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# Flatwoods Citrus



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**Multi-County Citrus Agent, SW Florida**



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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**  
11 June 2020

**ENSO Alert System Status: Not Active**

**Synopsis: There is a ~60% chance of ENSO-neutral during Northern Hemisphere summer 2020, with roughly equal chances (~40-50%) of La Niña or ENSO-neutral during the autumn and winter 2020-21.**

During May 2020, sea surface temperature (SST) anomalies were near-to-below average across the east-central and eastern equatorial Pacific (Fig. 1). All of the Niño indices decreased during the month, and the latest weekly Niño-3.4 index value was  $-0.4^{\circ}\text{C}$  (Fig. 2). Equatorial subsurface temperature anomalies (averaged across  $180^{\circ}$ - $100^{\circ}\text{W}$ ) decreased further during the first half of the month, but rebounded slightly toward the end of the month (Fig. 3). However, below-average subsurface temperatures prevailed east of the Date Line (Fig. 4). Also during the month, low-level wind anomalies were easterly across the east-central Pacific, while upper-level wind anomalies were westerly over the central Pacific. Tropical convection departures were weak, but were enhanced near Indonesia and suppressed over the Date Line and west-central Pacific (Fig. 5). Overall, the combined oceanic and atmospheric system remained consistent with ENSO-neutral.

The majority of models in the IRI/CPC plume (Fig. 6) favor ENSO-neutral (Niño-3.4 index between  $-0.5^{\circ}\text{C}$  and  $+0.5^{\circ}\text{C}$ ) through the Northern Hemisphere winter. The forecaster consensus also favors ENSO-neutral during the summer, but then chances become roughly split between La Niña and ENSO-neutral beginning with the August-October season. That consensus mostly reflects the dynamical model guidance, which leans toward La Niña, along with ocean conditions that are somewhat favorable for the development of La Niña. However, enough uncertainty remains that the chance of La Niña remains lower than 50%, and it is unclear whether oceanic and atmospheric anomalies will lock in and persist. In summary, there is a ~60% chance of ENSO-neutral during Northern Hemisphere summer 2020, with roughly equal chances of La Niña or ENSO-neutral (~40-50%) during the autumn and winter 2020-21 (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 9 July 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](mailto:ncep.list.enso-update@noaa.gov).

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

# 2020 Hurricane Season Forecast

## Forecast for Atlantic Hurricane Season and Common Questions

Hurricane season 2020 officially began on June 1. See this year's hurricane forecast—including expected number of storms and how many storms are predicted to make landfall. Also, find your common questions and answers about Earth's most violent storms!

### An Early Start for 2020

The official Atlantic hurricane season lasts from June 1 to November 30 (though hurricanes can certainly happen at any time). Forecasts cover the Atlantic Basin—the area encompassing the Atlantic Ocean, Caribbean Sea, and Gulf of Mexico.

On May 16—approximately two weeks prior to the official start of the 2020 season—**Tropical Storm Arthur** became the first named storm of the year. (Starting early is not unusual. This marks the 6th consecutive year.) Later, on May 27, **Tropical Storm Bertha** became the second named storm, followed by **Tropical Storm Cristobal** on June 3.

### 2020 Hurricane Forecast

Each year, a series of hurricane forecasts are issued from April through August by the noted hurricane experts at the Department of Atmospheric Science at Colorado State University (CSU). Additional forecasts are put out by the National Oceanic and Atmospheric Administration (NOAA).

When it comes to hurricanes, there are many indicators related to atmospheric and oceanic conditions that indicate what to expect. *Keep in mind:* Whatever the forecast, remember that it only takes one hurricane to make landfall and coastal residents should prepare for every hurricane season.

Below is information from CSU's hurricane season forecasts. (The next CSU hurricane forecast will be released on July 7.)

### What Is the 2020 Hurricane Season Outlook?

- **An above-average hurricane season is predicted.** The main reasons for this stronger-than-usual forecast:
  - Current El Niño climate conditions, which tend to suppress hurricane activity, are predicted to weaken to either a cool neutral El Niño or a weak La Niña during late summer. This would likely result in increased storm activity in the Atlantic.
  - In the tropical Atlantic, sea surface temperatures are somewhat above normal, which tends to be associated with stronger storms. In the subtropical Atlantic, temperatures are much warmer than average.

