UNIVERSITY OF FLORIDA

EXTENSION

Institute of Food and Agricultural Sciences

Hendry County Extension • P.O. Box 68 • LaBelle, Florida 33975-0068 • (941) 674-4092

Flatwoods Citrus

Vol. 4, No. 12 December 2001 | **Dr. Mongi Zekri**, Multi-County Citrus Agent

UPCOMING EVENTS

Date: Tuesday, December 18, 2001, 10:00 AM – 12:00 Noon

BMPs-What has been done and what to expect?

Speakers: Stan Carter, Peter McClure, Peter Spyke, and Mike Ziegler
Sponsor: Robert Murray, Florida Favorite Fertilizer
2 CEUs for Certified Crop Advisors

The above listed speakers are from the east coast. They have significantly contributed to the development of the BMPs for the Indian River Area Citrus Groves. They kindly accepted our invitation to share their expertise and experience with their colleague growers and production managers in SW Florida. Please plan to attend, do not miss this valuable opportunity, get up to speed, and do not stay behind-- ***More on page 16-***

Following the seminar, we are planning a free lunch (Compliments of Florida Favorite Fertilizer) for only who call Sheila at 863 674 4092 no later than Friday, 14 December.

Tuesday, January 15, 2002, 10:00 AM – 12:00 Noon

Thrips, citrus psyllid, and citrus greening

Speakers: Drs. Carl Childers and Pam Roberts
Sponsor: Sim Nifong, Dow AgroSciences
2 CEUs for Pesticide License Renewal
2 CEUs for Certified Crop Advisors

Participants with disabilities seeking accommodations, please inform us at least five working days prior to the program

Tuesday, February 5, 2002, 8:30 AM – 4:00 PM

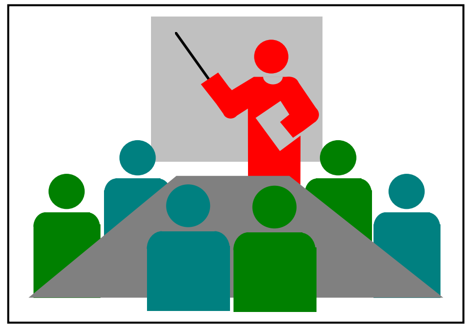
Workshop on scouting for pests and diseases

Speakers: John Taylor and Drs. Pam Roberts and Mongi Zekri
Sponsor: Robert Gregg, Syngenta
6 CEUs for Pesticide License Renewal
6 CEUs for Certified Crop Advisors

Tuesday, February 19, 2002, 10:00 AM – 12:00 Noon

Water management and issues related to water regulations

Speakers: Mary N. Gosa and Drs. Larry Parsons and Sanjay Shukla
Sponsor: Donna Muir Strickland, Monsanto
2 CEUs for Certified Crop Advisors



Tuesday, March 19, 2002, 10:00 AM – 12:00 Noon

Precision Ag and application technology

Speakers: Neal Horrom, Mike Roberts and others
Sponsor: Keith Hollingsworth, Chemical Containers
2 CEUs for Pesticide License Renewal
2 CEUs for Certified Crop Advisors

Tuesday, April 16, 2002, 10:00 AM – 12:00 Noon

Grove replanting and resetting strategies and Diaprepes and canker update

Speaker: Jack Neitzke and Drs. Fritz Roka and Clay McCoy
Sponsor: Shelby Hinrichs, New Farm Americas, Inc.
2 CEUs for Pesticide License Renewal
2 CEUs for Certified Crop Advisors

Tuesday, May 21, 2002, 8:30 AM –12:00 Noon

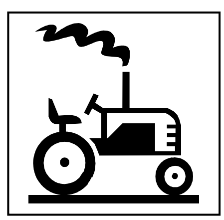
Greasy spot and other fungal diseases

Speaker: Drs. Pete Timmer and Pam Roberts
Sponsor: Mike Raines, Griffin LLC
2 CEUs for Pesticide License Renewal
2 CEUs for Certified Crop Advisors

Saturday, June 1, 2002, 7:45 AM – 2:45 PM

Farm Safety Day

Coordinator: Dr. Mongi Zekri
2 CEUs for Pesticide License Renewal



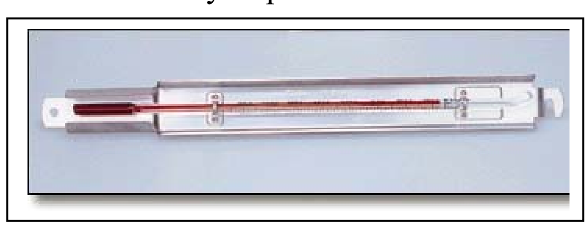
If you want to print a color copy of the Flatwoods Citrus Newsletter, get to the New Home of the Florida Citrus Resources Site at http://www.fcprac.ifas.ufl.edu/
You can also find all you need and all links to the University of Florida Citrus Extension and the Florida Citrus Industry.

