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Flatwoods Citrus

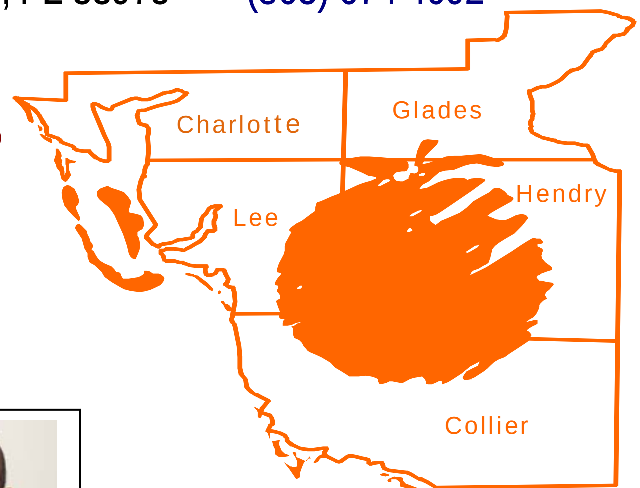

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Table of Contents

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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

12 March 2020

ENSO Alert System Status: Not Active

Synopsis: **ENSO-neutral is favored for the Northern Hemisphere spring 2020 (~65% chance), continuing through summer 2020 (~55% chance).**

During February 2020, above-average sea surface temperatures (SSTs) were evident across the western, central, and far eastern Pacific Ocean (Fig. 1). The latest weekly Niño-3.4 and Niño-3 indices were near-to-above average (+0.5°C and +0.1°C, respectively), with the Niño-4 and Niño-1+2 indices warmer, at +1.1°C (Fig. 2). Equatorial subsurface temperatures (averaged across 180°-100°W) remained above average during the month (Fig. 3), with positive anomalies spanning the western to the east-central equatorial Pacific, from the surface to ~150m depth (Fig. 4). Also during the month, low-level westerly wind anomalies persisted over the western tropical Pacific Ocean, while upper-level wind anomalies were mostly westerly over the eastern half of the basin. Tropical convection remained suppressed over Indonesia and was enhanced near and just west of the Date Line (Fig. 5). While the equatorial Southern Oscillation index (SOI) was negative, the traditional SOI was near average. 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°C and +0.5°C) through the Northern Hemisphere fall. Despite elevated Niño 3.4 index values in the near-term, the forecaster consensus expects the Niño-3.4 index values will decrease gradually through the spring and summer. In summary, ENSO-neutral is favored for the Northern Hemisphere spring 2020 (~65% chance), continuing through summer 2020 (~55% 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 9 April 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

FOLIAR FEEDING OF CITRUS TREES

Foliar fertilizer application is certainly not a new concept to the citrus industry. For over five decades, foliar fertilization of citrus has been recommended to correct zinc, manganese, boron, copper, and magnesium deficiencies. It is now common knowledge in agriculture that properly nourished crops may tolerate insect pests and diseases. Traditionally citrus growers try to achieve optimum nutrition through direct soil management. Currently with the introduction of citrus greening in Florida, many growers and production managers consider foliar fertilization a key factor to stimulate the natural defense mechanisms of their trees, to induce pest and disease tolerance, and to improve fruit yield and fruit quality.

In Florida, foliar nutrition programs are becoming very common and extensively used to deliver all of the essential nutrient elements to citrus trees. Furthermore, economic and environmental considerations require the utilization of more efficient methods for nutrient applications. Foliar application of fertilizers is more efficient than traditional soil application because of better, faster nutrient uptake and reduced losses. Although field research has shown that supplemental foliar feeding can increase yield by 10-25% compared with conventional soil fertilization, foliar fertilization should not be considered a substitute for a sound soil-fertility program.

Foliar fertilizer application is highly efficient because the materials are targeted to areas where they can be directly absorbed into the plant. However, nutrients foliarly applied prior to a rainfall are subject to being washed off the leaves and onto the soil. Foliar fertilizer application also provides a more timely and immediate method for delivery of specific nutrients at critical stages of plant growth. Foliar nutrition programs are therefore valuable supplements to soil applications. As indicated previously, foliar feeding is not intended to replace soil-applied fertilization of the macronutrients (nitrogen, potassium, and phosphorus). Foliar applications of macronutrients can however be alternatively applied in sufficient quantities to influence both yield and fruit quality. Citrus trees can have a large part of the annual nitrogen requirements met through foliar applications. Foliar applications of other macronutrients (calcium, magnesium, and sulfur) and micronutrients (zinc, manganese, copper, boron, and molybdenum) have proven to be an excellent means for satisfying citrus tree requirements.

