

**WATER QUALITY/ QUANTITY
BEST MANAGEMENT PRACTICES
FOR
FLORIDA SPECIALTY FRUIT and NUT CROPS**

Cover Artwork Pending

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2008 Edition

Florida Department of Agriculture and Consumer Services
Office of Agricultural Water Policy

**WATER QUALITY/QUANTITY
BEST MANAGEMENT PRACTICES
MANUAL REGISTRATION FORM**

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Best Management Practices (BMPs) are directed at enhancing and protecting the water resources of Florida. It is recognized by all the groups that participated in the development of BMPs, that they will need to be revisited, reviewed, and modified over time and as new scientific data becomes available. Therefore, all users are encouraged to register their copy of this manual. Registered users will be mailed all addendums and revisions as they become available. Register your manual by mail or fax at the following:

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COMMENTS BY COMMISSIONER CHARLES H. BRONSON

Dear Agricultural Producers:

Congratulations on completing the *Water Quality/Quantity Best Management Practices for Florida Specialty Fruit and Nut Crops*. This manual, applicable statewide, reflects many years of hard work from representatives of the agricultural industry, the environmental community, and federal, state and local government. The manual provides a valuable collection of many common-sense techniques that are directed at enhancing and protecting water quality.

While best management practices (BMPS) have been in place for many years in our state, their role in environmental protection was formally established in 1999 with the passage of the Florida Watershed Restoration Act. This legislation provides the framework for implementing Florida's Total Maximum Daily Load program, which sets water quality targets for impaired waters. As Florida's population continues to increase, so do the impacts to and competition for Florida's limited water resources. All Floridians must take part in conserving and protecting these resources. This manual represents the agricultural industry's commitment to do just that.

Florida is home to an increasingly diverse acreage of specialty fruit and nut crops, ranging from commercial operations to backyard hobbyists. This is important because, in general, agricultural lands maintain valuable water recharge areas and preserve open spaces. The BMPs in this manual help ensure that production activities do not compromise the environmental advantages of keeping the land in agriculture. The BMPs also provide equine operations with other benefits and help them remain competitive in a global economy.

As a fifth generation Floridian whose family has always been involved in agriculture, I want to thank all who participated with the Department in the development of this important manual. With the active support and participation of so many dedicated people, I am optimistic about the future of Florida's agricultural industry. I trust that you will join me in supporting this valuable water resource protection effort.

Sincerely,

CHB

ACKNOWLEDGEMENTS

A Steering Committee was established in 2008 to create this BMP manual. Additionally, a technical working group was formed to support the efforts of the Steering Committee, and charged with developing and reviewing specific BMPs contained in the manual. It should be noted that an effort of this magnitude could not have been accomplished without the tireless dedication of all participants. The following is a list of individuals who participated in the development of this manual. Each of these individuals and their organizations made important contributions to the process, and their work is sincerely appreciated.

Steering Committee

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INTRODUCTION

Opening Notes

Best Management Practices (BMPs) are practices or combinations of practices that, based on research, field-testing, and expert review, are determined to be the most effective and practicable means for improving water quality. BMPs are typically implemented as a **treatment train**. This normally includes a combination of nonstructural and structural practices that are effective in reducing or preventing pollutant discharges. BMPs must be: based on sound science, technically feasible, economically viable for landowners, and socially acceptable.

The practices outlined in this manual are intended for use statewide on specialty fruit and nut crops, and may include stone fruit (peaches, plums, and nectarines), tropical fruit, blueberries, grapes, brambles (blackberries and raspberries), and pecans as well as miscellaneous fruit and nuts. The manual can be downloaded at www.floridaagwaterpolicy.com. If producers are involved in farming ventures other than those covered by this manual, they should use the related BMP manuals, which are available at the same website.

Things to keep in mind as you use this manual are:

- Italicized words that appear in **red** are defined in the glossary.
- Specific record keeping requirements are noted using a “pencil mark” icon. 
- Remember to fill out the BMP Manual Registration Card inside the front cover and return it to the Florida Department of Agriculture and Consumer Services in order to receive future updates to this manual.