Special Thanks to the following sponsors of the Faltwoods Citrus Newsletter for their generous contribution and support. If you would like to be among them, please contact me at 863 674 4092.

Cold hardiness and cold protection

Both citrus fruit and foliage can be damaged if temperature falls below freezing for a prolonged period. However, weather conditions prior to cold temperature, duration of cold, position of the tree in the grove or yard, maturity of the fruit, health and age of the tree can affect tree and fruit hardiness. Citrons, Tahiti and Mexican limes are the most sensitive. True lemon are slightly more cold hardy, followed by grapefruit, tangelo, limequat, sweet orange, most mandarins, and kumquat. Leaves of kumquats are hardy to 20F. The majority of sweet oranges are hardy to 26-27F. Thin-skinned, small-sized fruit or fruit held toward the outside of the canopy are usually more sensitive to cold. Fruit that is mature or close to maturity and has a high sugar content can withstand more cold than immature fruit. Trees are more cold hardy when exposed to cooler temperature over several weeks prior to freezes. Sudden cold snaps can be particularly damaging to citrus. Cold tolerance develops most readily when trees are not flushing. Warm temperatures at any time during the winter may cause citrus trees to resume growth and reduce their cold tolerance. Ice formation in citrus tissues -not low temperature- kills or damages citrus trees and fruit. One hour below 28F may kill tender growth and citrus flowers. New flush growth and bloom buds will experience minimal damage at 28F when exposed for 30 minutes, but will be killed at 26F for the same period of time. Fruit damage occurs when the temperature falls below 28F for at least 4 hours. Frozen fruit can be salvaged for juice. Mature citrus leaves can generally withstand 4 hours of 23-24F with minimal damage. Four hours at 20F can kill 3/8-inch or smaller wood and temperatures below 28F for 12 continuous hours may kill larger limbs and possibly the entire tree. A clean, hard-packed surface intercepts and stores more solar radiation during the day and releases more heat at night than a surface covered with vegetation or a newly tilled area. Addition of water to the cleanly cultivated area prior to a freeze further improves heat accumulation during the day. Therefore, keep the area around the trees free of weeds and apply water to the soil prior to cold weather. Water should also be pumped high in the ditches the day before and during the time of freezing weather. But water has to be removed within 2-3 days after the freeze to avoid root damage. As the water cools, it releases heat, increasing air temperature around the trees. Young trees are more vulnerable to cold damage. It is more of a problem in open, solid-set plantings than resets in mature groves.

Minimum-reading thermometers should be installed in the coldest locations of several blocks of the groves. They should be placed at a height of 42 inches (4.5 ft) on a stand sheltered at the top and facing north. Use of microsprinkler for cold protection is very important. Turn on the water early when the air temperature reaches 36F. Remember that in cold pockets, the ground surface can be below 32F when it is 36F at the thermometer location. You have to keep running the system all night. The irrigation system can be turned off in the morning when the air temperature rises to 40F.



Microsprinkler emitters should be placed on the upwind (northwest) side 1-2 ft from the tree. As long as the water is constantly being changed to ice, the temperature of the ice-water mixture will remain at 32F. Use a 90-180 degree spray pattern, which concentrates the water on the trunk and lower limbs of the tree.

Special Thanks to these sponsors of the Flatwoods Citrus Newsletter for their generous contribution and support. If you would like to be among them, please contact me at Phone 863 674 4092, Fax: 863 674 4636, or maz@gnv.ifas.ufl.edu

COURSE ANNOUNCEMENTS

CITRUS FRESH FRUIT TECHNOLOGY - HOS 5325C - SPRING 2002 - Citrus Research and Education Center

A course on fresh citrus fruit development, physiology, pathology, harvesting, handling, packinghouse engineering principles, quarantine measures and marketing regulations will be offered this Spring semester from January 11th through April 24th at the Citrus Research and Education Center, Lake Alfred, FL. This upper division-graduate level course combines lectures and laboratory exercises and will meet Tuesdays from 4 to 8 pm. This is a team-taught 3-unit course that will cost approximately $432.60 for in-state tuition. The course is available in Continuing Education or as a regular Graduate Course offering. Interested students should have taken basic plant physiology, citrus production courses or have experience in a citrus packinghouse. Contact Dr. L. Gene Albrigo at (863) 956-1151 or by email (albrigo@lal.ifas.ufl.edu) for further information and class enrollment.