Because fertilizer applications to the soil can be subjected to undesirable processes such as leaching, runoff, and being tied up in the soil in unavailable forms, foliar applications of nutrients have been designed to be an integral component of overall tree nutrition programs. It is used in other situations to help trees through short, but critical periods of nutrient demand, such as vegetative growth, bud differentiation, fruit set and fruit growth. Foliar application of nutrients is of great importance when the root system is unable to keep up with crop demand or when the soil has a history of problems that inhibit normal nutrient uptake. Foliar nutrition is proven to be useful under prolonged periods of wet conditions, droughty conditions, calcareous soil, cold weather or any other condition that decreases the tree's ability to take up nutrients when there is a demand. Foliar feeding may be effectively utilized when a nutritional deficiency is diagnosed. Foliar application is absolutely the quickest method of getting the most nutrients into plants. However, if the deficiency can be observed on the tree, the crop has already lost some potential yield.

While foliar feeding has many advantages, it can burn leaves at certain rates under certain environmental conditions. It is important, therefore, to foliar feed within some established guidelines. There are a number of plant, soil, and environmental conditions that can increase the chances of causing foliar burn to foliar fertilizer application. For example, a tree under stress is generally more susceptible to damage. Stressful conditions include drying winds, disease infection, and unfavorable soil conditions. The environmental conditions at the time of application are also important factors. Applications when the weather is hot (above 80^0F) should be avoided. This means that during warm seasons, applications should be made in the morning or evening when the temperature is right, wind is minimal, and the stomates on citrus leaves are open, allowing leaves to efficiently exchange water and air.

Nutrient absorption is increased when spray coverage reaches the undersides of the leaves where the stomates are located. Favorable results from foliar feeding are most likely to occur when the total leaf area is large. Foliar applications of micronutrients with the exception of iron are more effective and efficient when the spring, summer, and fall new flush leaves are about fully expanded. Additionally, applications should be at least two-week apart to give the tree sufficient time to metabolize the nutrients and deal with the added osmotic stress. To be efficient and to avoid crop damage, dilute solutions of nutrient formulations are recommended. Highly concentrated sprays, especially those including salt-based fertilizers, have the potential to cause leaf burn and/or drop.

Another important factor when applying nutrients foliarly is to ensure that the pH of the spray solution is in the proper range (between 5.5 and 6.5). This is particularly important in areas where water quality is poor. In order to enhance uptake and thus the effectiveness of any foliar application, nitrogen should be added to the solution. Urea may be the most suitable nitrogen source for foliar applications due to its low salt index and high solubility in comparison with other nitrogen sources. Urea has been shown to stimulate absorption of other nutrients by increasing the permeability of leaf tissue. However, the urea utilized in foliar sprays should be low in biuret content (0.2% or less) to avoid leaf burn. Other sources of nitrogen can be obtained from ammonium polyphosphates, ammoniated ortho-phosphates, potassium nitrate, calcium nitrate, and ammonium thiosulfate. These sources, when utilized at low rates of foliar application, are excellent supplemental nitrogen carriers with minimal foliage burn side-effects. Triazone nitrogen has been shown to significantly reduce leaf burn and enhance foliar absorbed nitrogen compared with urea, nitrate, and ammonium nitrogen sources.

The use of a combination of poly and ortho-phosphates has been shown to lessen leaf burn and aid in leaf phosphate absorption. Phosphites have also been found useful, safe, and not phytotoxic as foliar sprays on citrus trees. Potassium polyphosphates, potassium hydroxide, potassium nitrate and potassium thiosulfate sources combine both low salt index and high solubility characteristics. Foliar application of calcium, magnesium, sulfur, zinc, manganese, copper, boron and molybdenum can be highly effective to satisfy nutrient requirements. However, there can be difficulties associated with leaf tissue absorption and translocation of calcium, magnesium, boron and molybdenum. Choosing the correct fertilizer sources for these nutrients can be critical.

