UF UNIVERSITY of FLORIDA
IFAS Extension
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Volusia County FLORIDA

3100 E. New York Ave.
DeLand, FL 32724-6410
DeLand: (386) 822-5778
Daytona Beach: (386) 257-6012
New Smyrna Beach: (386) 423-3368
Fax: (386) 822-5767
http://volusia.org/extension
Emails: bjeansonne@co.volusia.fl.us
bjeansonne@ufl.edu

From Roots to Shoots

For The Commercial Grower
By Brent Jeansonnne
Commercial Horticulture Extension Agent

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Preparing for Winter

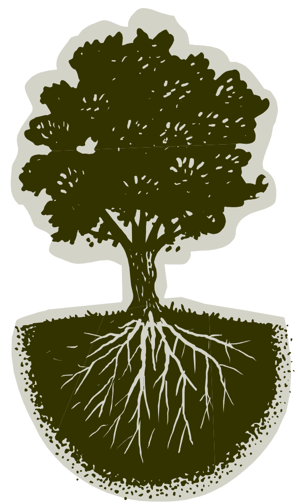
Within the last few years, one of the major challenges citrus and foliage growers in Volusia County have been experiencing is the protection of their crops from the bitter harsh winter freezes. In general, it seems as though frigid temperatures have been dipping lower and lower with more intensity into the Florida peninsula in the last several years.

Recently, the main culprit behind the cold temperatures in December 2010 was the same one which caused the cold winter of 2009-2010 which was a strongly negative North Atlantic Oscillation (NAO) and Arctic Oscillation (AO).

Prior to a freeze, a grower needs to maintain and test all engines, pumps, supply lines, solenoids, valves, and emitters for needed upgrades and repairs. Check and replace all worn and clogged emitters and adjust emitters to provide 100 percent coverage; also, have fuel ready to go when the time comes. A fast flushing of all lines with an acid based solution to kill any algae and remove contaminants may be needed on lines that are old. High fuel cost have made grove heating during freeze nights prohibitively expensive except for high value crops.

Citrus: Microsprinklers are the most efficient and beneficial for winter freeze protection of the bud union and lower portion of young trees. In citrus groves, the most commonly used spray jets discharge from 5 to 25 gallons/hour and cover a diameter of 5 to 21 feet. Irrigation rates of 2,000 gallons/acre/hour or 33.3 gallons/acre/minute are recommended.

Fern: By watering plants to field capacity before cold events can help protect the plants by increasing heat absorption and storage. Watering plants before a freeze can help protect plants. A well watered soil will absorb more solar radiation than dry soil and will reradiate heat during the night. This practice elevated minimum night temperatures in the canopy of citrus trees by as much as 2°F (1°C). Without a doubt, preparation is the key for freeze protection success.



Inside this issue:

Newsletter link is http://www.volusia.org/extension/frtswinter2011.pdf

Significance of Water in Leatherleaf Fern Production

In terms of a horticultural prospective, do we really know what function water serves? When we think about water, besides being wet, the first thing that comes to mind is simply the plant needs it. This thought is especially true when we see the plant drooping on a hot and sunny day. Some plants require more water than others to survive.

In leatherleaf fern production, there are many reasons water is essential for plant survival. Mature leatherleaf fronds are composed of approximately 75 percent water by weight. With this high margin, water is vital for the plants survival. As with all plants, water serves as:

1. a solvent in which reactions take place, along with chemical and physiological as well,
2. a raw material critical for the synthesis of organic compounds: a medium in which nutrients can transport throughout the plant (see Figure 1),[1]
3. and, a source for turgur pressure, due to the transpiration process, which is the determining factor for cell expansion (i.e. plant growth) and thus prevents cell collapse (i.e. plant wilting). In addition, the transpiration process aids in cooling the plant.

Figure 1

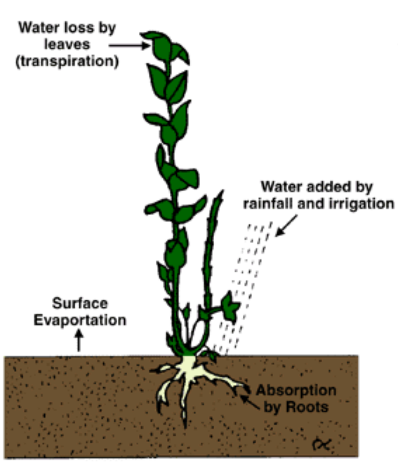


Fig. 1. The plant/soil/water cycle.

Water reservoir

As a vital element of survival, the leatherleaf fern relies on the soil as a continuous reservoir for the plants survival. Moisture in the soil is typically replenished by either rain or irrigated water. In ferneries, you can't always depend on Mother Nature to supply the constant supply of water, so irrigation is logical. In some cases, high water tables supply water to the plant through capillary action. Monitoring the soil moisture is necessary, especially in the summer months on sandy soils of Florida. Immediately after irrigation or after a rain, the majority of the water in sandy soil drains rapidly downward due to the force of gravity. At the time in which the initial drain is completed, the remaining moisture terms the soil at ***field capacity***. This can be illustrated by collecting a soil sample in your hand, and if the soil is moist, but not dripping with any water, this would be ***field capacity***. At this point, the large soil pores that once held water shortly after the irrigation, called ***macropores,*** are now filled with air. On the other hand, smaller pores are called ***capillary*** or ***micropore.*** These pores still retain available moisture for the plant for days. Hence, the moisture that is contained in the micropores is called ***available water***.