Overview of the Industry

Because the specialty fruit and nut industry is considerably smaller than most other production agriculture, the statistical information is not readily available. However, it is estimated that 50,000 acres exist in Florida for specialty fruit and nut crops. Urbanization of agricultural lands has put pressure on sustaining some specialty fruit and nut crops, such as pecans, but has allowed other growers to pursue alternative opportunities. Because of the use of fertilizers and pesticides used on many of these operations, runoff may adversely affect the quality of our water resources. In response, this manual has been developed to promote Water Quality and Quantity BMPs for Specialty Fruit and Nut Crops in Florida; and, is a compilation of generally accepted practices that are designed to reduce water quality impacts, conserve water, soil and other resources, and address pest and disease problems. The industry remains committed to fostering water resources protection through the implementation of BMPs.

BMP History and Purpose

The 1972 Federal Clean Water Act (**FCWA**) required states to assess the impacts of nonpoint sources of pollution on surface and ground waters, and establish programs to minimize these impacts. In 1978 Florida established a Nonpoint Source Management

Program, which includes the use of structural and nonstructural BMPs to minimize nonpoint source pollution, through both regulatory and non-regulatory means.

Section 303(d) of the FCWA requires states to identify impaired waters and establish total maximum daily loads (TMDLs) for pollutants entering these waters. TMDLs establish the maximum amount of pollutants that can be discharged to a waterbody and still meet designated uses such as swimming, fishing, or as a potable water source. The 1999 Florida Watershed Restoration Act (FWRA) provided the framework for Florida's TMDL program. Under the Act, once the Florida Department of Environmental Protection (*FDEP*) establishes a TMDL, the agency may develop and adopt a Basin Management Action Plan (*BMAP*), which specifies the activities that watershed stakeholders will undertake to reduce point and nonpoint source pollutant loadings. In *watersheds* with adopted BMAPs, agricultural producers are required either to implement FDACS-adopted BMPs or conduct water quality monitoring prescribed by FDEP or the water management district.

The FWRA gives the Florida Department of Agriculture and Consumer Services (FDACS) the authority to develop interim measures, BMPs, cost-share incentives, and technical assistance programs to assist agriculture in reducing pollutant loads in TMDL watersheds and other areas. The law also stipulates that the FDEP must verify that these BMPs are effective in reducing pollutant loading to waters. Florida's commercial producers will be required to help meet agricultural pollutant load allocations through implementation of BMPs.

Pursuant to sections 403.067(7)(c), and 570.085, *F.S.*, implementation, in accordance with FDACS rule, of FDEP-verified and FDACS-adopted BMPs gives growers the following advantages:

- A presumption of compliance with state water quality standards
- A release from the provisions of s.376.307(5), *F.S.*, for those pollutants addressed by the BMPs
- Assistance with BMP implementation

The implementation of FDACS-adopted BMPs does not preclude the FDEP or water management district from requiring compliance with water quality standards or with current BMP requirements in any applicable regulatory program authorized by law for the purpose of protecting water quality.

Statutory Exemption for Agricultural Activities

Under subsection 373.406(2), *F.S.*, any person engaged in the occupation of agriculture may alter the topography of any tract of land for purposes consistent with the practice of agriculture. These activities may not be for the sole or predominant purpose of

impounding or obstructing surface waters. Agricultural activities that meet these criteria may qualify for a statutory exemption from an Environmental Resource Permit (ERP).

Pursuant to 373.406(9), F.S., environmental restoration activities on agricultural lands that have minimal or insignificant impacts to water resources may also be exempt from an ERP, upon written request by the producer and written notification from FDEP or the water management district that the proposed activity qualifies for the exemption.

Even if the two exemptions above apply, they do not relieve agricultural producers located within a watershed with an adopted BMAP from either implementing BMPs or conducting monitoring.

Also, persons engaged in the occupation of agriculture have protections under the Florida Right to Farm Act (section 823.14, F.S.). The Act states, with certain exceptions, that no farm which has been in operation for one year or more and was not a nuisance at the time of its established date of operation shall be a public or private nuisance, if the farm operation conforms to generally accepted agricultural and management practices.

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KEYS TO POLLUTION PREVENTION

The following “common sense” recommendations have been provided in order to expand your knowledge of water quality issues. This will help you to prevent pollution problems on your farm. The recommendations are summarized below; however, growers should note that these are provided as an overview, and the actual BMPs appear later in this manual.