Be careful about possible chemical interactions among foliar fertilizers. Some materials are incompatible and should not be mixed together. They may create precipitates that tie up and make some nutrients unavailable and/or clog spray nozzles. Many product labels warn of such incompatibilities. If there is no specific packaging information, small quantities of the materials should be mixed with water in a jar and shaken. If there is no precipitate, there should be no problem. Foliar fertilization can sometimes be combined with pesticide application. However, timing conflicts and material incompatibilities can sometimes make combining such sprays unwise. Be sure to read all product labels and do the jar's test if uncertain.

Foliar applications of low biuret urea at 12-14 gallons or at 53-60 lbs (24-28 lbs N) per acre or phosphite (PO_3) at 3 pints (60% P) to 2 quarts (26% P) per acre in late December-early January (6 to 8 weeks before bloom) have been demonstrated to increase flowering, fruit set, and fruit production. Postbloom foliar applications of potassium nitrate or mono-potassium phosphate at 8 lbs K_2O per acre have also been found to increase yield and fruit size. 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 3 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.

Conclusion. Today, foliar feeding is playing an important role in Florida citrus production. It is rapidly gaining ground as a nutritional supplement to soil-applied fertilizers to improve yield and fruit quality, particularly in the face of HLB (citrus greening). Foliar nutrition is also a very important and effective way of addressing diagnosed problems with specific deficiencies observed within the grove and a best management strategy for supplying micronutrients with the exception of iron. The concept that foliar sprays should be applied only after the appearance of a deficiency is unsound since reductions in yield and quality usually precede the appearance of visual symptoms. Foliar sprays of nutrients should be used with the objective of maintaining citrus trees health at an optimal level. However, foliar fertilization should be considered a supplement, not a substitute for a sound soil-fertility program.

Citrus tree performance under soil-applied fertilizer program supplemented with foliar nutrition.

PLANT GROWTH REGULATORS (PGRs)

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

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

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

GIBBERELLIC ACID (GA_3) is recommended to be used on citrus hybrids that are weakly parthenocarpic and without sufficient cross-pollination to improve fruit set. Applied from full bloom to two-third petal fall, GA can effectively set and produce an excellent crop of seedless Robinson, Nova, Orlando, Minneola, or other self-incompatible mandarin hybrids. Use Gibeerellic acid (GA_3, 4.0% liquid concentrate) at the rate of 10-20 oz/acre. Products marketed include: Pro-Gibb, GibGro, and Gibbex. Because material concentration is important in plant growth regulators, water volumes below 125 gallons/acre are not recommended. Do not use in water above pH 7.5 because uptake will be reduced. Care should also be exercised in not exceeding the recommended GA dosage or concentration because it can cause severe leaf drop.
READ THE LABEL

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

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

NAA rate

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

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

Timing

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

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

PLANT GROWTH REGULATORS FOR CITRUS IN CALIFORNIA

The plant growth regulators 2,4-dichlorophenoxyacetic acid (2,4-D), gibberellic acid (GA_3) are registered for preharvest use on California citrus crops. 2,4-D is used mainly to delay and reduce unwanted fruit abscission (fruit drop), GA_3 is used mainly to delay senescence (overripening).

In order to be effective, plant growth regulators must be absorbed by plant tissue. Good spray coverage is essential and climatic conditions that favor absorption are therefore desirable.

Both 2,4-D and GA_3 seem to be compatible with urea, potassium foliar sprays, zinc and manganese micronutrient sprays, and neutral copper sprays, but the timing of growth regulator applications may not coincide with the best time for nutrient sprays.

2,4-dichlorophenoxyacetic acid (2,4-D). 2,4-D is used to control preharvest fruit drop, increase fruit size (oranges, grapefruit, mandarin, and mandarin hybrids), and to control leaf and fruit drop following an oil spray. When you use 2,4-D to reduce drop of mature fruit, apply the compound before (preferably *shortly* before) fruit drop becomes a problem, but far enough ahead of flowering to minimize undesirable effects that 2,4-D would otherwise have on the spring cycle of growth. For navel oranges, October through December sprays are common. October, however, may be too early to effectively reduce fruit drop if conditions favor it (e.g., warm winter, protracted harvest). January sprays may be somewhat risky, especially when environmental factors favor an earlier-than-usual spring flush of growth.

