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IFAS Extension

# Fertilizer Application Best Management Practices for Citrus Grove Workers[1]

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## Introduction

If not handled properly, fertilizer can be a significant source of water pollution. Nitrogen and phosphorus are of particular concern. Good nutrient management is an integral part of a system of agricultural practices that help conserve and protect natural resources. In fact, water and nutrients are intimately linked in our sandy soils. Implementing appropriate nutrient management practices and taking care with the placement of fertilizer materials helps maintain or improve agricultural productivity while minimizing environmental risk.

Management of nitrogen and phosphorus levels, in particular, is essential in maintaining healthy surface water bodies and natural systems in Florida. These nutrients originate from a variety of land uses, including: agricultural, urban, suburban, and natural areas. Excess nutrients stimulate algal blooms and growth of noxious plants in receiving water bodies and wetlands. This stimulation of growth may eventually result in reduced dissolved oxygen concentrations due to excessive decomposition of plant material. Moreover, lower dissolved oxygen concentrations may stress desirable game fish, and promote less desirable fish species.

Nitrogen, phosphorus, and potassium are three of the 15 essential elements for plant and animal growth and are necessary to maintain profitable citrus production. They can also increase the biological productivity of surface waters by accelerating eutrophication, the natural aging of lakes or streams brought on by nutrient enrichment. Although eutrophication is a natural process, it can be accelerated by changes in the land use of a watershed that increase the amount of nutrients added to an aquatic system. Nitrogen and phosphorus both affect eutrophication, but phosphorus is the critical element in most fresh water systems.

Nitrogen generally regulates aquatic plant growth in aquatic systems. Complicating the problem is the fact that eutrophication sometimes occurs many miles from where high-nutrient runoff originally entered the surface water system. By the time the water quality effects are noticeable

1. This is document No. AE248, one of a series of the Agricultural and Biological Engineering Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. Publication date: July 2005. Revised March 2009. Please visit the EDIS Web site at http://edis.ifas.ufl.edu for additional publications related to citrus best management practices. This document can be accessed as http://edis.ifas.ufl.edu/AE248.

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(sometimes years to decades after the runoff occurs), remedial strategies can be difficult and expensive to implement. This is why source control of nutrients used in fertilization programs is so important.

## Employee Training & Personal Protective Equipment Requirements

Proper training and education are requirements for field workers handling, loading, and operating fertilizer application equipment. **Safety is the most important component in any grove operation**. So if you are going to be operating farm equipment or applying nutrients you must be trained on proper application techniques. Together with routine maintenance of field equipment, proficient operators can facilitate the correct placement of fertilizers, avoid waste, and the prevent contamination to water resources.

Employees must be trained on how to handle fertilizer to prevent pollution. Most of the soil types in Florida are sandy and, if excess nutrients are applied, there is the potential for leeching or runoff. Remember operators also need proper Personal Protective Equipment (PPE) while handling fertilizer because it is a corrosive material. Minimal PPE for fertilizer loading or application are long sleeved shirt, long legged pants, boots, gloves, dust mask and eye protection.

## Fertilizer PPE Quiz

**Multiple Choice and True or False**

_____1.The most important thing in any grove operation is worker SAFETY!

_____2. Anyone can operate farm equipment and apply fertilizer, since farming doesn't require any training.

_____3. Most soils in Florida are sandy and don't hold nutrients well.

_____4. Nutrients entering and polluting water bodies originate from a variety of land uses including agriculture, urban, industrial and rural areas.

_____5. Fertilizers can be corrosive and PPE should be worn when applying them.

_____6. Excess nutrients create algal blooms and growth of unwanted aquatic weeds, thus reducing dissolved oxygen levels.

_____7. Fertilizer handling PPE should consist of a long sleeved shirt, long legged pants, protective hat, shoes or boots, socks, gloves and a dust respirator.