ADVANCED CITRICULTURE II - HOS 6546 - Spring 2002 - CREC and Distance Education Locations of Immokalee, Gainesville and Fort Pierce

A course on regulation of reproductive growth of citrus will be offered this spring semester from January 7th through April 22nd 2002 from the Citrus Research and Education Center Lake Alfred, FL. This graduate level course will meet Mondays from 4 to 7 pm. Students will meet at Lake Alfred or the nearest alternate location (Immokalee, Gainesville or Ft. Pierce) with interactive Internet Video-Audio Conferencing and participate in class through this media. The in-person site will be Lake Alfred and all students will come to Lake Alfred twice during the semester, when they lead the discussion session. Students will review literature on climatic, physiological, production practices and other factors as they influence reproductive development of citrus. Each week a student will lead the discussion of the assigned literature that has been selected by the student with guidance of the instructor. This is a 3-unit course that will cost approximately $432.60 for in-state tuition. The course is available in Continuing Education or as a regular Graduate School offering. Interested students should have taken basic plant physiology or citrus production courses. The limit is 12 students; please contact Dr. L. Gene Albrigo (863 956-1151 or albrigo@lal.ufl.edu) for further information and class enrollment.

More Courses offered at the Immokalee IFAS Center

Other courses are also offered next semester at the Southwest Florida Research and Education Center (SWFREC), Immokalee. **For more information, call or write to Dr. Bob Rouse**, Teaching Coordinator, WSFREC, 2686 S.R. 29 North, Immokalee, FL 34142-9515, Phone: (941) 658 3400.

MORE ON COLD PROTECTION

As a means of cold protection, overhead, high-volume sprinklers have been used successfully in citrus nurseries and low-volume microsprinklers have been used to protect young trees in groves. However, success can vary with the type of system, application rates, type of freeze (advective vs. radiative), and severity of the freeze. An <u>advective</u> or windy freeze occurs when a cold air mass moves into an area bringing freezing temperatures. A <u>radiation</u> frost occurs when a clear sky and calm conditions allow an inversion to develop and temperatures near the surface drop below freezing. <u>Inversion</u> occurs on a clear night during which heat continues to radiate out into the space. The temperature drops significantly and cool air collects at the surface. The temperature increases with altitude (height), which is the inverse of normal conditions.

Water protects young trees by transferring heat to the tree and the environment. The heat is provided from two sources, sensible heat and the latent heat of fusion. Most irrigation water comes out of the ground at 68° to 72°F, depending on the depth of the well. In fact, some artesian wells may provide water of 80°F or more. As the water is sprayed into the air, it releases this stored (sensible) heat. However, by the time the water reaches the tree it has lost most of its energy, particularly for low volume microsprinkler systems. Consequently, the major source of heat from irrigation is provided when the water changes to ice (latent heat of fusion). As long as water is constantly changing to ice the temperature of the ice-water mixture will remain at 32°F. The higher the rate of water application to a given area, the greater is the amount of heat energy that is applied.

The major problems in the use of irrigation for cold protection occur when inadequate amounts of water are applied or under windy (advective) conditions. Evaporative cooling, which removes 7.5 times the energy added by heat of fusion, may cause severe reductions in temperature under windy conditions, particularly when inadequate amounts of water are used. It should be kept in mind that most irrigation systems will not protect the upper portion of tree canopies. Because water can provide protection in one situation and cause damage in another, it is important to know what principles are involved and understand the dew point and what can happen when using water during a freeze.

What's the "<u>Dew Point?</u>" It is the temperature at which dew begins to form or the temperature at which water vapor condenses to liquid water. It is also the temperature at which air reaches water vapor saturation. A common example of condensation is the water that forms on the outside of a glass of ice water. This happens because the temperature of the glass surface is lower than the dew point temperature of the ambient air in the room. Hence, some of the water vapor in the surrounding air condenses on the outside of the cold glass. When referring to cold protection, the dew point is one of the better ways to describe the humidity or amount of water vapor in the air. When the dew point is below 32°F, it is often called the frost point because frost can form when the temperature is below freezing. The dew point is important on freeze nights because water vapor in the air can slow the rate of temperature fall. With a relatively high dew point on a cool night, radiant heat losses from a grove are reduced, and the temperature may be expected to fall slowly. But if the dew point is quite low, the temperature may be expected to fall rapidly. Water vapor absorbs infrared radiation. Water droplets or fog are an even more effective radiation absorber than water vapor. Hence, fog can reduce the rate of temperature drop on a frost night. Dew point temperatures are commonly higher on the coasts than they are inland. In addition to affecting the rate of radiation loss, the dew point is often a "basement" temperature, and the air temperature will not go much below it unless drier air moves in. The reason for this is that when dew condenses or ice forms, heat is given off.