Embrace Best Management Practices

BMPs have become the preferred mechanism for state agencies to address water quality issues related to agriculture, whether associated with leaching to ground water or runoff to surface water.

BMPs are practices, or a combination of practices based on research, field-testing, and expert review, to be the most effective on-location means, including economic and technological considerations, for improving water quality in agricultural and urban discharges. BMPs are typically implemented as a combination of nonstructural and structural practices that have been determined to be effective for reducing or preventing pollution.

Use this manual to improve environmental stewardship of your operation. Implementing the BMPs in this manual will demonstrate the agricultural industry’s commitment to protect water resources through voluntary programs, thereby minimizing regulatory intervention.

This manual is a living document, to be updated as new information about Florida water quality protection becomes available. Practices outlined in this manual are designed to protect Florida water quality and allow you to comply with state water quality standards.

In general, BMPs must be: technically feasible, economically viable, socially acceptable, and based on sound science.



Understand Water Quality Issues

Water quality relates to water’s chemical, biological and physical characteristics. The quality of water often determines its specific use or its ability to support various beneficial uses, also known as designated uses. Some pollutants for which TMDLs have been set include: total phosphorus, total nitrogen, total suspended solids and coliform bacteria, just to name a few.

Section 403.021, F.S., states as public policy the protection, maintenance, and improvement of surface water quality for the purposes of public water supply; propagation of wildlife, fish and other aquatic life; and domestic, agricultural, industrial, recreational, and other beneficial uses.

Nonpoint Source Pollution Most of the large, obvious pollution sources like city sewers and factories, which might discharge pollution directly into lakes, rivers and streams from an identifiable point, have been dealt with in the past 25 years.

Today, the US Environmental Protection Agency is addressing more diffuse, less easily identified sources of pollution (nonpoint sources). Unlike “point sources” of pollution, such as domestic or industrial wastewater discharges, nonpoint pollution comes from sources that cannot be centrally collected and treated. NPS pollution is associated with the cumulative effects of everyday activities occurring within a watershed. Typical examples include erosion and sedimentation from construction sites; septic tanks; and stormwater runoff from roads, parking lots, factories, suburban areas, and farms. NPS pollution is often driven by rainfall, which causes pollutants accumulated on the land surface to run into surface water or to leach into the ground water.

As a grower, your management practices determine your impact on Florida water quality. Elevated levels of phosphorus, nitrogen, sediment, bacteria, and oxygen-demanding organic material all contribute to the degradation of water quality. When you implement FDACS-adopted BMPs, you help demonstrate the effectiveness of using voluntary, consensus-based programs, in lieu of the traditional regulatory approach.

Potential for discharges from specialty fruit and nut crops to cause water quality problems varies greatly, depending on soil type, slope, drainage features, nutrient management, or activities in or near *wetlands* or other surface waters. For more information on water quality, go to the following link:

<http://lakewatch.ifas.ufl.edu/LWcirc.html>



Exercise Your Options

Most Florida agricultural operations have three options regarding their approach to water quality on private and commercial farms/facilities:

Option 1: Implement BMPs recommended in this manual and take positive steps toward maintaining state water quality standards. ***Strongly suggested.***

Option 2: Ignore BMPs and conduct water quality monitoring to demonstrate the farm is not causing or contributing to water quality impairment. This is an extremely costly and time-consuming process, involving extensive water quality monitoring. ***Not suggested.***

Option 3: Do absolutely nothing. As TDMLs are adopted and Basin Management Action Plans are developed throughout Florida, growers within identified basins who have not

complied with options 1 or 2 will be subject to regulatory and enforcement action by the FDEP and/or a water management district. ***This option is not recommended.***

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**General Information for
Environmental Protection
for Specialty Fruit and Nut Crops**

SPECIFIC WATER QUALITY IMPACTS ASSOCIATED WITH SPECIALTY FRUIT AND NUT CROPS

Most specialty fruit and nut crops are produced on perennial trees or shrubs that have well developed root systems. In South Florida, many commodities are cultivated on sandy, high water table soils with little relief or slope, thereby requiring adequate drainage. In contrast, North Florida generally has heavier (clay-type), lower water table soils with more relief in comparison. These innate differences create production challenges and the potential for associated water quality impacts. This section discusses some of the typical water quality impacts associated with specialty fruit and nut crops.