8._____ What are the nutrients of most concern in Florida canals, rivers, and lakes??

a) Calcium and phosphorus

b) Nitrogen and copper

c) Nitrogen and phosphorus

d) Nitrogen and calcium

9._____Choose from the list below the proper PPE's for loading fertilizer.

a) Dust mask

b) Long sleeve shirt and pants

c) Boots

d) All of the above

10._____Which of the following are important while applying fertilizers?

a) Placement

b) Correct amount

c) Formulation

d) Time of application

e) All of the above

## Soil Analysis

Its a good idea to develop a nutrient management plan, based on soil, water, plant, and organic material sample analysis.

Like humans, plants need food (nutrients) for healthy growth. The major plant elements are (N) Nitrogen, (P) Phosphorus, and (K) Potassium. They play a major role in the health of a tree. Trees also must have a correct pH level for growth. The pH level will determine how well the trees can utilize the nutrients they are given. Soil tests allow the grower to look at the levels of nutrients that are currently in the soil. Once the current amount is known you can easily decide how much needs to be applied based on the recomendations for that crop and soil. Applying more than is recomended is wasteful, because the tree won't absorb all the material you have applied. It will either be taken up by weeds growing around the tree that will later have to be delt with, or pass through the soil into the groundwater. Either case is a problem for the grower that can be easily minimized by taking careful soil samples, and following recomended guidelines.

When soil samples are taken, 15 to 20 tree locations should be randomly selected from representative soil types within the grove or block. One 6 inch deep core, about 1 inch in diameter, should be taken within the irrigated zone close to the drip line of each sampled location. Each core should be placed into a plastic bucket and thoroughly mixed with other cores from that grove or block. A sub sample taken from these composite samples should be air dried prior to shipping to a soil testing laboratory. Soil labs usually supply small bags for samples to be collected and shipped in. Analysis of the soil sample reflects the levels of nutrients currently in the soil. Fertilizer can then be formulated to meet the crops needs with out exceeding what it can use.

## Leaf Sampling

The benefits of leaf tissue sampling are accomplished by establishing an annual sampling program. By establishing a sampling program, trends in tree nutrition over several years may be noted and documented for production and environmental records.

For large groves, indicator blocks may be used. An indicator block is a designated zone within a uniform span of grove from which the sample is taken (for example, a 20-acre block within a uniform 100-acre of grove). Aerial photos are useful for the selection of these aeras within blocks. The sample results obtained from the indicator block are assumed to represent the entire grove. Management decisions made from the sample data are applied to the entire grove. The same block should be sampled repeatedly in succeeding years.

The standard leaf sample consists of at least 100 four- to six-month-old spring flush leaves taken from non-fruiting twigs. If the majority of the spring flush occurs in March, the best time to sample leaves would be July through September. About 15 to 20 trees should be sampled within each management unit. Leaf and soil sampling can be accomplished during the same trip through the grove. It is convenient to remove leaves from the same trees under which soil samples are taken.

A more elaborate approach to citrus soil and leaf tissue sampling involves the use of a global positioning system (GPS) and a geographic information system (GIS). Groves are sampled in a regular, grid-like pattern, and the geographic position of each sample is recorded using GPS technology. After the samples are analyzed, the results are processed with GIS software and maps can be created to show where and how much fertilizer needs to be applied . The grower uses the maps to determine and areas of high or low nutrition and creates a feeding program specifically for those trees. Variable rate technology allows spreaders to be controlled by on board computers that speed up, slow down or stop the chain that feeds the fertilizer to the fans. One of the most attractive features of the spreader is its ability to shut off automatically when exiting a row end. This not only saves material and avoids waste but allows the driver to pay full attention to driving. This method is more expensive than the traditional applications, but may provide a higher fruit quality and yield. Some local growers participating in the Indian River Citrus, Best Management Practices program have reported being able to pay for their VRT spreader in the first year with the money they saved in fertilizer by using this technology. These materials would have otherwise been applied and unused by the trees. Obviously growers with larger groves will benefit more from this type of investment,

however, smaller growers can use contracters with this type of equipment and still save in material costs.

## Essential Elements

**Nitrogen (N)**: Nitrogen is of primary importance in citrus production, directly influencing yield and quality. When N is in short supply, growth may be limited, and the foliage becomes pale green or yellowish in color, particularly on nonbearing trees. On fruiting trees, when N is supplied in suboptimal amounts over a long period of time, the trees adjust by recycling the nitrogen from the old leaves to the new ones.