Water relationship with leatherleaf fern production

The production of leatherleaf fern in Volusia County is predominately grown in well-drained sandy soils. Because of this fact, the moisture and nutrient holding capacity of the soils is extremely low. Fertilizer and other chemicals are easily leached out of the soil, and the soil dries rapidly. So to supply the needed nutrients at a constant level, the aid of irrigation is once again necessary. Not only water, but nutrients as well as pesticides can be delivered to the crop through injection of chemicals into the irrigation system. In the production of leatherleaf fern, an annual precipitation or irrigation requirement of a minimum of 50 inches per year is needed for adequate moisture. Without available moisture, commercial growers can expect fern growth and production to be severely decreased. You should never rely on an irrigation system to supply 100 percent of the needed water. Monitoring is essential! With time, constraints such as algae buildup in the pipes and contaminants in the water from a faulty filter system may clog the emitters and deprive the ferns of water. Another constraint is an accidental break of a water emitter or line by a laborer. This event would not only flood the area of breakage, but deprive other areas due to a loss in water pressure.

Fertilizer and pH relationship in leatherleaf fern production

Significance of Water in Leatherleaf Fern Production

Many people don't understand the importance of understanding soil pH and how it affects plant growth. From a nutritional stand point, pH monitoring is a vital component that determines the nutrient availability to a plant. In leatherleaf fern production, if the pH is too high minor elements such as manganese, zinc, iron, and copper will be tied up, and therefore, not available. For instance, yellowing foliage is an indication of magnesium, iron, and manganese deficiencies. A similar indicator of light green to yellow foliage is what Nitrogen deficiency also exhibits, but in addition, Nitrogen deficiency also will result in slow growth. Phosphorous deficiency will again exhibit not only yellowing fronds, but the plant will be stunted. To prevent this from happening, leatherleaf ferns perform best with a soil pH range of 5.5 – 6.0 and soil test should be done annually, and monitored to make the appropriate adjustment and maximize the effectiveness of the nutrient program. Adjustment of the pH can be done with the application of elementary sulfur. Make sure that immediately after the application of sulfur; the foliage of the plant should be washed to remove any residue on the leaves. The recommendation for best results is that sulfur should be worked into the soil.

When the soil pH value is at 5.5 or less, special issues become apparent. Aluminum manganese and other minor elements dissolve readily in the soil solution creating a toxic environment for the plant roots and damage occurs. At this pH level, other nutrients, such as calcium, phosphorous, and magnesium are less available also.

pH has an effect on macronutrient efficiency such as Nitrogen, Phosphorous, and Potash. As seen in (Chart 1 below), with all three macronutrients, there is a significant decrease in efficiency as the soil pH decreases.

The best remedy to these potentially costly situations is to have your soil tested. The procedure is to bring a soil sample to the Extension office and request a soil test.

If the soil is extremely acidic, below 5.5, dolomitic limestone may be used and watered in to raise the pH. If the soil is above 6.0, the use of sulfur may be used. The altering of the soil pH is a timely event. It will not happen overnight. The duration may be five to eight months due to chemical changes within the soil.

Chart 1

Soil Acidity (pH)	Nitrogen (N) efficiency	Phosphorous (P) efficiency	Potash (K) efficiency
4.5	30%	23%	33%
5.0	53%	34%	52%
5.5	77%	48%	77%
6.0	89%	51%	100%

Care of Freeze Damaged Trees

Tree dormancy at the time of a freeze is probably the most important factor influencing the susceptibility of citrus to freezing temperatures. Citrus trees are evergreen, never become fully dormant, and cannot withstand temperatures as low as those tolerated by deciduous trees. Cold weather preconditioning induces a degree of dormancy in citrus - if it comes gradually. Trees in active growth are more severely injured by cold than those which are somewhat dormant.

One of the best ways to lessen cold injury and hasten cold damage recovery is to maintain healthy trees. Follow cultural practices to induce dormancy in the early winter; strive to maintain this dormancy until all cold weather has passed. Ability to recover from cold damage depends largely on tree vigor. Weak trees showing disease, insect damage, or nutrient deficiency symptoms usually are the ones most severely damaged and slowest to recover.

Citrus trees which were exposed to freezing weather should be given careful attention during the next six months. To prevent further damage, several recommendations should be followed.

1. Examine trees individually for regrowth on the lower trunk. Trees that were banked or protected in some fashion probably will have a zone of living tissue on the lower trunk. Do not, under any circumstance, prune the tree for the next four months. It is impossible to tell the exact region where regrowth might occur. Any premature pruning may cut off living tissue.
2. Select the most upright and vigorous shoot that arises from the lower trunk. A stake should be placed alongside, and the shoot tied to it for support. Other shoots on the lower trunk can remain, but should be pinched back to eight to ten inches in length. Although lower shoots are allowed to remain, they are kept subordinated (pinched back) to force as much growth as possible into the "central leader" or replacement shoot. Leaves on the remaining shoots will provide added food to the damaged tree.
3. Once the central leader shoot reaches 36 inches in height, it can be pinched out or the tip cut back to encourage lateral growth from which scaffold branches can be selected.
4. Do not fertilize freeze-damaged trees for one year. However, trees should be watered regularly in the absence of regular rainfalls.
5. Check insect and mite populations carefully to make sure that no additional stresses occur.
6. After the central leader has become established (usually by midsummer), freeze-damaged parts of the plant - dead limbs and upper trunk - can be cut away.
7. Lower shoots can usually be removed during the next growing season, providing the central leader has been sufficiently established.