A sling psychrometer is a convenient portable gauge for measuring relative humidity and dew point. It is an important tool to determine when to stop irrigating during freezing conditions. This instrument compares the temperatures of a dry bulb thermometer and a wet bulb thermometer. The psychrometer is spun around rapidly for a few minutes and readings are taken for the dry and wet bulb temperatures. The scale on the back of the unit and the chart that comes with the unit allow deriving the dew point and relative humidity. In the morning, when the temperature warms up, it is not necessary to wait until the ice has melted before turning off the system. When the wet bulb temperature is above 33° or when the air temperature is 40°, the system can be turned off safely.

It is generally advisable to place the emitter northwest of the tree, approximately 1 to 2 feet away from the trunk. Emitters should be attached to risers for greatest tree trunk protection. Improper placement or inadequate spray coverage will greatly lessen the effectiveness of the irrigation. A 90° to 180° spray pattern, which concentrates the water on the trunk and lower limbs, gives cold protection superior to a 360° pattern. Inverted cone sprinklers positioned above the wrap in the tree also give adequate protection. The volume of water applied depends on the amount of cold protection required. Generally, 10 gallons per hour (gph) applied directly to the trunk in a 90° pattern will provide adequate cold protection during most freezes.

It is very important to know the critical temperature at which freezes can damage the grown crop. Minimum-temperature-indicating thermometers are not expensive and are a wise investment for any grower concerned with freeze/frost protection. Several thermometers should be placed in several blocks. Placement and number of thermometers should depend on the area and grower’s interest. Some factors to be considered include elevation, scion/rootstock cultivars, tree size, and irrigation systems. Some growers place one thermometer in the coldest spot and organize their protection strategy around the worst possible case. This is acceptable, but most of the area will receive more protection than it needs which will waste water and fuel and cost the grower money.

Winter Weather Watch

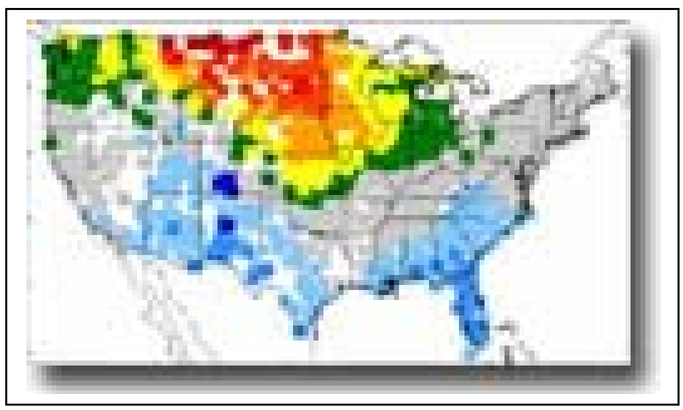
From the winter 1970/71 through the winter 1995/96, citrus growers in central Florida used a system based on an electronic answering machine to obtain weather forecasts, extended outlooks, a collection of current conditions on freeze nights and educational information to assist them in coping with cold weather. The information obtained through the system was originated from the National Weather Service (NWS) and retrieved at the Lake County Extension Office by John Jackson and at the Polk County Extension Office by Tom Oswalt. A decision by the NWS administrators in 1996 eliminated the agricultural weather program, which has forced the Extension Service to move to private sources. Since the 1996/97 winter, the Extension Service has started utilizing several private agricultural meteorologists to obtain accurate and reliable weather information. For more information, call John Jackson (352 343 4101) in Lake County, Chris Oswalt (863 533 0765) in Polk County, or Max Still (863 402 6540) in Highlands County. The Winter Weather Watch starts in mid-November and continues through mid-March. There is a subscription fee of $100 to get telephone access to the daily weather recordings. The fee for the program goes towards telephone lines rental fees, long distance calls, equipment, weather service fees, and repairs. Weather forecasts are updated daily, seven days a week throughout the winter season. If temperatures of 35F or lower are predicted, the afternoon forecast is recorded also. This service provides timely information to help growers and farmers minimize their damage from frosts and freezes. There is an unlisted telephone number available to subscribers. Subscribers are asked not to give out the telephone number to others outside of their organization. If willing to subscribe, contact John Jackson (352 343 4101), Chris Oswalt (863 533 0765), or Max Still (863 402 6540).