**Calcium (Ca)**: Calcium is the most abundant element in citrus trees, since occasional applications of $CaCO_3$ (lime) are used to neutralize soil acidity, and because Ca is present in most irrigation water. Generally, alkaline soils have an abundance of Ca.

**Magnesium (Mg)**: Magnesium is needed to produce chlorophyll. A deficiency produces a characteristic chlorotic pattern and may cause premature defoliation. Dolomitic limestone is often used to correct acidity and supplies slowly available Mg.

**Sulfur (S)**: Sulfur is supplied through fertilizer materials such as ammonium sulfate, superphosphate, and sulfates of micronutrient metals. Sulfur is also present in many areas of Florida in irrigation water, as well as the elemental sulfur applied in groves for rust mite control.

**Iron (Fe)**: chlorotic patterns due to Fe deficiency appear first on young shoots. Iron deficiency occurs in plants growing in alkaline soil, waterlogged soil, or in soil very low in organic mater.

**Copper (Cu)**: Copper should not be added to fertilizers if copper sprays are used, or if a copper test shows adequate levels. For new plantings on virgin soil, Cu should be added to the fertilizer.

**Zinc (Zn)**: Zinc deficiencies are most often expressed in citrus trees as a severe chlorosis in which leaf tissue becomes nearly white, except for green veins. Severe Zn deficiency restricts growth and reduces yields.

**Manganese (Mn)**: a mild form of chlorosis has been associated with Mn deficiency on acidic, sandy soils.

**Boron (B)**: Boron deficiency is caused when growers use fertilizers without micronutrients, or following a long drought. Boron can be applied as a soil or foliar application but not both because only a small amount of boron is required.

**Molybdenum (Mo)**: a symptom described as "yellow spot," is characteristic of Mo deficiency. This element is less available in acidic than in slightly alkaline soils, unlike many other nutrients.

Taking soil sampling a step further may be simpler than you think. With today's tools like computers and electromagnetic conductivity sensors cpouled with GIS software an even better idea of what truly lies in the soil can be derived. These services are not as expensive as you would think and can be found in various locations around the state including the University of Florida's Extension Soil Testing Lab (ESTL).

**ESTL Contact Information**:

UF/IFAS ESTL PO Box 110740

Wallace Building 631

Gainesville, FL 32611-0740

Tel: 352-392-1950 Ext. 221

Email:soilslab@ifas.ufl.edu

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## Fertilizer Sources and Formulations

Nitrogen fertilizers are grouped into three categories:

1. **Inorganic**
2. **Synthetic organic**
3. **Natural organic**

The inorganic and synthetic organic are high-analysis materials that are generally most

rapidly available to plants unless they have been formulated into a control release form.

Natural organic materials are mineralized slowly and lower in analysis, so higher rates are needed per acre to supply equal amounts of nutrients as compared with the high-analysis materials.

**Variety of Fertilizer Sources**

***Granular sources***: These are usually bulk blended into multi-analysis blends for spreading in citrus groves. Uniform particles size is required to prevent segregation of mixtures while in transit. Most nutrient forms are readily water soluble and rapidly available for tree uptake. Solid fertilizers are applied with conventional spreading equipment or newer VRT.

***Solution sources:*** Solution fertilizers are free of solids and are made by dissolving readily-soluble sources of plant nutrients in water. Nutrient sources used to prepare solutions include ammonium nitrate, urea, potassium nitrate, potassium chloride, ammonium polyphosphates and phosphoric acid. These materials are used in fertigation.

***Foliar N Sources:*** Spray mixtures containing urea or nitrate N sources can be used to provide a portion of the tree nitrogen requirements, especially during the summer months when leaching potential is greatest. However, tank mixing N sources with pesticides, oil, and other products should be approached with caution, as urea is known to be phytotoxic at higher rates, particularly in combination with oil.