Sources

Excess nutrients in water resources are generally associated with various forms of nitrogen and phosphorus, which make up the bulk of fertilizer materials. They are the result of stormwater runoff and/or groundwater leaching, and are the most common source of water quality impairments in Florida. They usually exist as dissolved species in a water column. High levels of nutrients in runoff may result in abnormal plant growth or *eutrophication* of a waterbody. The nitrogen species that is most abundant in natural waters is nitrate. Due to its high mobility, nitrate can also leach through the soil profile and enter groundwater. Ammonia, which is very toxic to fish, is an inorganic source of nitrogen and originates primarily from chemical volatilization. Phosphorus, another key element necessary for growth of plants and animals, has a much lower solubility than nitrate. Unlike nitrogen, phosphorus is generally retained in the soil by a complex system of biological uptake, absorption, and mineralization. However, in terms of freshwater lake ecology, it tends to be the most (growth) limiting nutrient. Phosphorus enters waterbodies attached to particulate matter via sediment transport or as a dissolved species in water. The best defense for keeping nutrients out of waters is source-control.

Sediment is the result of erosion and affects surface waters in many ways. The principal types of sediment most commonly associated with row crop farming are from water or wind erosion. Suspended solids from sediments reduce the amount of sunlight available to aquatic plants, cover fish spawning areas and food supplies, clog and harm the gills of fish, and can adversely affect shellfish. These effects combine to reduce fish, shellfish and plant populations, and decrease the overall productivity of lakes, streams, estuaries, and coastal waters. Recreation may also be limited because of decreased fish populations and reduced desirability of any downstream swimming areas. Deposited sediment also reduces the flow capacity of drainage ditches, streams, rivers, and navigation channels which can result in more frequent maintenance dredging or flooding. Chemicals, such as some pesticides, phosphorus, and ammonium, may be transported by sediment through adsorption. Over time, the aquatic environment can cause these chemicals to be released from the sediment into the water column. This further exasperates pollution problems. The best defense for keeping sediments out of waters is vegetated areas.

Excess freshwater volume can also be a source of water resources impacts. The cumulative effect of farms over-irrigating and prematurely discharging water downstream can adversely affect natural wetlands, by stacking too much water in the wetlands for too long. Also, too much freshwater discharge at the wrong time to downstream estuaries can adversely affect critical salinity levels within the estuary. It's important to remember that any excess water that is not held in the soil or used by the plants will likely carry other pollutants with it. The best defense for keeping excess water from leaving your farm field is proper irrigation management.

Water Quality Degradation Indicators

Algae are essential to aquatic systems. As a vital part of the food chain, algae provide the nutrition necessary to support all aquatic animal life. Certain types of algae also provide habitat for aquatic organisms. Blue-green algae (which are actually a photosynthetic bacteria known as cyanobacteria) are usually found in freshwater systems, most commonly in calm, warm waters with high levels of nutrients. While cyanobacteria are naturally present in low numbers, increased algal production can cause many problems in a waterbody. Cyanobacteria can become so abundant that they will cause a scum layer to form on the surface, choking the sunlight-dependent life below and disturbing the food chain. The bacteria produces a small amount of toxin, which is generally harmless to animals and humans when algal populations are under control; however, livestock and pet deaths have been attributed to consumption of water with an abundance of cyanobacteria. The toxin is known to cause liver and nervous system effects in humans as well. Cyanobacteria toxin cannot be eradicated by boiling or ultraviolet irradiation, so untreated surface water (any water not obtained through a public water system) with increased cyanobacteria poses a risk. Potential risks from recreational contact include skin, respiratory, and mucous membrane irritation. Other algal blooms can significantly alter the natural balance of the flora and fauna by causing a waterbody to become anaerobic, resulting in a failing or impaired ecosystem. Certain types of noxious weeds or a monoculture of one or two species of aquatic plants can indicate an imbalance of nutrients in a waterbody, which can also lead to further problems.