For mature grapefruit and 'Valencia' orange trees, 2,4-D can be applied to control drop of mature fruit or as a dual-purpose spray (to control mature fruit drop and to improve fruit size for the next year's crop). Fruit-sizing sprays require excellent coverage. In general, 'Valencia' orange is more responsive than grapefruit to fruit-sizing sprays. For mandarin and mandarin hybrids, 2,4-D fruit sizing sprays are applied 21 to 35 days after 75% petal fall.

Gibberellic acid (GA_3). The purpose of applying GA_3 to citrus trees in California is to delay fruit senescence. Make applications while the fruit are still physiologically young, but are approaching maturity. GA_3 can have a negative effect on flowering and thus on production for the following year, especially if it is applied much later than specified on the current label or in these guidelines. It delays changes in rind color, an effect that can be considered either desirable or undesirable. For example, if you apply GA_3 to navel orange trees while the fruit still have green rinds, delayed coloring will have a negative effect on your ability to harvest and market the fruit early in the season. In contrast, this effect is desirable for late-harvested fruit because it delays rind senescence, which results in fruit that are paler in color than the deeper-colored fruit from untreated trees. GA_3 applications amplify the re-greening of "Valencia" oranges. This is considered undesirable and can be minimized if you apply the compound no later than the date specified on the label or in these guidelines. GA_3 application may result in leaf drop, which can be severe, especially when it is applied to navel orange trees that are under heat or water stress. When this happens, the tree may also suffer twig dieback. By including 2,4-D in the GA_3 spray, you may be able to reduce this kind of damage.

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PLANT GROWTH REGULATORS IN FLORIDA

By Davies, Ismail, Stover, and Wheaton, UF-IFAS

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

Importance of material concentration and spray volume

Most registered pesticides are effective over a fairly broad concentration range with little likelihood of phytotoxicity. Since PGRs function by directly influencing plant metabolism, plant response can vary considerably with concentration, making sprayer calibration and accurate material measurement especially important. Studies show that variability in spray deposition increases as spray volume is reduced below 250 gallons/acre in mature citrus groves. At lower water rates, canopy surfaces closest to the sprayer manifold tend to retain much more material than other plant surfaces. Because material concentration is especially important in PGR use, water volumes below 250 gallons/acre are not recommended.

PGR uptake

Unlike most agrichemicals applied to crop plants, efficacy of PGRs depends on entry of materials into plant tissues. Uptake is influenced by a number of factors: amount of PGR applied, concentration of PGR, presence of surfactants, after application, and plant stress level.

Effect of surfactants and tank mixes

Surfactants and other spray adjuvants can affect uptake in several ways. Surfactants and oils spread spray materials over leaf surfaces, and increase uptake by enhancing the total area contacted by spray solution. Many surfactants, urea, ammonium salts and oils can also directly enhance uptake by helping materials penetrate the plant cuticle. Organosilicone surfactants and some oils can result in very rapid uptake by carrying material through plant pores known as stomates. Surfactants can significantly enhance entry of PGRs into plant tissues, however, most PGR studies in citrus were conducted without surfactants or with less effective surfactants than many currently available. Use of untested surfactants may significantly enhance uptake, resulting in excessive plant response and/or phytotoxicity. Tank mixing with other spray materials may influence PGR uptake through surfactants or oils in material formulation or may bind PGR molecules rendering them ineffective.

https://edis.ifas.ufl.edu/pdffiles/HS/HS131000.pdf

Importance of weather conditions
Studies with other crops have shown that weather conditions greatly influence PGR uptake. Uptake generally increases with both temperature and duration of spray drying. Application at night or in early morning often enhances uptake because greater drying time more than compensates for somewhat lower temperature.

Dew following application is likely to enhance PGR uptake by prolonging drying. Considerable uptake often occurs after spray has dried, therefore, rain within a few hours of application may significantly reduce PGR effectiveness. Many PGRs degrade rapidly in sunlight. Growers should consider the likely influence of environmental factors in timing PGR sprays. It is illegal to apply 2,4-D when wind speed is above 10 miles/hour and distance to susceptible crops downwind is specified at lower wind speeds.