**Suspensions:** Suspension fertilizers are fluids in which the solids are held in suspension (prevented from settling) by use of a suspension agent, usually a swelling-type clay. Suspensions provide an excellent way to apply fertilizer-herbicide mixtures and small amounts of micronutrients uniformly. Mechanical agitation may be necessary to maintain a uniform suspension. Suspensions are usually applied with a specially designed herbicide-type boom in a band underneath the tree canopy.

***Slow release sources***: These materials have limited water solubility that release plant available N during decomposition. These fertilizers are grouped according to their mode of release in soil.

***Controlled-release sources***: These contain one or more plant nutrients in a form that delays their availability to the plant significantly longer than a conventional fertilizer, such as ammonium nitrate, urea or potassium chloride.

## Leaf and Soil Sampling Quiz

**Multiple Choice and True or False**

_____1. A nutrient management plan can be developed based on soil and leaf sampling.

_____2. The pH level determines how well the tree will use the nutrients.

_____3. Soil sampling demonstrates the level of nutrients that are available in the soil for the tree.

_____4. Leaf sampling demonstrates the level of nutrients that are currently in the tree.

5. What tests can growers use to develop a nutrient management plan?

_____

6. The major nutritional elements found in fertilizer are:

a) _____

b) _____

c) _____

7. How many total trees should be used for leaf sampling in a block?

a) 1

b) 3

c) 5

d) 15-20

8. How many leaves should be picked for leaf sampling?

a) 1

b) 10

c) 25

d) 100

9. Leaf samples should be taken from which twigs?

a) Non-fruiting

b) Those with fruit

c) Those with the most leaves

## Environmental Issues

The presence of fertilizers and agricultural chemicals in groundwater has become an issue for agricultural production areas around the world. Over 50 percent of the total fresh water used in Florida comes from groundwater sources, and over 90 percent of the public rely on groundwater supplies for their drinking water. Of all the fresh water in Florida, only one-third is consumed by evapo-transpiration, transpiration, and production processes. The remaining two-thirds is returned to the groundwater.

Leeching is the process of excess rain or irrigation water moving soluble materials (such as fertilizers or pesticides) below the root zone and into the groundwater.

Many soils used for citrus production in the "ridge area" of Florida are particularly subject to leaching. These **"vulnerable soils"** are well drained with low organic matter content. These soils provide ideal conditions for the leaching of soil-applied chemicals and nutrients. Most flatwoods soils are more prone to surface movement of nutrients. Trees on these sandy soils often have rootzones less than 12 inches deep.

## Preventitive Maintenance

Preventive maintenance is a schedule of planned maintenance actions aimed at the prevention of breakdowns and failures. The primary goal of preventive maintenance is to prevent the failure of equipment before it actually occurs. It is designed to preserve and enhance equipment reliability by replacing worn components before they actually fail. Preventive maintenance activities include equipment checks, partial or complete overhauls at specified periods, oil changes, lubrication and so on. In addition, workers should maintain records of equipment deterioration so they know to replace or repair worn parts before they cause system failure.

Always follow a routine safety check of the tractor and spreader before heading out in the grove. The preventitive maintenance inspection should include a few basic steps. These include checking and replenishing all fluids, and giving the tractor and spreader a good assesment.

A few more things to remember are, you need to travel on public roads between the barn and grove make sure you display a slow moving vehicle sign (SMV). This will warn other drivers that you are moving below the speed limit and to give you extra room. Remember to always fasten your seatbelt if the tractor is outfitted with a ROPS (Roll Over Protective Structure).

## Bulk Fertilizer Spreader Checkpoints

Before use granular applicators should be checked for cracked and leaking floor plates, and disfunctional and poorly lubricated chains. Since hydraulics normally operate the drive chain and open and close the supply doors, closely inspect the hydraulic oil tank, hoses and fittings for leaks. Check tire pressure on the tractor and spreader and inspect the sidewalls for cracks. Power take off (PTO) shields should be in place, and all U-Joints and greese fittings lubricated. A slow moving vehicle sign (SMV) should be in place on the rear of the spreader when transported on or near roads between loads. Spreading equipment should always be calibrated for correct application rate, and proper placement.