- **Above-normal probability of major hurricanes striking the U.S. coastline is also predicted.**
  - The latest forecast from Colorado State University gives a 70% chance of a major (Category 3 or greater) hurricane making landfall along the entire coast of the continental U.S., a 46% chance along the East Coast and Florida peninsula, a 45% chance along the Gulf Coast, and a 59% chance in the Caribbean. These probabilities are roughly 15% above the averages for the last century.

## How Many Hurricanes Are Expected This Year?

Overall, an **above-average number of storms** is expected in 2020:

- **CSU’s forecast (published June 4, 2020)** predicts a total of 19 named tropical storms (average is 12.1) for the year, of which 9 will become hurricanes (average is 6.4). Of the hurricanes that are expected to occur, 4 will turn into major hurricanes (average is 2.7). Major hurricanes are storms reaching at least Category 3 strength in the [Saffir-Simpson Hurricane Scale](#).
- **NOAA’s initial forecast (published May 21, 2020)** predicts a 60% chance of an “above-normal” season made up of between 13 and 19 named tropical storms. Of those storms, between 6 and 10 are likely to become hurricanes, and between 3 and 6 of those hurricanes could become *major* hurricanes (category 3, 4, or 5). [Read NOAA’s forecast here.](#)

## 2020 Forecast of Atlantic Hurricane Activity (CSU)

Forecast Parameters	<a href="#">Extended Forecast (April 2020)</a>	<a href="#">Updated Forecast (June 2020)</a>	Final Forecast (August 2020)	Observed Storm Activity (through June 2, 2020)	Median Count (1981-2010)
Named Storms	16	16*	-	3	12.1
Named Storm Days	80	81.75	-	3.25	59.4
Hurricanes	8	9	-	0	6.4
Hurricane Days	35	40	-	0	24.2
Major Hurricanes	4	4	-	0	2.7
Major Hurricane Days	9	9	-	0	6.2
Accumulated Cyclone Energy	150	158	-	2	106
Net Tropical Cyclone Activity	160%	164%	-	6%	116%
Activity Level	<b>Above average</b>	<b>Well above average</b>	-	-	-

\*Number does **not** include tropical storms Arthur, Bertha, and Cristobal, which had formed prior to the release of the June 4 forecast.

## 2020 Hurricane Names

See this year's list of [hurricane names](#) for both the Atlantic Basin and Eastern North-Pacific. Is your name listed? The World Meteorological Organization's Hurricane Committee chooses these names (not The Old Farmer's Almanac!).

The list actually repeats every **six years** unless a storm is so severe that the World Meteorological Organization votes to retire that name from future lists. See more [about how hurricanes get their names](#).

More than 60 names have been retired since 1950 because they resulted in significant property damage or deaths. A name can be retired at the request of a country affected by the storm. [See the most recent list of retired hurricane names](#).

### Q. How Are Hurricanes Classified and What Are Hurricane Categories?

**A.** The Saffir-Simpson Hurricane Scale is a 1-5 rating based on the hurricane's present intensity. This is used to give an estimate of the potential property damage and flooding expected along the coast from a hurricane landfall. Wind speed is the determining factor in the scale, as storm surge values are highly dependent on the slope of the continental shelf in the landfall region. Wind speeds are measured using a 1-minute average. [See more about the Saffir-Simpson Hurricane Scale](#).

Saffir-Simpson	Wind (mph)	Hurricane Examples
Category One	74 - 95	Allison (1995), Danny (1997)
Category Two	96 - 110	Bonnie (1998), George (1998), Gustav (2002)
Category Three	111 - 130	Roxane (1995), Fran (1996), Rita (2005)
Category Four	131 - 155	Opal (1995), Iniki (1992), Charley (2004), Katrina (2005)
Category Five	156 +	Andrew (1992), Matthew (2016), Irma (2017), Maria (2017)

**Source:** Colorado State University, Dept. of Atmospheric Science





## FLOODING INJURY

Almost all citrus trees grown in southwest Florida are located on high water table, poorly drained soils. Water management on poorly drained soils is difficult and expensive because during heavy rains in the summer, excess water must be removed from the rootzone and in periods of limited rainfall, irrigation is needed. On these soils, drainage is as important as irrigation. The concept of total water management must be practiced. If either system—irrigation or drainage—is not designed, operated, and maintained properly, then the maximum profit potential of a grove cannot be achieved. Both surface and subsoil drainage is necessary to obtain adequate root systems for the trees.