Symptoms of cold damage: Citrus leaves commonly assume a drooping or wilted appearance during periods of low temperatures, but remain firm and brittle if frozen. The leaves first become slightly flaccid as they thaw, and if the injury is not too severe, they gradually regain normal turgidity and recover. Seriously frozen leaves, however, gradually collapse and dry out. This is accelerated by warm, sunny days immediately following a freeze.

The youngest leaves are most easily injured, but all leaves may be killed in a severe freeze. If twigs are seriously frozen, the leaves dry out and remain attached for several weeks. However, the damaged leaves are shed rather promptly if the twigs and larger wood are not seriously injured.

Cold damage on the trunks and larger branches may appear as splitting or loosening of the bark. Certain areas, especially at or near crotches, are particularly sensitive. Localized damage to patches of bark on the trunk and larger limbs (cold cankers) are often mistaken for gummosis, since these may exude gum at a later date.

Care of bearing groves: Rules for the care of citrus trees that have been injured by cold must be flexible and varied. Time of year at which the cold occurs, condition of the trees at time of injury, and weather conditions immediately following injury will influence to a marked degree the type of treatment to use.

The natural reaction after a freeze is to do something right away. Actually, there is very little that can be done at that time, as it is impossible to determine the full extent of injury. Twigs and branches may continue to die for a period of several months to as long as two years following a severe freeze, due to latent damage to the bark and wood which may not be apparent soon after a freeze. Citrus trees on which twigs and branches have been killed by cold should receive extra care during the following season. Thus, a "wait and see" attitude is best.

Fertilization: Running north and south throughout the central portion of Florida's peninsula is the Lake Wales Ridge. This ridge is composed of primarily deep, well-drained sandy soils. Consequently, these soils permit a very rapid infiltration of rain and irrigation water, setting the scene for leaching of

Care of Freeze Damaged Trees

nutrient movement out of the citrus root zone. The leaching process depletes the nutrients in the plant's root zone, and therefore, will no longer be available to the plant. This process also is an environmental concern as well.

In commercial citrus production, fertilizers are important and commercially viable in both the ridge and flatwood areas of Florida. Based upon Florida's fertilizer use in the 2002 through 2003 production season, nitrogen (N) is by far the most used nutrient in citrus production. The traditional water-soluble nitrogen sources are made up of dry granular fertilizers and solution fertilizers. Two of the most popular dry granular fertilizers sources include: ammonium nitrate and ammonium sulfate. Urea is by far the most popular solution fertilizer. The relatively newcomer in the fertilization process is the use of controlled-release fertilizers (CRF). Although these products have been available since the 1950s and were strictly nitrogen source, advancements in the 1980s and 1990s have made significant improvements where the CRF technology has expanded to include potassium, phosphorus, and other nutrients including micronutrients. There are several CRFs to choose from, and each one has its own features of releasing and nutrient content.

In the 1970s, Isobutylidene diurea (**IBDU**) was developed. It contained 31 percent nitrogen. This compound undergoes hydrolysis, not requiring microbial decomposition. The hydrolysis process splits the IBDU molecule to form urea. Another CRF product is Sulfur-coated urea (**SCU**, 30 to 40 percent nitrogen). This product is designed to allow water from the soil solution to slowly penetrate the sulfur coating, dissolving the encapsulated urea. To retard the fast release of urea, SCU sources contain a wax sealant. With this product (i.e. methylene urea, nitroform, and ureaform) microbes are required to degrade this wax sealant, releasing the nitrogen for plant uptake. Finally, one of the commonly known CRF products is the **polymer-coated** nitrogen sources, and goes by brand names such as Osmocote, Meister, Multicoat, and Polyon. This product is a water-soluble fertilizer that is encapsulated with a semi-permeable membrane. The mode of action is that water will pass through the outer membrane dissolving the fertilizer, which in turn, the dissolved nutrients will diffuse back into the soil solution and subsequently is taken up by the plant. Bearing-tree fertilizer blends may contain some SCU to extend the period within which nitrogen is available to the trees. In some citrus-growing areas, polymer-coated materials are added to the planting hole during reset operations.

Fertilizer should be applied at the regular time, but the amount of fertilizer should be reduced in proportion to the amount of tree damage. A reduction in the pounds of nutrients per acre may be in order where twigs and limbs have been damaged, especially if it is obvious that there will be a light crop. It may be advisable to make two or more frequent light applications to assure a steady supply of nutrients to the plant and promote rapid recovery.

A unique situation may occur where many leaves were lost, but little or no twig or limb damage was sustained. Such trees may temporarily need more fertilizer than before, due to a rapid depletion of nutrients within the tree.

Nutrient deficiency symptoms may be intensified in freeze-damaged trees due to the drain entailed by the large amount of growth necessary to replace lost foliage. Thus, a nutritional spray of copper, zinc, and manganese may be beneficial to new growth and tree condition.

Irrigation: Irrigation of damaged trees during warm periods in the winter is usually unnecessary and often ill-advised. If freeze damage occurs early in the winter and soil moisture is adequate, it will be well to delay irrigation in hopes of delaying tree growth until the danger of additional freezes has passed. On the other hand, trees that do put forth new growth should not be allowed to wilt for the lack of water.

Pruning: Cutting of dead wood from bearing trees which have suffered heavy damage should not be done until late spring or summer following the injury. This delay is desirable since it is difficult to determine the actual extent of injury until new growth commences.

It is well to remember when pruning that all cuts should be made into living wood, and where possible, at crotches, leaving no studs or uneven surfaces. The use of pruning paint is unnecessary. It is advisable to remove heavy brush from the grove immediately following the pruning operation.