### Bulk Fertilizer Operation

Dry material spreaders should be adjusted to place fertilizers under the tree canopies. Tree skirts can be pruned to facilitate placement of fertilizers and other agri-chemicals such as herbicides.

Young tree fertilizer spreaders with manual or electronic discharge devices can deliver precise rates of fertilizer quite accurately. Since the root zones of small trees is limited, accurate placement is essential to prevent loss to runoff or leaching beyond the root zone.

Equipment to apply and incorporate granular controlled-release products should be evaluated to reduce surface movement of nutrients by rainfall and wind. When animal manure is applied, spreading equipment should be designed to place the manure on the root zone under the canopy.

## Apply Materials to Target Sites

Proper fertilization will result in higher yields and minimizes environmental effects. Operate the machinery as designed to get precise and desired placement of nutrient materials, at specified rates, consistent with the form and source of nutrient materials. Proper calibration and maintenance of fertilizer application equipment is therefore essential to avoid misapplication of applied nutrients.

Place nutrients within drip-line bands along hedge row of trees. Avoid placement in areas prone to off-site transport of nutrients, especially water furrows.

For young trees, fertilizer should be spread uniformly around the tree in an area consistent with the highest root development. Be careful not to get fertilizer within 3 inches of the trunk to prevent salt burn to the tree.

In addition to applying fertilizer to the target sites, remember that many factors may affect movement of the materials away from target sites these include:

1. Soil type.

2. Timing/season.

3. Rainfall and irrigation

4. Tall weeds or grass

5. Proper calibration.

6. Root zone location.

7. Formulation and composition of nutrients.

**Split Applications Throughout Season**

Dividing the annual fertilizer requirement into three or more applications can minimize leaching during the summer rainy season and help maintain the supply of nutrients over the long growing season of Florida. Frequent fertigations can be an efficient method of N and K applications while minimizing leaching during excessive rainfall events. The trade-off between production costs, fertilizer use efficiency, and resource protection must be considerations for the number of split applications per year.

## Loading Fertilizer from a Bulk Trailer

**Loading Fertilizer**

Always load fertilizer into application equipment away from wells or any surface water bodies when possible. An asphalt or concrete pad with rainfall protection permits easy recovery of spilled fertilizer. When possible, use a tarp and load at random locations in the field. Random loading locations prevent the build up of nutrients on one specific site.

To minimize the potential for spilled materials to pollute surface waters, locate mixing and loading activities away from ground water wells, ditches, canals, and other areas where runoff may carry spilled fertilizer into surface water bodies. If such areas cannot be avoided, protect wells by properly casing and capping them. Use concrete or asphalt berms to keep spills out of surface waters. Recover and apply any spilled materials to the application site.

Don't load fertilizers on chemical mix-load stations because of the potential for cross-contamination. Fertilizers contaminated with pesticides could cause crop damage or generate hazardous waste.

**Proper BMPs**

1. Load fertilizer into application equipment at locations away from wells, ditches, or surface water bodies.

2. Clean up spilled fertilizer immediately. Spills can be contained by the use of tarps below the fertilizer applicator.

3. With liquid applicators make sure all cut-off valves are functioning correctly, and check for leaks on hoses, filters, valves, nozzles, pumps and lines. Use proper sized nozzle orifices to reduce drift.

4. While making turns at the end rows with bulk spreaders turn off the belly chain. Stopping the belly chain will prevent waste.

5. It's important that the fertilizer placement be in the target area under the tree canpoy so the trees can utilize the fertilizer and minimize off site movement.

6. Ensure all chemical materials are covered and protected from the weather, whether in the transport or in the spreader.

## Spreader Calibration

### Calibration

Any type of machinery used for applying materials has to be calibrated and set to accurately apply materials at desired rates. Ensure that all machinery has been accurately calibrated **before** applying materials in the field.

Never use guesswork. Only workers who are familiar with the equipment and have been trained in calibration should do the calibrating.

### Storage

Some fertilizers are strong oxidizers. For this reason, store all fertilizers away from fuel, solvents and pesticides. All fertilizers should be stored inside a concrete building with a metal or flame resistant roof.