Roots, like the rest of the tree, require oxygen for respiration and growth. Soils in Florida typically contain 20-21 % oxygen. When flooding occurs, the soil oxygen is replaced by water. This condition causes tremendous changes in the types of organisms present in the soil and in the soil chemistry.

Flooding injury would be expected if the root zone were saturated for 3 days or more during extended summer rains at relatively high soil temperatures (86-95° F). Flooding during the cooler December-March period can be tolerated for several weeks at low soil temperatures (< 60° F). The rate of oxygen loss from the soil is much greater at high than at low temperatures. The potential for damage to roots is less obvious but equally serious when the water table is just below the surface. Flooding stress is much less when water is moving than when water is stagnant. The use of observation wells is a very reliable method for evaluating water-saturated zones in sites subject to chronic flooding injury.



Short-term estimates of flooding stress can be obtained by digging into the soil and smelling soil and root samples. Sour odors indicate an oxygen deficient environment. The presence of hydrogen sulfide (a disagreeable rotten egg odor) and sloughing roots indicate that feeder roots are dying. Under flooded conditions, root death is not exclusively associated with oxygen deficiency. Anaerobic bacteria (the kind that can grow only in the absence of oxygen) develop rapidly in flooded soils and contribute to the destruction of citrus roots. Toxic sulfides and nitrites formed by anaerobic sulfate- and nitrate-reducing bacteria are found in poorly drained groves. Sulfate-reducing bacteria require both energy and sulfates in order to change sulfates to sulfides. The best sources of energy have been found to be certain organic acids contained in citrus roots, grass roots, and buried pieces of palmetto. Thus, citrus roots can contribute to their own destruction by being an energy source for these bacteria.

Symptoms of flooding injury may occur within a few days or weeks, but usually show up after the water table has dropped and the roots become stranded in dry soils. Leaf wilting, leaf drop, dieback, and chlorosis patterns may develop and tree death may occur. Trees subjected to chronic flooding damage are stunted with sparse canopies, dull colored, small leaves and produce low yields of small fruit. New flushes of growth will have small, pale leaves due to poor nitrogen uptake by restricted root systems. Usually, the entire grove is not affected, but most likely smaller more defined areas will exhibit the symptoms. Striking differences in tree condition can appear within short distances associated with only slight changes in rooting depths. Water damage may also be recognized by a marked absence of feeder roots and root bark, which is soft and easily sloughed.

With acute water damage, foliage wilts suddenly followed by heavy leaf drop. Trees may totally defoliate and actually die, but more frequently partial defoliation is followed by some recovery. However, such trees remain in a state of decline and are very susceptible to drought when the dry season arrives because of the shallow, restricted, root systems. Moreover, waterlogged soil conditions, besides debilitating the tree, are conducive to the proliferation of soil-borne fungi such as *Phytophthora* root and foot rot. These organisms cause extensive tree death especially in poorly drained soils.

Water damage may usually be distinguished from other types of decline by a study of the history of soil water conditions in the affected areas. Areas showing water damage are usually localized and do not increase in size progressively as do areas of spreading decline. Foot or root rot symptoms include a pronounced chlorosis of the leaf veins caused by root damage and girdling of the trunk. Lesions also appear on the trunk usually near the soil level (foot rot) or roots die and slough-off (root rot). Flood damage does not produce lesions. Trees with blight or CTV are usually randomly distributed within the grove and diagnostic tests are available to distinguish them from water-damaged trees.

Citrus trees respond physiologically to flooding long before morphological symptoms or yield reductions appear. Photosynthesis and transpiration decrease within 24 hours of flooding and remain low as flooding persists. Water uptake is also reduced which eventually translates to decreased shoot growth and yields.

It is both difficult and costly to improve drainage in existing groves, so drainage problems should be eliminated when the grove area is prepared for planting by including a system of ditches, beds and/or tiling. Growers should not depend on the slight and often unpredictable differences in rootstock tolerance to waterlogging to enable trees to perform satisfactorily under such conditions. Trees, irrespective of scion and rootstock cultivars, should be planted under the best drainage conditions possible. Drainage ditches should be kept free of obstruction through a good maintenance program including chemical weed control. Tree recovery from temporary flooding is more likely to occur under good drainage structure maintenance conditions.