Waterbodies both produce and consume oxygen. Oxygen is obtained from the atmosphere and from plants through photosynthesis. The presence of algal blooms, noxious weeds, and too many floating aquatic plants can reduce the amount of dissolved oxygen in a waterbody and can block sunlight necessary for photosynthesis to occur. Respiration by aquatic animals, decomposition of organic material, and various natural chemical reactions consume oxygen. The amount of oxygen consumed by microorganisms in breaking down wastes is known as the biochemical oxygen demand or **BOD**. If BOD exceeds the amount of dissolved oxygen in a waterbody, widespread fish kills can occur. If dissolved oxygen levels are already lower due to algal blooms or other flora, the likelihood of a fish kill increases.

Turbid water, a result of excessive sedimentation, is another water quality degradation indicator. Soil conservation practices must be used to prevent the loss of sediments to waterbodies. Soil and sediment can fill in water bodies, clog waterways and affect water clarity. Suspended sediment can have numerous effects on fish as decreased penetration of sunlight can affect the feeding and breeding behaviors of fish. The sediments can also clog gills and cause irritation to mucous membranes covering their eyes and scales. As the sediment settles, fish eggs are susceptible to suffocation due to burial. To reiterate, nutrients and toxins can also attach to sediments, which can contribute to downstream eutrophication and pollution.

Strategies to Minimize Water Quality Impacts

The strategy behind using BMPs to achieve water quality protection while maintaining or even improving productivity is not a new process, but may require a new business model. It relies on a simple planning circle using the following steps:

- Evaluate the existing situation
- Plan what to do
- Implement the plan
- Check to make sure everything is working correctly, and if not
- Go back to the first bullet.

To do this correctly, specialty fruit and nut farmers should do an inventory of the farm's natural resource features as noted in the *BMP Selection and Implementation* chapter. The outcome of this exercise will be a plan – remember to keep it available and update it regularly. This plan will also help you communicate with your employees and your county agent, *USDA-NRCS* staff, or others.

Furthermore, there are a number of simple strategies that farmers can use to minimize water quality impacts. Vegetative cover, nutrient and irrigation management are essential elements for the protection of water quality. Many of the BMPs listed elsewhere in this manual will address water quality – both onsite and offsite. Remember to think about and employ the treatment-train concept whenever possible. Many of the BMPs in this manual will address more than one environmental issue. Therefore, by implementing BMPs, you usually solve more than one problem.

NUTRIENT MANAGEMENT

General Fertilization Management Principles

Nitrogen (N) and phosphorus (P) represent the greatest fertilizer cost to growers and contribute to the majority of water quality problems, given that most Florida soils are sands and therefore retain limited quantities of water and nutrients. In general, N compounds are readily oxidized to nitrate in most Florida soils, and nitrate has a very low affinity for mineral soil particles or organic matter. Consequently, growers almost always have to add supplemental N fertilizer to meet a crop's nutrient requirement. Conversely, some of Florida's soils naturally provide adequate phosphorous and near neutral soil pH levels, while some of the sandier, highly leached soils may not contain adequate phosphorus levels to support optimum plant growth. The near neutral soil pH levels help to facilitate cation exchange in soils and minimize potential leaching of certain cation nutrients such as ammonium, which is a positively charged molecule. As you can see, developing a basic understanding of the chemical and colloidal properties of your soil type will make you a better environmental steward and farm manager.

Individuals with only limited training in soils can discern whether a soil is mostly sand or predominately clay, and whether the soil contains flakes of free calcium carbonate or shell. The "feel and appearance method" has been promoted for years by the USDA-NRCS, and it can also be used to estimate soil moisture levels. Keep in mind that soil properties may significantly affect a fertilization management program. Given these variables, growers need to use soil and tissue testing to determine what fertilizer amounts and formulations are appropriate for their site.

Growers commonly use fertilizer materials that contain nitrogen, phosphorous and potassium (K) sources. These are the most prevalent macronutrients, discussed more fully in the following section. In general, phosphorous and liming materials (if necessary) are applied prior to planting, and nitrogen is applied during the growing season in multiple or split applications. Subsequent fertilizer applications are often made following plant establishment, with continued applications made based on observation, experience and sampling.