## Fertigation

Application of liquid fertilizer through irrigation systems (fertigation) enables multiple applications of fertilizer with little additional cost. The added advantage of fertigation is that nutrients are applied directly to the root zone. Boom applications of liquid or suspension fertilizers also offer this advantage.

### Fertigation Best Management Practices

1. Routinely monitor system components including pumps, injection devices, lines, filters, tanks and emitters. Don't forget backflow prevention devices are mandatory.

2. Routine monitoring of the fertigation process is essential. Particular emphasis is placed on start-up and shut-down periods.

3. Frequently calibrate and re-check injection rates and times is necessary to ensure proper operation of the system.

4. Prevent leaks, runoff, calibration, and spill prevention.

5. Flush all system components with clean water after each use.

Fertilizers which are salts can cause leaf burns, even when mixed with low salinity water. Better results for fertilization purposes are to inject small frequent dosages rather than fewer applications at higher rates. Proper and legal backflow prevention devices are mandatory in the irrigation system to prevent nutrient back-siphoning into the water supply.

## Fertilizer Recommendations for Young Trees.

Citrus growers in Florida have traditionally applied soluble granular fertilizers 4 to 6 times per year to ensure a continuous supply of nutrients to young trees. Such repetition demands a heavy investment in energy, time, labor and machinery. Repetitive applications can also increase soil compaction and contribute to the contamination of groundwater. Another expense is the need for the fertilization of isolated young trees replanted in established groves.

However, controlled or slow release fertilizer mixtures can be applied less frequently than conventional soluable materials, typically once per year. Studies have shown that controlled release fertilizers applied at lower rates result in growth comparable to that obtained with readily soluble fertilizers. Fertigation and controlled release

fertilization may reduce application frequency and associated energy costs.

Low rates of fertilizer are applied with frequency to ensure even distribution within the limited root zone and to avoid root damage from excess salt concentrations in localized areas. Although studies have shown that 2 to 3 applications of granular fertilizer are sufficient for adequate growth during the first year of tree life, more frequent applications are recommended to ensure optimum fertilization under all Florida conditions. Additional applications are used as insurance against uneven fertilizer distribution with mechanical spreaders and when heavy rains leach fertilizer away from the root zone.

## Fertilizer Application Quiz

**Multiple Choice and True or False**

1. Proper calibration and maintenance of fertilizer application equipment is essential to avoid _____?

a) Misapplication

b) Proper application

c) None of the above

d) All of the above

2. Place nutrients within areas prone to runoff, especially water furrows. Avoid placement in the root zone of individual trees or drip line bands along hedge row of trees.

3. Which of the following describes the best area to load the fertilizer spreader?

a) An area where there's no grass

b) Tarp, concrete or asphalt

c) Chemical mix-load station

d) None of the above

4. Which of the following describes the procedure to set the equipment for even and accurate applications in the field?

a) Calibration

b) Rebuild

c) Tune-up

d ) None of the above

5. Calibration is a very important part of application. It should only be acomplished by someone knowledgeble with the procedure and the equipment.

6. Fertilizers as strong oxidizers should be stored away from fuel, solvents and pesticides to prevent contamination or fire.

7. It is OK to load fertilizer near wells, canals, or any surface water.

8. To reduce drift, use low pressure while applying liquid fertilizers.

9. For protection against the weather, use storage facilities or plastic tarps to protect nutrients.

10. Proper fertilization will result in higher yields and minmize environmental effects, as compared to applying more than is needed.

## References

University of Florida, Institute of Food and Agricultural Sciences, "Fertilization of Young Citrus Trees", http://edis.ifas.ufl.edu/HC79

University of Florida, Institute of Food and Agricultural Sciences, " Citrus Grove Leaf Tissue and Soil Testing: Sampling, Analysis, and Interpretation" http://edis.ifas.ufl.edu/SL115

University of Florida, Institute of Food and Agricultural Sciences, "Plant Nutrients for Citrus Trees", http://edis.ifas.ufl.edu/SL200

## Additional Readings

The following publications that provide information for citrus grove workers are available through EDIS, the UF/IFAS on-line document system.