Weed control: Weed control will be essential to rapid recovery from freeze damage, as weeds will compete heavily with the trees for available moisture, nutrients, and in some cases, light. Weed populations should be at low levels following a freeze, which will provide growers with a good opportunity to get many troublesome species under control.

continued on page 6

Care of Freeze Damaged Trees - Young Trees

With slight damage: If damage is slight and there are some leaves and green twigs above the bank or wrap, no special steps need to be taken. Trees in such instances have sufficient living wood to develop new tops. Even so, the banks or wraps should be removed from a few trees and the trunks inspected to see that the bark is firm. This process should be repeated at weekly intervals, as damaged trees often "sweat" when covered, resulting in additional damage.

With heavy damage: If the tree has been killed or damaged beneath the bank or wrap, it may be a good practice to remove the entire bank or wrap, at least a portion of it (where possible), to expose live tissue to sunlight and air. Otherwise, the bark beneath the bank or wrap may soften and slough off - resulting in complete loss of the tree. The extent of this operation will depend upon the acreage involved and the manpower available. When trees are unbanked or unwrapped, it will be necessary to protect them when freezing temperatures are forecast. Banks or wraps should again be removed as soon as the danger of cold has passed. This process may need to be repeated several times before winter is over.

Trees that were not banked or wrapped: Damaged trees that were not banked or wrapped when the cold came should not be banked or wrapped until the next forecast of freezing temperatures. It is useless and often detrimental to bank or wrap such trees immediately following a freeze, as they are likely to "sweat" in the bank or wrap, and be more severely damaged than if unbanked or unwrapped. Wait until the forecast of additional freezing temperatures to bank or wrap.

Cultural practices: If tree damage is slight, exert every effort to keep the young tree as dormant as possible. If heavy damage has occurred, in addition to removing the banks or wraps; it may be necessary (depending on conditions) to water the trees. Pruning, fertilization, and spraying should be delayed until the danger of subsequent freezes has passed.

T.A. Obreza, R. Rouse, and E.A. Hanlon, SL-243, Advancements with Controlled-Release Fertilizers for Florida Citrus Production: 1996 -200612, http://edis.ifas.ufl.edu/pdffiles/SS/SS46300.pdf

pH

INTRODUCTION: Sometimes when a plant doesn't look good, the grower may think the plant has a disease, needs water, or needs fertilizer. This may be true in terms of fertilizer need; however, simply adding fertilizer may not be the cure. There are several factors that must be considered. One of them is soil or planting media chemistry. For a plant to absorb the nutrients from a fertilizer, the soil media chemistry has to be suitable for the plant to absorb nutrients. From an agricultural point of view, the soil condition is referred to as pH, whereas, the letters "p" and "H" represent the "**p**otential **h**ydrogen" in the soil. By definition, the term is that pH is the 'negative logarithm of the hydrogen ion concentration [H+]', i.e., pH = -log [H+]. Through a soil testing procedure, a system of measurement is used to distinguish what type of soil you may have. In simple agricultural terms, pH is typically referred to as soils being either acid, neutral, or alkaline; depending on the pH range of 0 to 14. Neutral soils have a pH of 7; below 7 are considered acidic; and, above 7 are considered alkaline or basic. Some common slang that is referred to soil pH is sour [acidic] or sweet [alkaline].

CEC relationship with sandy to organic soils: You may have a question on how does pH affect the nutrient availability of a plant. The answer is the degree in which nutrients are absorbed by the soil and are available to the plant is termed cation exchange capacity (CEC). CEC is directly affected by soil pH. The CEC is referred to as the capability to which a soil can absorb and exchange nutrients (i.e cations). A few examples of cations, positively charged particles, are nitrogen (NH_4^+), potassium (K^+), calcium (Ca^{2+}), and iron (Fe^{2+}). Organic matter and soil particles have negative charges on their surfaces and attract positive charged particles (i.e . NH_4^+, K^+, Ca^{2+}, Fe^{2+}). When negative

pH

charged particles of soil particles and plant roots attract positively charged particles of nutrients, this is one of the basic fundamentals of simple soil chemistry. Once the minerals or cations are absorbed, the minerals are not easily lost when the soil is leached by water; however, they will provide a nutrient reserve available to plant roots. In addition, plant roots, themselves, exhibit cation exchange capacity as well. Sandy soils normally exhibit low CEC while clay and organic soils exhibit high CEC (see Table 1 on page 9). The high CEC clay and organic type soils also possess a higher buffering ability compared to sandy type soil where this increases the soils ability to resist change in pH.[1 2]

pH and nutrient availability: Still, what does this have to do with the relationship of absorbing nutrients you may ask. Once again, the availability of nutrients is directly influenced by soil pH. It is the controlling factor for nutrient uptake. For instance, some nutrients become insoluble if the soil pH is too high or too low, limiting the availability of these nutrients to the plant root system. For instance, iron (Fe) is readily available in acidic soil, where its optimum range is pH 4.0 to 6.5; whereas, it is very limited in alkaline soils. Potassium is most available from slight acidic to alkaline soils that are above 6.0 and tapers off in its availability below pH 6.0. Nitrogen is readily available in a soil pH mid-range of 6.0 to 8.0, then below 6.0 and above 8.0, nitrogen becomes less available. Finally, molybdenum is readily available in higher pH (i.e. above pH 7) and limited in acidic (i.e. below pH 7), (see Chart 1 on page 9).

pH and the availability of specific nutrients: Soil chemistry and pH is quite challenging. Landscape plants may exhibit nutrient deficiency or toxicity symptoms as a result of highly acidic or alkaline soil pH. In acidic soils, the availability of plant nutrients such as potassium (K), calcium (Ca), and magnesium (Mg) is reduced, while availability of potentially toxic elements such as aluminum (Al), iron (Fe), and zinc (Zn) are increased. In alkaline soils, iron, manganese (Mn), zinc, and boron (B) are commonly deficient.