A balance needs to be maintained between all major and minor elements since the unavailability of any nutrient may affect other plant processes. Environmental concerns also need to be carefully weighed, since applying macronutrients such as nitrogen and phosphorus in excess of plant nutrient uptake can cause eutrophication of nearby water bodies. The result may be low dissolved oxygen levels which negatively affect aquatic organisms. Therefore, farm managers should conduct soil tests before planting as well as yearly thereafter to monitor pH and nutrient levels, and should remain cognizant of the needs of the particular fruits and nuts being grown.

One of the most important principles of fertilization timing is avoiding fertilizer application to dormant fruits and nuts. During dormancy, *deciduous crops* take up very small quantities of nutrients, and applied nutrients are much more likely to leach.

Controlled-release fertilizer sources also influence the timing of fertilization, in that fertilization is required less frequently. In either case, do not apply fertilizer when heavy rains are imminent. The scheduling of fertilizer for various specialty fruit and nut crops depends on the variety, the region, soil pH, and the maturity of the shrub/tree. Blueberries, brambles (raspberries and blackberries), and grapes have shallow roots and should not be fertilized at planting time. Contact your county Cooperative Extension Agent for recommended scheduling and rates of application.

Macronutrients

The three macronutrients most relevant to plant growth are N, P, and K. Nitrogen, which is important for plant protein synthesis and vegetative growth, has the potential to be leached to groundwater by rainfall or over-irrigation on sandy soils, and may move laterally into surface waters. The rate of nutrient application, particularly nitrogen, depends on a number of factors: soil type, crop variety, region, time of year, and type of fertilizer source being used (soluble or controlled release). Nitrogen should be applied in small amounts (split applications) throughout the growing season at rates that match the needs of the crop. Nitrogen is often applied in a water soluble form such as urea, ammonium nitrate or ammonium sulfate. Low-rate applications are usually made using soluble fertilizers, whether applied as a liquid during fertigation or as a granular product.

Phosphorus is used in the photosynthesis process and for the formation of all oils, sugars and starches. A soil test will indicate the need for supplemental phosphorus which should be incorporated into the soil prior to planting any new trees. The addition of phosphorus ensures that crops will reach their full potential by encouraging root growth and stalk strength while promoting resistance to root rot diseases. Most soluble phosphorus fertilizer materials are in the inorganic form so it can be readily absorbed by plants.

Because of its high mobility in sandy soils, K fertilization should be made as soon as possible, after soil testing results are received. Excessive K fertilization can contribute to high soil electrical conductivity (EC) levels that may limit root growth and tolerance to drought. Keep in mind that K is considered to be a soluble salt constituent, and combined with other “salts” such as sodium and chloride ions can result in plant toxicity effects. P must be water soluble and K preferably in sulphate form. The table below shows examples of some fertilizers and their grades.

General Fertilizer Information for Specialty Fruit and Nut Crops

Crop	pH	Fertilizer Sources	Granular soluble	Slow Release	Controlled Release
Temperate Crops					
Blueberries (Pine Bark)	4.0-5	Anhydrous Ammonia, Diammonium Phosphate, Potassium Chloride	8-8-8, 10-10-10, 12-4-8	12-6-6	13-6-6, 15-5-10, 18-7-10, 18-6-12
Muscadine Grapes	5.5-6.5	Ammonium, Potash		10-10-10	
Pecans	5.5-6.5	Ammonium Sulfate/Nitrate		10-10-10, 13-13-13	
Peaches	6-6.8	Ammonium Nitrate, Urea, Nitrate of Soda		10-10-10	
Nectarines	6-6.8	Ammonium Nitrate, Urea, Nitrate of Soda		10-10-10	
Persimmons	5.8-6.5	Anhydrous Ammonia		10-10-10, 5-10-15	
Brambles	5.5-6.5	Ammonium Nitrate, Phosphate, Potash	10-10-10		
Subtropical					
Lychee	6-6.5	Ammonium, Potash		6-6-6-2, 8-3-8-3, 4-4-8-3	
Guava	7-8.5	Ammonium, Phosphoric Acid		6-6-6-2, 8-3-9-2	
Avocado	any pH	Ammonium Nitrate			
Loquat	6-6.5	Ammonium Sulfate	8-8-8, 12-4-8		
Tropical					
Banana	5.5-6.5	Anhydrous Ammonia		10-10-10, 20-0-50	
Atemoya	6.6-7.8	Ammonium		2-8-8, 4-8-8, 6-6-6-3	
Papaya	6-7	Anhydrous Ammonia		14-14-14	
Mamey Sapote	6-7	Ammonium, Phosphoric Acid	6-6-6-2, 8-3-8-3		
Mango	4-8.5	Triple Superphosphate		16-16-16, 10-20-20	