Influence of plant stress
Trees under significant drought, cold, or pest stress may respond excessively to PGR treatments. Therefore, application of PGRs is recommended only to healthy citrus trees.

Leaf curling
Even when properly applied, some PGRs may cause leaf curling, especially when sprayed on young leaves.

Recommended Chemical Controls

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 Plant Growth Regulators.

Growth Regulator	Rate/Acre[1]	Variety and Activity	Time of Application/Cautions
Fruit Fix K-Salt **200** (Naphthaleneacetic acid, NAA, 200 g/gal liquid formulation)	8-20 pt. Use lower rates on Murcotts.	Tangerines, Murcotts, & Tangelos. Fruit thinning to increase fruit size and reduce alternate bearing.	May/June drop, typically mid-May. Activity is temperature dependent. Severe overthinning may result from applications made to trees of low vigor and/or under stress conditions. Heavy rain within several hours of application may reduce activity.

[1]Rates are based on application in 250 gallons per acre to mature trees. Proportional reduction in water and material rates is desirable for smaller trees. Application of Pro-Gibb at full rate to juice oranges in 125-150 gallons per acre to mature trees has been effective. The effects of applications in concentrate sprays are unknown.

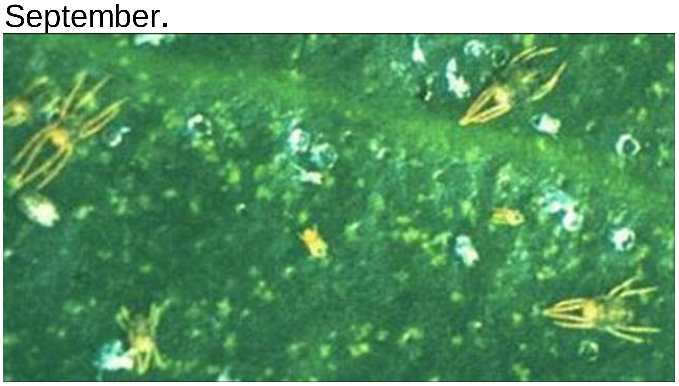
[2]Greater uptake at lower spray solution pH. Do not use in water above pH 8.

Table 1. Recommended Plant Growth Regulators.

Growth Regulator	Rate/Acre[1]	Variety and Activity	Time of Application/Cautions
Citrus Fix (2,4-Dichlorophenoxyacetic acid isopropyl ester 3.36 lb/gal)	3.2 oz	Orange, Temple and grapefruit. Reduction of preharvest drop.	Nov-Dec. Do not apply during periods of leaf flush. Observe restrictions to avoid drift.
Citrus Fix (2,4-Dichlorophenoxyacetic acid isopropyl ester 3.36 lb/gal)	2.4 oz	Navel orange. Reduction of summer and fall drop.	6-8 wks after bloom for summer drop or Aug-Sept for fall drop. Do not apply fall spray when fruit is to be harvested early. Do not apply during periods of leaf flush. Observe restrictions to avoid drift.
Pro-Gibb (Gibberellic acid, GA_3, 4.0% liquid concentrate)[2]	20 oz	Seedless grapefruit. Delay of rind aging process and peel color development. Combine with Citrus Fix for fruit drop control.	Nov-Dec. Greater response prior to colorbreak but early harvest is disrupted by delayed coloring and irregular green spotting may develop. Surfactants increase activity but may cause fruit marking, so use is not recommended. Application within 6 weeks of copper or oil may increase rind marking. Application in Dec may reduce subsequent crop and regreen fruit.
Pro-Gibb (Gibberellic acid, GA_3, 4.0% liquid concentrate)[2]	10-20 oz	Tangelo. Improvement of fruit set. Can result in small fruit size from excessive cropping and/or leaf drop.	Full bloom. Surfactants not recommended.
Pro-Gibb (Gibberellic acid, GA_3, 4.0% liquid concentrate)[2]	20 oz	Minneola tangelo. Delay of stem rind deterioration.	Apply 2 weeks before aniticipated colorbreak. Application after or during coloring may cause rind staining or blotchy color development.
Pro-Gibb (Gibberellic acid, GA3, 4.0% liquid concentrate)2	18 oz	Oranges for processing. Delay of rind aging process and peel color development. Delays decline in peel firmness and increases juice extraction weight during processing.	Apply at or near colorbreak. Application may delay bloom the following year. Do not apply after December 1.
Tre-Hold (Naphthaleneacetic acid, NAA, 1.0% liquid concentrate)	Apply undiluted to trunk only as thorough spray or light brush application.	Nonbearing citrus. Inhibition of trunk sprout growth.	Prior to sprout growth. Caution-may inhibit sprouting desired for tree recovery following freeze. Excessive heavy application may result in tree damage. Do not apply after Sept 1.