Do not disk a grove if trees were injured by flooding. Irrigation amounts should be reduced, but frequencies should be increased to adequately provide water to the depleted, shallow root systems. Soil and root conditions should be evaluated after the flooding has subsided. Potential for fungal invasion should be determined through soil sampling and propagule counts. If there is a *Phytophthora* problem, the use of certain fungicides can improve the situation.

## WATER TABLE MEASUREMENT AND MONITORING



Most flatwoods citrus soils have a restrictive layer that can perch the water table and significantly affect tree water relations. To optimize production and tree health, the level of this water table should be monitored and maintained within an optimal zone. Simple and practical observation wells can normally produce adequate information.

**Water Table Behavior.** The water table under flatwoods citrus may rise rapidly in response to either rainfall or irrigation because sandy soils are highly conductive to water flow. A general rule of thumb is that 1 inch of rain will cause the water table to rise about 10 inches in fine textured soils, 6 inches in most of the flatwoods sandy soils, and 4 inches in coarse sands. It may take 4 to 6 days for the water table to return to its desired levels following rains of 1 inch or more.

**Observation Wells.** A water table observation well is made with a porous casing buried vertically in the ground. It permits the groundwater level to rise and fall inside it as the water level in the adjacent soils. Observation wells with a simple float indicator can provide rapid evaluation of shallow water table depths. The float and indicator level move with the water table, allowing an above-ground indication of the water level. Water table observation wells installed in flatwoods soils usually penetrate only to the depth of the restrictive (argillic or spodic) layer. Typically this layer is within 30 to 48 inches of the soil surface.

**Well Construction.** The basic components of the well itself include a short section of 3-inch perforated PVC pipe (3-5 ft long), 3-inch PVC cap, screening material, a float, indicator rod, and small stopper.

The indicator rod can be a dowel, ½ -inch PVC pipe (thin wall) or microsprinkler extension stake. Dowels are a poor choice since they require painting and will rot out near the float within a few years. The float is typically a 2½- inch fishing net float or a 500 ml (approximately 2½ in. diameter x 6 in. high) polyethylene bottle with a 28-mm (1.1 in.) screw cap size. The float assembly can be constructed by inserting the microsprinkler extension stake into the fishing float or ½-inch pipe into the polyethylene bottle.

The bottle neck provides a snug fit for the stake and no sealant is required. The hole in the cap should be drilled slightly larger than the indicator stake to serve as a guide for the float assembly. Fittings should not be glued so that components can be easily disassembled for cleaning or replacement.

Observation well casings are constructed from 3-in. diameter PVC pipe (Class 160). A circular saw or drill can be used to perforate the pipe prior to installation. Perforations should be staggered in rows around the pipe to allow flow into the well from the sides in addition to the bottom. Perforations totaling about 5% of the well's surface area are adequate for sandy soils

encountered in the flatwoods. No perforations should be made within 12 inches of the surface in order to minimize the chances of ponded water from high intensity storms creating flow channels into perforations near the soil surface.

The pipe should be wrapped (sides and bottom) with a screening material to prevent soil particles from moving into the well. Materials such as cheesecloth, polyester drain fabric, and fiberglass screen have been used successfully as filters. The filter material should be taped in place with duct tape. A 3-inch soil auger can be used to bore holes for the wells. When possible, the observation wells should be installed when no water table is present in order to minimize chances of the well sides sloughing into the bore as it is dug.

When a water table is present, it is easiest to install the well by starting off with a larger diameter pipe. For a 3-inch observation well, a 4-inch installation pipe (Sch 40 preferred) will be needed. The installation pipe should be cut at least 6 inches longer than the intended depth of well. Holes (½-inch diameter) should be drilled in the sides of the pipe opposite each other about 1½ inches from the top of the pipe. These will be used to aid in removing the pipe from the soil after the observation well is installed. Auger a hole in the soil until it begins to slough in (when the water table is reached). The 4-inch pipe should then be forced into the hole. A 3-inch auger can then be used to remove soil from within the 4-inch casing. As soil is removed, the casing needs to be forced downward to keep the hole from sloughing. Continue to remove soil from inside the casing until the appropriate depth is achieved (typically when hardpan material begins to be excavated).