Plants and their optimum pH and problems associated with pH: Each plant has an ideal pH range it best performs at. Some plants can tolerate a wide range. Optimal ornamental ranges can vary from 4.5 to 8.0 (see Chart 2 on page 10). For instance, azaleas require a specific pH range of 4.5 to 6.0, citrus needs 5.5 to 6.5, in contrast, verbena prefer a range of 6.0 to 8.0. Leatherleaf fern is one plant that is tolerant of a wide range of soil pH. It can grow and look great in soil having a pH range of 4.0 to 6.5. If the pH range does not match the plant requirements, although there may be ample nutrients in the soil, the plant simply cannot and will not be able to absorb them. There are varying degrees of pH and growth responses (see Table 2 page 10).

A pH scale is logarithmic: In a case where an individual may wonder why his/her verbena may be declining with yellow foliage when the soil pH is 5.8. Remember that the ideal pH range for verbena is 6.0 to 8.0.The situation is that there is only 0.2 difference from its ideal range. The fact is the pH scale is a logarithmic scale. A change of one unit in the pH scale represents a ten-fold change in acidity or alkalinity. A soil with a pH of 5.0 is ten times more acidic than a soil with a pH of 6.0 and one hundred times more acidic than a soil with a pH of 7.0. This is one good reason to be very careful in trying to increase or lower soil pH. In this case with the verbena, the soil pH is two times more acidic than the minimum requirements. In this case the individual may want to increase his/her soil pH with the use of lime.

Altering pH: To alter the soil pH takes time. In short, you can raise or increase the soil pH with the use of agricultural limestone. If you wish to lower the soil pH, sulfur is normally used. This process may take up to four to six months or even longer depending on the soil or media type. As a rule, the heavier the soil (i.e., more clay or organic matter) the longer the process of change.

Alkaline soils: The common materials used to lower the soil pH is with the use of elemental sulfur (S), microbes oxidized the elemental sulfur into a sulfate (SO4) and H+ resulting in the lowering pH. Hydrogen (H+) ions also are pro-

pH

duced with the use of ammonium (NH4) based fertilizer and soil organic matter (SOM). This also will lower the pH of your soil.

Acidic soils: Depending upon where you live, over time, with rain in our humid climate, soils become acidic due to the leaching. In addition, with the addition of fertilizers and organic matter, the acidulation process is enhanced. Monitoring of soil pH is important, for the fact if the pH becomes very acidic, (below pH 5.4), some minerals such as aluminum and manganese become very soluble and often are toxic to plants. Leaf yellowing, puckering, and burning symptoms may appear. Plant nutrients such as calcium and magnesium often are deficient in acidic soils. For legumes, beneficial soil bacteria that fix nitrogen on the roots of legumes such as beans and peas will not survive in acidic soils, and then those crops will suffer.

The common material used in raising soil pH is with the use of lime. Lime comes in many forms such as CaCO3, $CaMg(CO_3)_2$, CaO, or Ca(OH)2 to name a few. In the soil, the lime reacts with carbon dioxide and water yielding bicarbonate (HCO3-), thus displacing or removing (H+) ions and raising the pH in the process.

Other contributing factors: Organic matter (OM) also has an effect on soil pH. As a result of microbes' decomposition process, carbonic acid is produced dissolving nutrients and organic and inorganic acids that also provide (H+) ions, thus aiding in lowering the pH as well. Soil pH also can affect soil bacterial and fungal activity, enhancing or inhibiting the development of soil-borne plant diseases or how efficiently microbes function as decomposing organisms.

Various fertilizers have different reactions with the soil, some alter pH to acidic and some to alkaline spectrums (see Chart 3 page 11). It's always wise to consult with your local Extension agent prior to any application of amendment.

BLUEBERRIES: Blueberries require an acid, well-drained soil. The soil pH maximum range should be 4.2 to 5.5. Adjust soils with a pH above 6.0 in the direction of pH 5.4 with the addition of sulfur. Sandy soils can be slightly acid in the top 6 inches because of previous nitrogen fertilization, but still have an alkaline reaction in the subsurface depths. Avoid sites where brush and timber have been burned. The basic minerals of ash will raise the soil pH above the range for best plant growth. Avoid recently limed land unless the lime was applied to raise the soil pH into the favorable range for blueberries. In fertilizing blueberries, use nitrogen fertilization should be with ammoniac nitrogen, not nitrate nitrogen.

CITRUS: The optimal soil pH for citrus should be maintained at a pH range of 6.0 – 6.5. To prevent any trace element toxicity, particularly copper, soil pH management is essential.

LEATHERLEAF FERN: Leatherleaf fern is one plant that is tolerant of a wide range of soil pH. It can grow and look great in soil having a pH range of 4.0 to 6.5.

PITTOSPORUM: The optimal soil pH for pittosporum should be maintained at a pH range of 6.2 – 6.8. Magnesium (Mg) should be applied in sufficient quantities to meet crop needs. The most frequently used Mg sources are MgSO4 (Epsom salts) and dolomite (dolomitic limestone containing both calcium and Mg). Growers should be aware that dolomite can cause the soil pH to rise, i.e., become more alkaline.