The Florida Automated Weather Network (FAWN)

It is another tool to provide a reliable source of real-time agricultural weather information from the UF main campus in Gainesville, 10 UF/IFAS Research Centers including the Southwest Florida Research and Education Center in Immokalee, and 10 more sites that are part of the Network. Because of the importance of weather in agriculture, every effort is made to make the information available to the grower and other potential groups as soon as possible. Data are collected every 15 minutes and available through the Internet (**http://fawn.ifas.ufl.edu**) and a voice data system using conventional telephone (352 846 3100). The FAWN management tools provide decision support functions to growers, using historical weather data and crop modeling technology to help in both short and long term planning. The Brunt minimum temperature calculator uses the temperatures at sunset to estimate the lowest temperature for any given night. FAWN also offers several management tools for evapotranspiration calculations, irrigation management, and microirrigation scheduling for citrus. Learn more about them in the download area. FAWN will offer more management tools in the near future as IFAS Information Technology developers build cooperative relationships with University of Florida researchers and extension agents.

Forecast Discussion from the FAWN Website

Climate shifts due to El Niño and La Niña are well-known and are now used to predict seasonal temperature and precipitation trends up to 12 months in advance. These climate shifts are particularly strong in Florida and the Southeast United States. During the winter and spring months, El Niño brings plentiful rainfall (40% more than normal) and cooler temperatures to Florida. The last El Niño occurred in 1997-1998 and was one of the strongest on record. Conversely, La Niña is associated with warm and dry winter and spring seasons in Florida and the Southeast. A persistent La Niña is responsible for the warm winter temperatures and drought conditions in Florida for the past three years. While El Niño and La Niña affect the average temperature of the winter season as a whole, they both tend to suppress the severe arctic outbreaks of cold air that cause damaging freezes in Florida. Changes in the jet stream patterns during El Niño and La Niña play a part in the intrusion of cold Canadian air that make their way this far south. A strong subtropical jet accompanies El Niño and for the most part "blocks" the Arctic air masses from entering Florida. La Niña limits the movement of the Polar jet over the United States, steering winter storms and stronger cold fronts to our north. However, in Neutral years the position of the Polar jet is highly variable and it tends to meander over the entire continent. Due to this "unstable" pattern, the southern tier of the US is more susceptible to the dramatic dips (or troughs) in the jet stream that push Arctic air masses south from Canada. These are the severe Arctic outbreaks that lead to freezing temperatures in the Central and Southern parts of Florida. Near normal sea surface temperatures are expected in the tropical Pacific this year, so **the upcoming winter will be considered Neutral (neither El Niño nor La Niña)**. For this reason we are forecasting an increased risk of damaging freezes. An examination of minimum temperatures from weather stations all over Florida from the past 50 years shows that freezing events are up to three times more likely to occur in Neutral years than during El Niño or La Niña.



Another Weather Watch Service in SW Florida

US Weather Corporation, Southwest Florida's Premier Weather Consulting Service announces Frost and Freeze Warning Services for local agricultural interests.

US Weather Corporation meteorological offices are headed by ABC-7 Chief Meteorologist Jim Reif and NBC-2 Chief Meteorologist Jim Clarke. US Weather corporation's Frost and Freeze Warning Services are available via e-mail to area subscribers. Subscription services offer a daily outlook 7 days a week during the cold weather season. Short and long range forecasts are issued once daily during periods of tranquil weather to as many as 4 times a day during times of critically cold patterns, and can be tailor-made for the user. Phone consultation is included in the subscription fee. For further information, contact Jim Reif or Jim Clarke at US Weather Corporation at 941 931 4572.

Soil Acidity and Liming

With the exception of some native vegetation (e.g. pine trees) and a few acid-loving plants such as azaleas, blueberries, and gardenias, most plants and fruit trees including citrus do best in a slightly acid soil with a pH between 6.0 and 7.0.

Acid Soil Infertility

When the pH falls below 6.0, the availability of nutrients such as phosphorus, potassium, calcium, and magnesium decreases and the availability of the metallic micronutrients, like zinc, manganese, copper, and iron increases.

Problems in very acid soils

*Aluminum (Al) toxicity to plant roots
*Manganese toxicity to plants
*Calcium & magnesium deficiencies
*Molybdenum deficiency
*Phosphorus tied up by iron (Fe) & Al
*Poor bacterial growth
*Reduced nitrogen transformations

Problems in alkaline (high pH) soils

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

<u>Factors Affecting Soil pH</u>

Soils are not homogenous and the pH can vary considerably from one spot in the field to another. It also varies with depth. Soils in different geographic regions may have different pHs because of several factors including the parent material and the climate.