Spider Mites

The Texas citrus mite is the predominant species in most citrus groves throughout the state. The citrus red mite is usually second in abundance, but in some nursery operations it is the predominant species. The Texas citrus and citrus red mites occur on citrus throughout the year and usually are most abundant in groves during the dry season. They are found most commonly on the upper leaf surface of recently mature flush, and all stages of the mites orient along the mid-vein. As populations increase, they move to leaf margins and fruit. Spider mites feed primarily on mature leaves and differ from rust mites by feeding beneath the epidermal layer of cells. They are capable of removing cellular contents, causing cell destruction and reducing photosynthesis. Mesophyll collapse and leaf drop can result when trees are stressed by high spider mite infestations in combination with sustained dry, windy conditions that may occur in the late fall, winter or early spring months. When populations of Texas citrus mite or citrus red mites are high, they will also feed on developing fruit. Spider mites prefer dry weather and low relative humidities in the range of 30 to 60% and generally do not pose a sustained problem in the higher humidity conditions that occur between June and September.



Populations of Texas citrus and citrus red mites aggregate among leaves within and between citrus trees.

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

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

Application of Miticides

Selection of a miticide should be based on the target pests to be controlled, avoiding risks of phytotoxicity, products that will be tank mixed, the time of year, treatment to harvest interval, and prior use of a product. All miticides except petroleum oil should be used only once a year to minimize resistance development. For example, dicofol can be effectively used for spider mite or rust mite control during the supplemental early spring or postbloom intervals. The product is most effective when applied at ONE of these times. Conversely, Comite would be recommended in the fall or supplemental late fall intervals. Vendex is effective in one of the following four periods: supplemental spring, postbloom, fall, or supplemental fall periods. Petroleum oil spray applications can be effectively applied during the postbloom, summer, or fall intervals. Sulfur is included since it has a short treatment to harvest interval and provides a highly effective means of cleaning up rust mite infestations prior to harvest when needed. Use of sulfur should be minimized given its toxic effects on several beneficial arthropods.

Recommended Chemical Controls

READ THE LABEL.

TO MINIMIZE RISK OF RESISTANCE, DO NOT APPLY A SPECIFIC MITICIDE MORE THAN ONCE PER ACRE PER SEASON OTHER THAN PETROLEUM OIL.

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.