**English**

First Aid, Heat Stress, and Safety for the Citrus Grove Worker, http://edis.ifas.ufl.edu/AE242

Understanding the Pesticide Label for the Citrus Grove Worker, http://edis.ifas.ufl.edu/AE243

Personal Protection Equipment for the Citrus Grove Worker, http://edis.ifas.ufl.edu/AE244

Equipment Safety for Citrus Grove Workers, http://edis.ifas.ufl.edu/AE245

Herbicide Application Best Management Practices for the Citrus Grove Worker, http://edis.ifas.ufl.edu/AE246

Pesticide Application Best Management Practices for the Citrus Grove Worker, http://edis.ifas.ufl.edu/AE247

Fertilizer Application Best Management Practices for the Citrus Grove Worker, http://edis.ifas.ufl.edu/AE248

Aquatic Vegetation Management Best Management Practices for the Citrus Grove Worker,

http://edis.ifas.ufl.edu/AE249

Drainage Management Best Management Practices for the Citrus Grove Worker, http://edis.ifas.ufl.edu/AE250

Irrigation Management Best Management Practices for the Citrus Grove Worker, http://edis.ifas.ufl.edu/AE251

Riser Board Water Control Structures Best Management Practices for the Citrus Grove Worker, http://edis.ifas.ufl.edu/AE252

Best Management Practices for Agricultural Maintenance Facilities, http://edis.ifas.ufl.edu/AE253

**Spanish**

Primeros Auxilios, Insolación y Seguridad para los Trabajadores de Cítrico, http://edis.ifas.ufl.edu/AE270

Entendiendo la Etiqueta del Pesticida para los Trabajadores de Cítrico, http://edis.ifas.ufl.edu/AE271

Equipo de Protección Personal para los trabajadores de Cítrico, http://edis.ifas.ufl.edu/AE272

Seguridad con el Equipo para los Trabajadores de Cítrico, http://edis.ifas.ufl.edu/AE273

Mejores Prácticas de Manejo en Aplicaciones de Herbicida para los Trabajadores de Cítrico, http://edis.ifas.ufl.edu/AE274

Mejores Prácticas de Manejo en Aplicaciones de Pesticida para los Trabajadores de Cítrico, http://edis.ifas.ufl.edu/AE281

Mejores Prácticas de Manejo en Aplicaciones de Fertilizante para los Trabajadores de Cítrico, http://edis.ifas.ufl.edu/AE275

Mejores Prácticas de Manejo en Aplicaciones de Malezas Acuáticas para los Trabajadores de Cítrico, http://edis.ifas.ufl.edu/AE276

Mejores Prácticas de Manejo con Drenaje para los Trabajadores de Cítrico, http://edis.ifas.ufl.edu/AE277

Mejores Prácticas de Manejo con Irrigación para los Trabajadores de Cítrico, http://edis.ifas.ufl.edu/AE278

Mejores Prácticas de Manejo con compuertas de retención de agua para los Trabajadores de Cítrico, http://edis.ifas.ufl.edu/AE279

Mejores Prácticas de Manejo para el Mantenimiento en Facilidades Agrícolas, http://edis.ifas.ufl.edu/AE280

**Table 1.** Fertilizer PPE Quiz

| Question Number | Correct Anwser |
|---|---|
| 1 | True |
| 2 | False |
| 3 | False |
| 4 | True |
| 5 | True |
| 6 | True |
| 7 | True |
| 8 | C |
| 9 | D |
| 10 | E |

**Table 2.** Leaf and Soil Sampling Quiz

| Question Number | Correct Anwser |
|---|---|
| 1 | True |
| 2 | True |
| 3 | True |
| 4 | True |
| 5 | Soil, Leaf |
| 6 | N, P, K |
| 7 | D |
| 8 | D |
| 9 | A |

**Table 3.** Fertilizer Application Quiz

| Question Number | Correct Anwser |
|---|---|
| 1 | True |
| 2 | A |
| 3 | False |
| 4 | B |
| 5 | A |