<u>Rainfall/leaching</u>. Rainfall affects soil pH. Water passing through the soil leaches basic cations such as calcium (Ca^{2+}), magnesium (Mg^{2+}), and potassium (K^+) into drainage water. These basic cations are replaced by acidic cations such as aluminum (Al_3^+) and hydrogen (H^+). For this reason, soils formed under high rainfall conditions are more acid than those formed under arid conditions.

<u>Fertilizers</u>. Both organic and non-organic fertilizers may eventually make the soil more acid. Hydrogen is added in the form of ammonia-based fertilizers (NH_4^+), urea-based fertilizers [$CO(NH_2)_2$], and as proteins (amino acids) in organic fertilizers. Transformations of these sources of N into nitrate (NO_3^-) releases H^+ to create soil acidity. Therefore, fertilization with fertilizers containing ammonium or even adding large quantities of organic matter to a soil will ultimately increase the soil acidity and lower the pH.

$$NH_4^+ + 2O_2 + \text{(bacteria)} \rightarrow NO_3^- + 2H^+ + H_2O$$

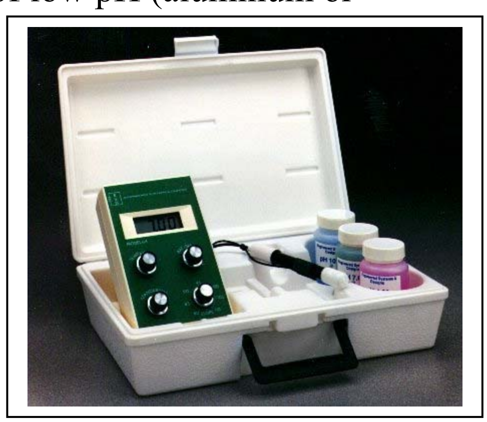
Common Fertilizers and their Equivalent Acidity or Basicity

Material	**% Nutrient in Material**	**Amount to supply one unit (20 lbs) of nutrient**	**$CaCO_3$ equivalent per unit (20 lbs) of nutrient***
Nitrogen fertilizers			
Ammonium nitrate	34	60	-36
Ammonium sulfate	21	98	-107
Anhydrous ammonia	82	24	-36
Diammonium phosphate	18	111	-71
Monoammonium phosphate	11	182	-107
Nitrogen solutions	28-32	71-63	-36
Potassium nitrate	14	143	+36
Sodium nitrate	16	125	+36
Urea	45	44	-36
Phosphorus fertilizers			
Diammonium phosphate	46	43	-21
Monoammonium phosphate	55	36	-28
Ordinary superphosphate	20	100	Neutral
Triple superphosphate	46	43	Neutral
Potassium fertilizers			
Potassium chloride	60-62	33-32	Neutral
Potassium nitrate	44	45	+11
Potassium magnesium sulfate	22	91	Neutral
Potassium sulfate	48-52	42-38	Neutral
***A minus sign indicates the number of pounds of pure $CaCO_3$ needed to neutralize the acidity created by 20 lbs of N, P_2O_5, or K_2O. A plus sign indicates that the material is basic and is equivalent to the number of pounds of pure $CaCO_3$ indicated.**			

Plant uptake. Plants take up basic cations such as K^+, Ca^{++}, and Mg^{++}. When these are removed from the soil, they are replaced with H^+ in order to maintain electrical neutrality and the soil pH is reduced.

Raising Soil pH (Liming Acid Soils)

Soils are limed to reduce the harmful effects of low pH (aluminum or manganese toxicity) and to add calcium and magnesium to the soil. The amount of lime needed to achieve a certain pH depends on the pH of the soil and its buffering capacity. The buffering capacity is related to the cation exchange capacity (CEC). The higher the CEC, the more exchangeable acidity (hydrogen and aluminum) is held by the soil colloids. As with CEC, buffering capacity increases with the amounts of clay and



organic matter in the soil. Soils with a high buffering capacity require larger amounts of lime to increase the pH than soils with a lower buffering capacity.

Most soil testing laboratories use a special buffered solution to measure the exchangeable acidity. This is the form of soil acidity that must be neutralized for a change in soil pH. By calibrating pH changes in the buffered solution with known amounts of acid, the amount of lime required to bring the soil to a particular pH can be determined.