TABLE 3. Recommended Chemical Controls for Mites

Pesticide	IRAC MOA[1]	Mature Trees Rate/Acre[2]	Comments	Pests Controlled
Agri-Mek 0.15 EC + Petroleum Oil 97+% (FC 435-66, FC 455-88 or 470 oil)	6	5 to 10 fl oz + min of 3 gal	Restricted use pesticide. Do not apply any petroleum oil products when temperatures exceed 94°F. Do not apply Agri-mek or any other abamectin containing product within 30 days of last treatment. Do not apply more than 40 fl oz/A of Agri-mek or any other abamectin containing product in any growing season. Do not make more than 3 applications of Agri-mek or any other abamectin containing product in any growing season.	Rust mites Broad mites Citrus leafminer
Apta	21A	14 to 27 fl oz	Do not apply by air. Do not apply more than 27 oz/acre per growing season. Do not make more than 2 applications per year. Allow at least 14 days between applications.	Asian citrus psyllid
Comite 6.55 EC	12C	3 pt	Leaf distortion and/or fruit spotting may occur when used in the spring or if tank mixed with oil or applied within 2 weeks prior to or following an oil application. Do not use in spray solution above pH 10.	Rust mites Spider mites
Envidor 2 SC	23	13 to 20 oz	Limit to one application per season. Use 20 oz rate if tank mixing with oil. Tank mixing with oil results in reduced residual activity.	Rust mites Spider mites
Micromite 80WGS	15	6.25 oz	Restricted use pesticide. See restriction on the label.	Rust mites Root weevils Citrus leafminer
Movento 240 SC + Petroleum Oil 97+% (FC 435-66, FC 455-88 or 470 oil)	23	10 fl oz/A + 3% V/V	Limit of 20 fl oz of product (0.32 lb ai) per acre per season. Do not apply within 10 days prior to bloom, during bloom, or until petal fall is complete. Movento has a smilar mode of action as Envidor; do not make back-to-back applications of these two products.	Asian citrus psyllid nymphs Some scale insects
Movento MPC + Petroleum Oil 97+% (FC 435-66, FC 455-88 or 470 oil)	23	16 fl oz/A + 3% v/v	Limit of 32 fl oz of product (0.32 lb ai) per acre per season. Do not apply within 10 days prior to bloom, during bloom, or until petal fall is complete. Movento has a similar mode of action as Envidor; do not make back-to-back applications of these two products.	Asian citrus psyllid nymphs Some scale insects
Nexter 75 WP	21	6.6 oz	Tank mixing with oil or copper results in reduced residual activity.	Spider mites False spider mites Rust mites
Petroleum Oil 97+% (FC 435-66, FC 455-88 or 470 oil)	NR[3]	2% v/v	Do not apply when temperatures exceed 94°F. 470 weight oil has not been evaluated for effects on fruit coloring or ripening. These oils are more likely to be phytotoxic than lighter oils.	Rust mites Scales Whiteflies Spider mites Greasy spot Sooty mold
Sulfur	NR[3]		Limit to one application per season where supplemental rust mite control is needed between main sprays. Do not combine with oil or apply within 3 weeks of oil as fruit burn may result. May cause eye irritation to applicators and fruit harvesters.	Rust mites Broad mites (Kumulus, Thiolux and Microthiol only)
Kumulus 80 DF		15 lb		
Microthiol 80 DF		15 lb		
Thiolux 80 DF		15 lb		
Wettable powder or dust		50 lb		
Vendex 50 WP	12B	2 lb	Restricted use pesticide. Tank mixing with oil or copper results in reduced residual activity. Do not apply at rates greater than 20 oz/500 gal to fruit less than one inch in diameter within 10 days of an oil spray.	Rust mites Spider mites

[1] Mode of action class for citrus pesticides from the Insecticide Resistance Action Committee (IRAC) mode of action classification V7.3 (2014). Refer to ENY624, Pesticide Resistance and Resistance Management, in the 2017-18 Florida Citrus Production Guide for more details.

[2] Lower rates may be used on smaller trees. Do not use less than minimum label rate.

[3] No resistance potential exists for these products.

For more information and details, go to:

Rust Mites, Spider Mites, and Other Phytophagous Mites

https://edis.ifas.ufl.edu/cg002
https://edis.ifas.ufl.edu/pdffiles/CG/CG00200.pdf

DROUGHT

Water stress is the physiological condition to which a plant is subjected whenever the rate of water loss from the leaves by transpiration exceeds the rate at which water is absorbed by the root system. Water stress can be the result of excessive transpiration due to hot weather or slow absorption from a dry soil, flooded soil or saline conditions. Any degree of water imbalance can produce a deleterious change in physiological activity of growth and reproduction. Short-term drought often reduces production and prolonged drought can cause total crop failure. Severe drought between February and June can reduce fruit set, fruit development and fruit growth. The number of fruit, fruit size, and tree canopy are reduced with water stress. Extension growth in shoots and roots, and leaf expansion are all negatively correlated with water stress. Trees subjected to water stress are generally reduced in size. Vegetative growth is particularly sensitive to water deficit. Growth is closely related to turgor and the loss of turgidity reduces photosynthesis, leaf and fruit enlargement, juice content and yield, and increases wilting and leaf and premature fruit drop. Growers cannot afford water stress or water restrictions during critical periods. Irrigation is not only essential during the springtime, but it is also important during dry falls to minimize premature fruit drop.

Flatwoods Citrus

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Racial-Ethnic Background

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

Gender

__Female

__Male