates and distortion of distribution patterns and should be checked regularly. Improved herbicide boom design to reduce tree skirt contact, spray drift and interference of heavy weed cover with nozzle output will reduce tree damage and fruit drop while improving control of target vegetation. Tree skirt pruning and timing of postemergence applications will also reduce boom and spray contact with low hanging limbs and fruit.



Environmental Considerations

In determining management options, herbicide selection should be based not only on species and stage of vegetation development, but product solubility and leaching potential, soil type and rainfall distribution. Objectives are to reduce weed competition and interference through measured vegetation control/suppression with inputs having reduced potential for leaching through over-irrigation, runoff and erosion, chemical drift, or other off-target impacts. CAUTION: Herbicides may move through the soil to groundwater. Several factors influence the rate of this movement. Lower rates applied more frequently combined with sound irrigation management practices will reduce herbicide movement. **The use of bromacil-containing herbicides is prohibited on deep, sandy Ridge-type soils**. For more information and for the list of herbicides registered for citrus in Florida, go to: https://crec.ifas.ufl.edu/media/crecifasufledu/production-guide/production-guide-20202021/Weeds.pdf

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 (Nov-Dec through Feb-Mar) — **Growing Season** (Feb-Mar through Sep-Oct)

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

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)

Flatwoods Citrus

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__Asian American
__Hispanic
__White, non-Hispanic
__Black, non-Hispanic

Gender

__Female __Male