[1]McCauley, Ann, University of Montana, Soil pH and Organic Matter, pub. 4449-8, http://landresources.montana.edu/nm/Modules/Module8.pdf

[2]Washington State University, Tree Fruit Research & Extension Center, 7/9/2004, Cation-exchange capacity (CEC), http://soils.tfrec.wsu.edu/webnutritiongood/soilprops/04CEC.htm

[3]Washington State University, Tree Fruit Research & Extension Center, 7/9/2004, Cation-exchange capacity (CEC), http://soils.tfrec.wsu.edu/webnutritiongood/soilprops/04CEC.htm

[4]Chart of the Effect of Soil pH on Nutrient Availability, *www.avocadosource.com/tools/FertCalc_files/**pH**.htm*

[5]Stamps, Robert PhD, University of Florida IFAS Extension, pub. ENH840, Potential Cut Foliage Crops for Production in Full Sun in Florida, http://edis.ifas.ufl.edu/pdffiles/EP/EP09700.pdf

[6]Gu, Mengmeng, PhD et.al., Crouse, Keith PhD, Mississippi State University Extension Service, Information Sheet 372 Soil pH and Fertilizers, http://msucares.com/pubs/infosheets/is0372.pdf

[7]Koske, Thomas J. PhD, LSU AgCenter, 9/27/2011, Acid Soil Problems, http://www.lsuagcenter.com/en/lawn_garden/home_gardening/lawn/soil_fertility/Acid+Soil+Problems.htm

[8]Gu, Mengmeng, PhD et.al., Crouse, Keith PhD, Mississippi State University Extension Service, Information Sheet 372 Soil pH and Fertilizers, http://msucares.com/pubs/infosheets/is0372.pdf

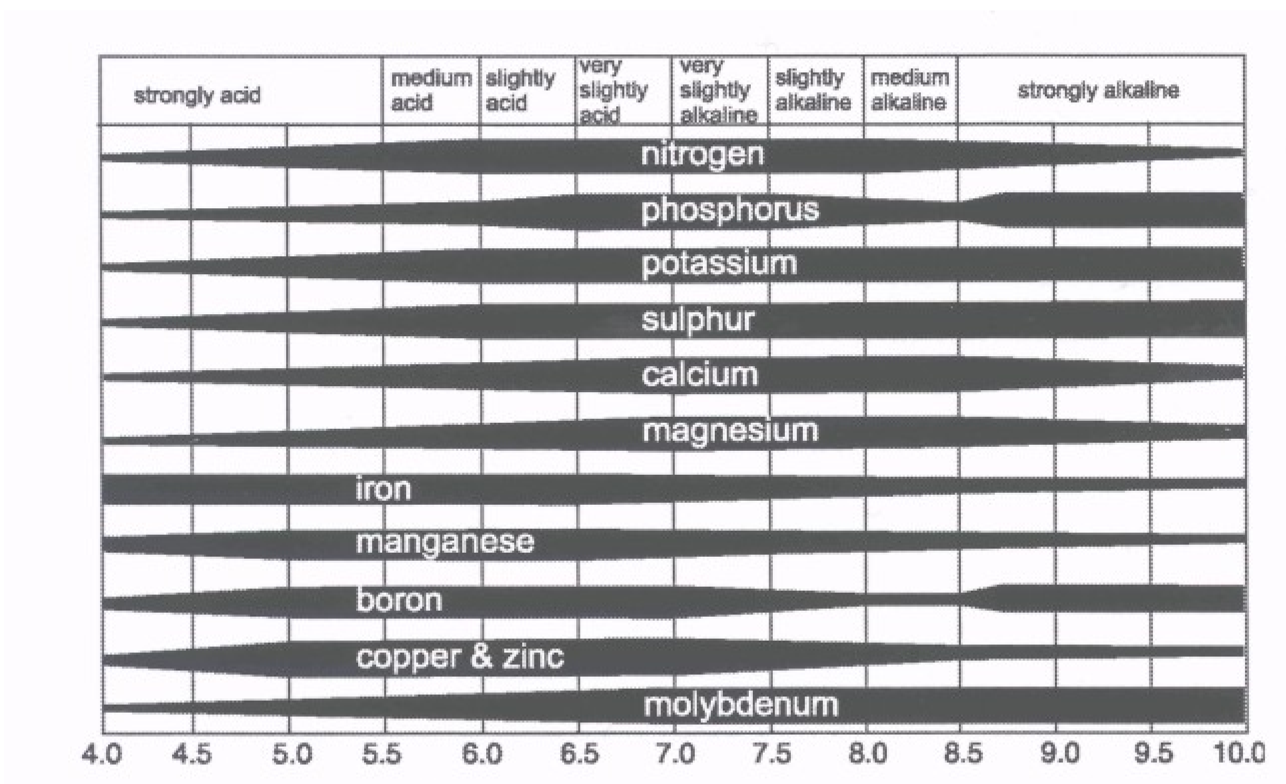
pH

Table 1

Soil texture	CEC (meq/100g soil)
Sands (light-colored)	3-5
Sands (dark-colored)	10-20
Loams	10-15
Silt loams	15-25
Clay and clay loams	20-50
Organic soils	50-100