Lime reduces soil acidity (increases pH) by changing some of the hydrogen ions (H^+) into water (H_2O) and carbon dioxide (CO_2). A Ca^{++} ion from the lime replaces two H^+ ions on the cation exchange complex. The carbonate (CO_3^-) reacts with water to form bicarbonate (HCO_3^-). These react with H^+ to form H_2O and CO_2. The pH increases because the H+ concentration has been reduced.

$$\textbf{Soil Colloid}\begin{matrix}H^+\\ \\ H^+\end{matrix} + CaCO_3 \Rightarrow \textbf{Soil Colloid-}Ca^{++} + H_2O + CO_2$$

***Dissolution of lime:** $CaCO_3 + H_2O \Rightarrow Ca^{2+} + HCO_3^- + OH^-$

***Neutralization:** $H^+ \text{ (soil solution)} + OH^- \Rightarrow H_2O$

$H^+ \text{ (soil solution)} + HCO_3^- \Rightarrow H_2O + CO_2$

(Neutralization is caused by the carbonate in lime, not the calcium)

An acid soil can become more acid as basic cations such as Ca^{2+}, Mg^{2+}, and K^+ are removed, usually by crop uptake or leaching, and replaced by H^+.

Liming Materials

The most common liming materials are calcitic or dolomitic agricultural limestone. These are natural products made by finely grinding natural limestone. Since natural limestone is relatively insoluble in water, agricultural limestone must be very finely ground so it can be thoroughly mixed with the soil and allowed to react with the soil's acidity. Calcitic limestone is mostly calcium carbonate ($CaCO_3$). Dolomitic limestone is made from rocks containing a mixture of calcium and magnesium carbonates. Either will neutralize soil acidity. Dolomitic limestone also provides magnesium. Not all materials containing calcium and magnesium are capable of reducing soil acidity. Gypsum ($CaSO_4$) does not reduce soil acidity.

$$CaSO_4 + 2H_2O \Rightarrow Ca(OH)_2 + H_2SO_4$$

These 2 products neutralize each other.

Application and Placement of Lime

Time of year. Lime may be applied at any time during the year. Application in early fall and spring or prior to soil preparation is recommended. Caustic liming materials such as burned lime, hydrated lime, or wood ashes to actively growing plants are not recommended.

Lime placement. Since ground limestone is relatively insoluble in water, maximum contact with the soil is necessary to neutralize the soil acidity. Lime will not move into the soil like water-soluble fertilizers. The recommended amount of lime should be thoroughly mixed with the topsoil. As soon as moisture is present, the lime will begin to react. Coarse lime particles react more slowly than very fine particles. Therefore, using very finely ground limestone and thoroughly mixing it are necessary to achieve the desired soil pH change within a few months.

Overliming

While a correct liming program is beneficial for plant growth, excessive liming can be detrimental because deficiencies and imbalances of certain plant nutrients may result. The practice of estimating lime requirement without a soil test is risky because it can lead to overliming. Overliming causes the soil pH to increase beyond the range of optimum plant performance. Reduced plant growth is usually associated with deficiencies of micronutrients such as Mn, Fe, zinc (Zn) or copper (Cu), which become less available as soil pH increases. Overliming is costly -- it costs to buy and apply the lime, and it costs in terms of reduced plant performance.

The principal factors contributing to overliming are: (1) application of lime to soil without testing or determining if lime is needed, (2) liming to soil pH levels much higher than those necessary to achieve the desired plant response, (2) liming to supply calcium (Ca) and/or magnesium (Mg) as nutrient elements without sufficient regard to the effect of lime in raising the soil pH.

If there is a need for Ca or Mg as nutrients and an increase in soil pH is not desired, another source of Ca or Mg should be used. Gypsum (calcium sulfate) and magnesium sulfate or oxide can supply Ca and Mg without affecting soil pH.

Calcium sources

Source	Chemical formula	Calcium carbonate equiv. (pure form)
Burned lime (Quicklime)	CaO	179
Hydrated lime (Builder's lime)	$Ca(OH)_2$	135
Dolomitic lime	$CaCO_3 + MgCO_3$	109
Calcitic lime	$CaCO_3$	100
Basic slag (by-product)	$CaSiO_3$	80
Marl (soft carbonates)	$CaCO_3$	70 to 90
Gypsum	$CaSO_4$	0
Calcium nitrate	$Ca(NO_3)_2$	----
Ordinary superphosphate	$Ca(H_2PO_4)_2 + CaSO_4$	----
Concentrated superphosphate	$Ca(H_2PO_4)_2$	----

FLOWER BUD INDUCTION OVERVIEW and ADVISORY #1 for 2001- 2002

L. Gene Albrigo, Horticulturist, Citrus Research & Education Center, Lake Alfred

It is the time of year to start following citrus flower bud induction conditions for the coming year's bloom. Cool weather stops growth and then promotes induction of flower buds as more cool weather accumulates. A warm spell can then initiate differentiation which after sufficient days of warm temperatures leads to bloom. The meteorologists say that this winter in Florida will be cooler than normal, an El Nino year.