The well casing pipe should be cut to length and installed in the hole so that it extends 2 to 6 inches above the soil surface. Care should be taken to ensure that the casing is installed plumb to minimize binding of the float assembly. If a 4-inch installation pipe was used to excavate the hole, it needs to be removed. A ½-inch rod can be inserted through the holes that were drilled in the top of the 4-inch pipe. If the pipe cannot be removed easily by hand, a chain can be attached to the rod and attached to a high-lift jack. Usually, after jacking the installation pipe up about a foot, the pipe can be easily removed by hand. The soil should be backfilled around the observation well casing and tamped to compact the soil and get a tight fit between the soil and the sides of the pipe.

A measurement should be taken of the distance from the bottom of the well to the soil surface. The float assembly can then be lowered into the well. Make sure that the indicator rod and float do not bind against the sides of the observation well. The well is now ready for calibration.

**Calibration.** A mark on the indicator stake or rod should be made at the top of the well when the float is at the bottom of the well. This level is the reference mark for the well depth. The indicator stake or rod can then be marked with major divisions (feet) and minor divisions (inches) for easy reading of the water table depth. These rings can be painted at appropriate intervals using different colors for major and minor divisions. Marks painted at 2-inch increments provide enough accuracy for most users.

The mark at the upper level is dependent on the depth of the water furrow and root depth. The upper depth should be selected so that water does not pond in water furrows and it should be at least 6 inches below the bottom of the root zone to prevent root pruning. Observations over time will help to determine the water table level depth that will prevent root damage or excessive wetness in the root zone.

## 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://edis.ifas.ufl.edu/pdf/CG/CG01300.pdf>

Florida Citrus Production Guide--Weeds.

## LEAF AND SOIL SAMPLING AND ANALYSES TO ADJUST FERTILIZER PROGRAMS

Optimum growth and yield of high quality fruit cannot be obtained without adequate nutrition. The most successful fertilizer program should be based on tissue analysis, knowledge of soil nutrient status through soil analysis combined with university recommendations. The deficiency or excess of an element will cause disturbance in plant metabolism and lead to poor performance.



### Plant analysis

Used in conjunction with other data and observations, tissue analysis aids in evaluating the nutrient elements of the soil-plant system. It has proven useful in confirming nutritional deficiencies, toxicities or imbalances, identifying “hidden” toxicities and deficiencies where visible symptoms are not manifested, and evaluating the effectiveness of fertilizer programs.

### Leaf Sampling

For reliable results and useful interpretation of lab analysis reports, citrus growers, production managers, and consultants must follow the proper procedures for leaf sampling and sample handling because improperly collected leaf samples will provide misleading information about the nutritional status of the trees and the fertilizer programs.

Considerable care is needed in taking samples. Chemical analysis values

can only be useful if the samples obtained are representative of the blocks they were taken from. The proper sampling, preparation and handling would affect the reliability of the chemical analysis, data interpretation, nutritional recommendations, and adjustment of fertilizer programs.

Leaf samples must also be taken at the proper time because nutrient levels within leaves are continually changing. However, leaf mineral concentrations of most nutrients are relatively stable within 4 to 6 months after emergence of the spring flush. Therefore, for mature tree blocks, the best time would be in **July and August** to collect four- to six-month-old spring flush leaves. If taken later in the season, the summer flush would probably be confused with the spring flush.

Each leaf sample should consist of about 100 leaves taken from non-fruiting twigs of 15- 20 uniform trees of the same variety and rootstock, and under the same fertilizer program. Clean brown paper bag should be used. Information sheets from the testing lab should be completed for each sample as this information helps when interpreting the results. The sample bag and the corresponding information sheet should each be carefully labeled with the same identity so that samples and sheets can be matched in the laboratory.

### **Sampling techniques for leaves**

- ◆ Immature leaves should be avoided because of their rapidly changing composition.
- ◆ Abnormal-appearing trees, trees at the edge of the block and trees at the end of rows should not be sampled because they may be coated with soil particles and dust or have other problems.
- ◆ Do not include diseased, insect damaged, or dead leaves in a sample. Use good judgment.