Chart 1

Chart of the effect of soil pH on nutrient availability



pH

Chart 2
Commonly used landscape plants and their preferred pH ranges

Commonly used landscape plants and their preferred pH ranges

Shrubs	Preferred pH
Azalea	4.5 - 6.0
Barberry	6.0 - 7.5
Buddleia (Butterfly Bush)	6.0 - 7.5
Camellia	4.5 - 5.5
Crapemyrtle	5.0 - 6.0
Deutzia	6.0 - 7.5
Euonymus	6.5 - 7.0
Flowering Almond	6.0 - 7.0
Gardenia5	.0 - 6.0
Hibiscus	6.0 - 8.0
Holly	5.0 - 6.0
Huckleberry	5.0 - 5.5
Hydrangea (blue)	4.5 - 5.0
Hydrangea (pink)	6.0 - 7.0
Japanese Quince (flowering quince)	6.0 - 7.0
Ligustrum	6.0 - 7.0
Lilac	6.0 - 7.5
Oleander	5.0 - 7.5
Philadelphus (English Dogwood)	6.0 - 8.0
Pyracantha (Firethorn)	6.0 - 7.0
Spiraea Spp.	6.0 - 7.0
Tea Roses	5.5 - 7.0
Viburnum	6.5 - 7.5
Weigela	6.0 - 7.0

Trees	Preferred pH
Apple, Peach, Pear, Cherry	6.5 - 7.0
Dogwood	5.0 - 7.0

Trees	Preferred pH
Elm	6.0 - 7.5
Flowering Crab Apple	5.0 - 6.5
Holly	5.0 - 6.0
Magnolia	5.0 - 6.0
Maple	6.0 - 7.5
Oak Group	
Pin Oak	5.0 - 6.5
Scarlet Oak	6.0 - 7.0
Red Oak	5.0 - 7.5
Pine	5.0 - 6.0
Redbud	5.5 - 6.5
Vitex	6.0 - 7.0
Weeping Willow	5.0 - 6.0

Garden Flowers	Preferred pH
Amaryllis	5.5 - 6.5
Baby's Breath	6.5 - 7.0
Balsam (Touch-Me-Not)	6.5 - 7.0
Begonia	5.5 - 7.5
Caladium	6.0 - 7.0
Candytuft	6.5 - 7.0
Canna	6.0 - 7.0
Carnation	6.5 - 7.0
Chrysanthemum	6.0 - 8.0
Cockscomb (Celosia)	6.0 - 7.5
Coleus	6.0 - 7.0
Cornflower	6.0 - 7.5
Cosmos	6.5 - 7.0
Daffodil	6.0 - 7.5

Garden Flowers	Preferred pH
Dahlia	6.5 - 7.0
Day Lily	6.0 - 8.0
Easter Lily	6.0 - 7.5
Four-O-Clock	6.0 - 7.5
Foxglove	6.5 - 7.0
Geranium	6.0 - 8.0
Gladiolus	6.5 - 7.0
Hollyhock	6.0 - 8.0
Iris	6.5 - 7.0
Larkspur	6.5 - 7.0
Lupine	6.5 - 7.0
Marigold	6.0 - 7.5
Nasturtium	6.5 - 7.0
Narcissus	6.0 - 7.5
Pansy	5.0 - 6.0
Periwinkle	6.5 - 7.0
Petunia	6.5 - 7.0
Phlox	5.0 - 6.0
Poppy	6.5 - 7.0
Salvia	6.0 - 7.0
Shasta Daisy	6.0 - 8.0
Snapdragon	6.0 - 7.5
Sweet Alyssum	6.5 - 7.0
Sweetpea	6.5 - 7.0
Sweet William	6.5 - 7.0
Tuberose	6.0 - 7.0
Tulip	6.0 - 7.0
Verbena	6.0 - 8.0
Zinnia	5.5 - 7.5

Table 2
Varying degrees of pH and growth responses

	Soil pH	Effect
Extremely acid	below 4.5	Few crops survive. Aluminum/manganese toxicity.
Very acid	4.5-5.0	Only acid-tolerant plants such as azaleas, carpet grass and blueberries do well.
Very acid	5.0-5.5	Some aluminum and manganese toxicity. Some nutrient deficiencies. Mid-5 is good pH for Irish potatoes, because scab bacteria don't survive well at this pH. Most crop yields slightly reduced, especially legumes.
Moderately acid	5.5-6.0	No visible problems with most crops. Yields of crops requiring high calcium and magnesium may be reduced (for example, tomatoes and peppers). Good for centipede and carpet grasses.
Slightly acid	6.0-7.0	Ideal for most crops. Best for soil bacteria/nitrogen fixation. Optimum nutrient availability. St. Augustine, Bermuda and zoysia.
Slightly alkaline	7.0-8.0	Micronutrient deficiencies of iron, zinc and manganese may occur. Too high for acid plants.
Alkaline	8.0+	Severe micronutrient deficiencies. Few garden crops do well. Acidulate your soil.

pH

Chart 3

Various fertilizer have different pH eactions with the soil[8]