Potentially sufficient cool temperatures should accumulate, below 68 degrees F., to induce adequate flower buds for an economic crop. Sufficient flower bud induction under Florida conditions is achieved when total accumulated cool hours of 850 to 1000 hours below 68 degrees F. occurs without interruption before a warm spell triggers growth, ie., 7 to 12 days with max. temperatures > 70 to 75 degrees F. So far this year sufficient cool weather has occurred to slow down or stop vegetative growth on mature trees, 160 to 190.hr < 65 degrees F. in southern districts and 230 to 250 hr < 65 degree F. in northern districts. This information is available on the Florida Automated Weather System **(fawn.ifas.ufl.edu).**

The major concern for the next 45 days is the possibility of an early warm spell that will initiate differentiation of easily induced flower buds or push vegetative buds to grow. Some flower buds will be induced in the range of 300 to 600 accumulated hr < 68 degrees F. These early warm events therefore result in many buds remaining that can be induced by later cool spells and multiple blooms will occur. If winter bud break is not prevented in Florida, multiple blooms occur in about half of the years. The early time period in which some bud growth can occur and lead to multiple blooms is roughly Thanksgiving to Christmas. Presently, the only management tool available to eliminate or reduce the chance of multiple blooms is to allow water stress to develop during this time period.

If no rains interrupt a mild stress condition of the citrus tree, buds will not grow in response to warm temperatures. These warm spells in the late fall-early winter usually last less than two weeks. A warm spell is predicted for the Thanksgiving week [(www.lal.ufl.edu), click on weather links and 8 day forecast]. After a warm spell has passed, trees again can be watered to minimize fruit water stress. Although no weather prediction is guaranteed even by the meteorologist, rains in the winter usually come on the fronts of cool spells. Therefore, the chances of applying water stress to prevent an early flower bud differentiation is reasonably good for some warm spells.

With the shallow soils in bedded groves, it is relatively easy to reach sufficient stress to suppress growth by withholding irrigation for a few days. In deeper sandy soils, 2 or more weeks may be required. To minimize the time to initiate water stress, the soil should be allowed to dry out in late fall so that trees show wilt by mid-day. For bedded groves, minimum irrigation can then be applied as needed until a weather prediction indicates a warm spell is expected. At this time irrigation should be shut down. For deep sands, the soil needs to be dried out and left that way until at least Christmas so that no growth can occur. This may be risky for Hamlin or other early maturing cultivars that tend to drop fruit near harvest.

CHECK THE WEBSITE FOR FLOWER BUD INDUCTION ADVISORY #2 for 2001- 2002 - 11/24/01. Cool weather stops growth and then promotes induction of flower buds as more cool weather accumulates. A warm spell can then initiate differentiation which after sufficient days of warm temperatures leads to bloom…….

CITRUS PATHOLOGY RESEARCH AND EXTENSION PROGRAM

Dr. L. W. Timmer, Professor in plant pathology at the Lake Alfred Citrus Research & Education Center, has a new website location for Citrus Pathology Research and Extension Program.

It includes general disease notes, Alternaria Brown Spot, Citrus Scab, Greasy Spot, Melanose, Postbloom Fruit Drop, and Systemic Induced Resistance. The website has also several useful links such citrus canker, the Florida citrus pest management guide, and postharvest citrus guide. The website address is: http://www.lal.ufl.edu/timmer/

CLIPS FROM THE BMPs MANUAL

Requirements For BMP Development
All BMPs must be environmentally protective and economically viable. Recommendations must be based on factual information and science, and must be focused on real problems and solutions that work.

Implementation of BMPs
These BMP measures are not regulatory or enforcement-based. Landowners are requested to maintain records and provide documentation regarding the implementation of all BMPs. Adequate records are very important for documentation of BMP implementation. These records are an integral part of the non-regulatory, incentive-based initiative of the BMP program.

The priorities for BMP implementation are:

1. To correct existing water quality/quantity problems.
2. To minimize water quality/quantity problems resulting from land use.
3. To improve effectiveness of applied BMPs.
4. To seek additional improvement of BMPs based on new information.

All growers are encouraged to perform an environmental assessment of their crop production operations. This resource allocation assessment process is a tool that will aid in identifying which BMPs should be considered to achieve the greatest economic and environmental benefit. Among the incentives for adoption of BMPs are:

- Improved crop yield
- Improved crop quality
- Improved worker safety
- Efficient allocation of resources
- Reduced environmental impacts
- Opportunity to receive cost-sharing incentives
- Reduced new regulatory requirements
- Opportunity for industry self-regulation.