- ◆ Select only one leaf from a shoot and remove it with its petiole (leaf stem).

### **Diagnosing growth disorders**

- ◆ Collect samples from both affected trees as well as normal trees.
- ◆ Trees selected for sampling should be at similar stage of development and age.
- ◆ Whenever possible, confine the sampling area to trees in close proximity to each other.

### **Handling of leaf samples**

- ◆ Samples should be collected in clean paper bags and clearly identified.
- ◆ They should be protected from heat and kept dry and cool (stored in portable ice chests), and placed in a refrigerator for overnight storage if they cannot be washed and oven dried the same day of collection.
- ◆ For macronutrient analysis, leaves usually do not need to be washed.
- ◆ Leaves should be dried in a ventilated oven at 60-70°C.

### **Preparation for analysis**

- ◆ Leaves that have been recently sprayed with micronutrients for fungicidal (Cu) or nutritional (Mn, Zn) purposes should not be analyzed for those micronutrients because it is unlikely to remove all surface contamination from sprayed leaves.
- ◆ For accurate Fe and B or other micronutrient determination, samples would require hand washing, which is best done when leaves are still in a fresh condition.

### **Soil analysis**

Soil analysis is an important method for gaining basic information regarding the chemical status of the soil. Soil analysis is particularly useful when conducted over several years so that trends can be seen.

Unlike leaf analysis, there are various methods and analytical procedures of soil analysis used by laboratories. In Florida, soil tests for the relatively mobile and readily leached elements such as N and K are of no value. Soil tests are mainly important for pH, P, Mg, Ca, and Cu. For

Florida sandy soils, using the Mehlich-1 or double acid (hydrochloric acid + sulfuric acid) extraction procedure adopted by the University of Florida analytical lab, 40-60 lbs/acre (20-30 ppm) of P, 70-120 lbs/acre (35-60 ppm) of Mg, 500-800 lbs/acre (250-400 ppm) of Ca, and 5-10 lbs/acre (2.5-5 ppm) of Cu are considered adequate for citrus. A Ca:Mg ratio of 7:1 seems desirable and ratios of higher than 10 may induce Mg deficiency problems. Copper levels higher than 50 lbs/acre may be toxic to citrus trees if the soil pH is below 6.

### **Soil sampling**

The accuracy of a fertilizer recommendation depends on how well the soil sample on which the recommendation was based represents the area of the grove. In Florida, if soil samples were to be collected once a year, the best time would be at the end of the summer rainy season and prior to fall fertilization, usually during September and October. However, soil sampling may be conducted at the same time as leaf sampling to save time and reduce cost.

Standard procedures for proper sampling, preparation and analysis have to be followed for meaningful interpretations of the test results and accurate recommendations. Each soil sample should consist of 15-20 soil cores taken at the dripline of 15-20 trees within the area wetted by the irrigation system to a depth of 6 inches. The area sampled should be uniform in terms of soil and tree characteristics and correspond to the area from which the leaf sample was taken. Individual cores should be mixed thoroughly in a plastic bucket to form a composite sample. Subsample of appropriate size should be taken from the composite mixture and put into labeled paper bags supplied by the lab. Soil samples should be air-dried but not oven-dried before shipping to the testing laboratory for analysis.

## Conclusion

Tissue and soil analyses are a powerful tool for confirming nutrient deficiencies, toxicities and imbalances, identifying "hidden hunger," evaluating fertilizer programs, studying nutrient interactions. However, if initial plant and soil sampling, handling, and analysis of the sample were faulty, the results would be misleading.

If properly done, tissue and soil analyses can point the way toward more economical and efficient use of fertilizer materials, avoiding excessive or inadequate application rates.