Material	Analysis N-P-K	Rate of application per 100 square feet: Dry	Rate of application per 100 square feet: Liquid	Speed of Reaction	Effect on pH
Ammonium Sulfate	20-0-0	½-1 lb	1 oz per 2-3 gal	Rapid	Very acid
Sodium Nitrate	15-0-0	¾-1½ lb	1 oz per 2 gal	Rapid	Basic
Calcium Nitrate	15-0-0	¾-1½ lb	1 oz per 2 gal	Rapid	Basic
Potassium Nitrate	13-0-44	½-1 lb	1 oz per 3 gal	Rapid	Neutral
Ammonium Nitrate	34-0-0	¼-½ lb	1 oz per 5 gal	Rapid	Acid
Urea	45-0-0	¼-½ lb	1 oz per 5-7 gal	Rapid	Sl. acid
Mono-ammonium Phosphate	11-48-0	1 lb	1 oz per 3 gal	Rapid	Acid
Di-ammonium Phosphate	18-46-0	½-¾ lb	1 oz per 4-5 gal	Rapid	Acid
Triple Superphosphate	0-46-0	1-2½ lb	Insoluble	Medium	Neutral
Superphosphate	40-20-0	3-5 lb	Insoluble	Medium	Neutral
Potassium Chloride	0-0-60	½-¾ lb	1 oz per 4-5 gal	Rapid	Neutral
Potassium Sulfate	0-0-50	½-1 lb	Not advisable	Rapid	Neutral
Complete Soluble (mixtures)	20-20-20 20-5-30 12-12-12	Not advisable	1 oz per 3-5 gal	Rapid	Various
Complete Dry (mixtures)	10-10-10 5-10-10	2 lb 2-3 lb	Relatively insoluble	Various Various	Various Various
Limestone	None	5-20 lb	Insoluble	Slow	Basic
Hydrated Lime	None	2 lb	Relatively insoluble	Rapid	Basic
Gypsum (calcium sulfate)	None	2-5 lb	Insoluble	Medium	Neutral
Sulfur	None	1-2 lb	Insoluble	Slow	Acid
Epsom Salts (magnesium sulfate)	None	8-12 oz	1 oz per 5 gal	Rapid	Neutral
Aluminum Sulfate	None	(not advisable)	1 oz per 5 gal	Rapid	Very acid
Urea Formaldehyde	38-0-0	3-5 lb	-	Slow	Sl. acid
Magnesium Ammonium Phosphate	7-40-6	Variable	-	Slow	Neutral
Dried Blood	12-0-0	2-3 lb	-	Medium	Acid
Steamed Bone Meal	Usually	5 lb	-	Slow	Basic
Castor Pumice	5-1-1	3-5 lb	-	Slow	-
Cottonseed Meal	7-2-2	3-4 lb	-	Slow	Acid
Hardwood Ashes	0-1-5	3-10 lb	-	Medium	Basic
Hoof and Horn Meal	13-0-0	2-3 lb	-	Slow	-
Seaweed (Kelp)	Usually	2-3 lb	-	Slow	-
Linseed meal	5-1-1	3-5 lb	-	Slow	Acid
Soybean Meal	6-0-0	3-5 lb	-	Slow	-
Trace Elements	-	3-6 oz	-	0	-
Iron Sulfate	-	8-12 oz	1 oz per gal	-	-
Chelated Iron	-	1-2 oz	1 oz per 25 gal	-	-
Borax	-	½ oz	-	-	-
Copper Sulfate	-	1-2 oz	-	-	-

Citrus Health Management Areas - Prep-to-spray?

As we enter into the fall of the year, we again focus on the Citrus Health Management Areas (CHMA) program. A fall and winter spray program is a vital tool and jump-start to achieving success in reducing the psyllid population for the upcoming year. With a fall spray program, followed by a winter dormant program, the psyllid population can exhibit great success by reducing the overwintering psyllid populations. If growers follow the recommendations, in a cooperative effort, the psyllid population can be reduced significantly prior to the next season. It's with this cooperative effort that determines the success of the program and hence, the farmers profitability. With these two sprays, the growers will benefit from the length of control as well. The two sprays will control psyllids for approximately half of the upcoming year. When the spray is applied in the winter, the trees are dormant and "hardened off". The psyllids that are overwintering will be reduced significantly. The purpose of the dormant spray will be specifically to target the overwintering psyllids. With the winter dormant spray and winter temperatures, the psyllid population levels will be low prior to the very attractive and susceptible spring flush.

In cooperation with Lake County Extension, agent Gary England and I are encouraging growers to spray for psyllids in our area the week of November 8th.

As recommended from last year's program where the first part of the program included two economical spraying resulting in control of psyllid for half of the year.

1) **November**: The fall spray is done after the growing season is over and trees are "hardening off" for winter. At this time, the spray reduces the number of psyllid that will be overwintering in your grove.

2) **February**: The dormant spray in mid-February reduces those few psyllids that have survived the fall spray and the cold weather. This brings you through the spring flush with low psyllid population levels.

Once again, for the February spraying, the Volusia CHMA is, therefore, recommending all citrus growers to apply a Pyrethroid insecticide (i.e. Danitol or Mustang) to all their citrus acres between the dates of February 1-14. Research consistently supports that this "dormant" application provides some of the best psyllid control of the year.

Although tough economical times are at hand for farmers and individuals these days, the investment may payoff in the long-run through more productive and higher quality products. If you have questions, you can contact Brent Jeanesonne at (386) 822-5778. Growers in the Oak Hill area may choose to time their spray activities with Brevard County's CHMA. More information is available at the IFAS website www.flchma.org

So, please remember this information: Recommended spraying date **- February 1 – 14**
Recommended spray chemical - **Danitol or Mustang**

Note: Mention of a commercial or proprietary product or chemical does not constitute a recommendation or warranty of the product by the authors or the University of Florida, Institute of Food and Agricultural Sciences, nor does it imply its approval to the exclusion of other products that may also be suitable. Products should be used according to label instructions and safety equipment required on the label and by federal or state law should be employed. Users should avoid the use of chemicals under conditions that could lead to ground water contamination. Pesticide registrations may change so it is the responsibility of the user to ascertain if a pesticide is registered by the appropriate state and federal agencies for an intended use.