**For more details, consult UF-IFAS publication SL 253, "Nutrition of Florida Citrus Trees," at <http://edis.ifas.ufl.edu/pdf/SL/SL253.pdf>**

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## **Standard Table for Assessing Nutritional Status and Adjusting Fertilizer Programs for Citrus**

**Leaf analysis standard for assessing current nutrient status of citrus trees based on concentration of mineral elements in 4- to 6-month-old-spring-cycle leaves from non-fruiting terminals.**

<b>Element</b>	<b>Deficient less than</b>	<b>Low</b>	<b>Satisfactory</b>	<b>High</b>	<b>Excess more than</b>
Nitrogen (N) (%)	2.2	2.2-2.4	<b>2.5-2.8</b>	2.9-3.2	3.3
Phosphorus (P) (%)	0.09	0.09-0.11	<b>0.12-0.17</b>	0.18-0.29	0.30
Potassium (K) (%)	0.7	0.7-1.1	<b>1.2-1.7</b>	1.8-2.3	2.4
Calcium (Ca) (%)	1.5	1.5-2.9	<b>3.0-5.0</b>	5.1-6.9	7.0
Magnesium (Mg) (%)	0.20	0.20-0.29	<b>0.30-0.50</b>	0.51-0.70	0.80
Sulfur (S) (%)	0.14	0.14-0.19	<b>0.20-0.40</b>	0.41-0.60	0.60
Chlorine (Cl) (%)	-----	-----	<b>less than 0.5</b>	0.5-0.7	0.7
Sodium (Na) (%)	-----	-----	<b>less than 0.2</b>	0.2-0.5	0.5
Iron (Fe) (ppm)	35	35-59	<b>60-120</b>	121-200	250
Boron (B) (ppm)	20	20-35	<b>36-100</b>	101-200	250
Manganese (Mn) (ppm)	18	18-24	<b>25-100</b>	101-300	500
Zinc (Zn) (ppm)	18	18-24	<b>25-100</b>	101-300	300
Copper (Cu) (ppm)	4	4-5	<b>6-16</b>	17-20	20
Molybdenum (Mo) (ppm)	0.06	0.06-0.09	<b>0.1-1.0</b>	2-50	50

# 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

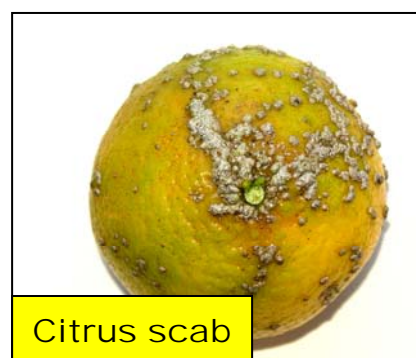
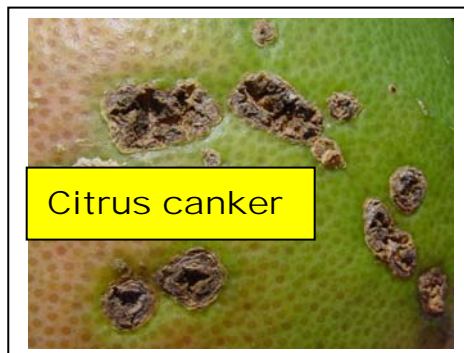
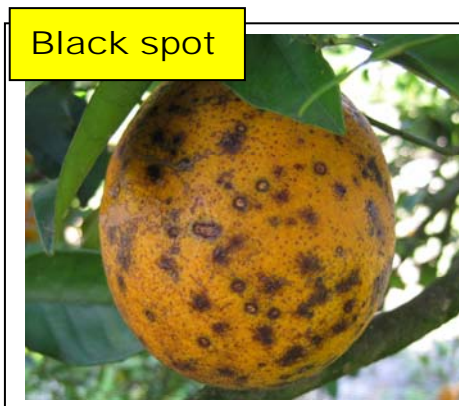
Dormant Season

Growing Season

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

# Fungicide effectiveness

Products	<u>Canker</u>	<u>Greasy Spot</u>	<u>Alternaria</u>	<u>Scab</u>	<u>Melanose</u>	<u>Black spot</u>	<u>PFD</u>
Copper	Good	Good	Good	Moderate	Good	Moderate	Weak
Oil	None	Good	None	None	None	None	None
Ferbam	None	Weak	Moderate	Moderate	Weak	Weak	Weak
Enable 2F		Good		Good		Good	
Headline	None	Good	Good	Good	Good	Good	Good
Abound	None	Good	Good	Good	Good	Good	Good
Gem	None	Good	Good	Good	Good	Good	Good
Pristine	None	Good	Good	Good	Good	Good	Good
Amistar Top	None	Good	Good	Good	Good	Good	Good



# Flatwoods Citrus

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P.O. Box 68  
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