Soil Testing and Interpretation

Soil testing is an applied science and should be used as one of the tools in the maintenance of healthy fruit and nut orchards. Proper fertilization recommendations and minimizing the nonpoint source pollution risk are the hallmarks of a routine soil testing program. For the effective management of nutrients, soil testing should be used in conjunction with tissue testing. An exception to this requirement would be for blueberries, where growers generally use a bed of pure pine bark or pine bark mixed with native soil. Soil test recommendations are based on a correlation between the level of a given nutrient extracted from the soil and the anticipated plant response. The amount of nutrients extracted by a particular extractant is only an index relative to crop

response. It is not a direct measure of actual plant nutrient availability. The levels of extracted P, K, and Mg are typically divided into five categories: very low, low, medium, high, and very high. For more information, see Appendix 4 of this manual.

A soil analysis supplies a wealth of information on the nutritional status of a soil and can detect potential problems that limit plant growth. Chemical properties such as soil pH, lime requirement, extractable levels of phosphorus, potassium, calcium, magnesium, and selected micronutrients such as manganese, copper and zinc can be determined through proper soil testing. Florida soils are not analyzed for nitrogen because this element is highly mobile in sandy soils. It is also important to observe plant growth and crop production over the long term and use these records as well as soil analysis to guide fertilization decisions.

Tissue Testing

Because of the mobility of most essential nutrients in soils, one of the best indicators of appropriate fertilization and plant health is tissue analysis. Since specialty fruit and nut crops are mostly perennial and/or a deciduous crop, historical logs of tissue composition can be used to fine-tune a fertilization program for optimum plant growth and minimum environmental impact. Leaf analysis, along with observation and soil testing, can be used to diagnose the effectiveness of a fertilization program, especially for micronutrient deficiencies. In most fruit and nut crops, samples should be taken from mid-shoot areas of average terminals. Soil analysis for some nutrients - because it is a snapshot of what is present at the time of sampling - does not always indicate their availability to plants. Potential nutrient deficiencies can be detected with leaf analysis before visual symptoms appear. Also, leaf analysis may provide information on induced deficiencies and inferences on plant uptake. The table below shows some tissue analysis ranges for different specialty fruit and nut crops. For specific crop information not shown in the table, please contact your local extension agent.

Sufficiency Ranges for Specialty Fruit and Nut Crops

Crops	% N	P	K	Mg
Blueberry	1.7-2.1	0.1-0.4	0.35-0.65	0.15-0.3
Muscadine Grape	1.2-2.2	>0.15	1.5-2.5	0.3-0.5
Pecan	2.5-3.3	0.18-0.2	1.3-2.5	0.35-0.6
Peach	2.75-3.5	0.12-0.3	1.3-3.2	0.25-0.5
Persimmon	1.5-2.5	0.1-0.35	1.93-3.7	0.17-0.46
Brambles	2.5-3.0	0.35-0.4	2-2.5	0.7-0.9
Carambola	1.7-2.0	0.15-0.25	1.3-1.7	0.92-1.3
Mamey Sapote	2.1-2.3	0.12-0.15	1.21-1.82	0.25
Lychee	1.4-2.0	0.15-0.2	0.6-1.0	0.3-0.5
Papaya	3.57-4.95	0.36-0.53	2.56-3.42	0.56-1.02
Avocado	1.7-2.0	0.09-0.14	1.3-1.7	0.39-0.65

** These rates may vary and are influenced by soil type, leaf position, fruiting or non-fruiting, and crop size. Contact your local extension agent for more information.*

IRRIGATION AND WATER RESOURCES MANAGEMENT

Water Supply

Proper water management planning must consider all uses of water, ranging from the source of irrigation water to a plant's water use requirements. It is very important to differentiate between crop water requirements and irrigation water requirements. Crop water requirements refer to the actual water needs for *evapotranspiration* (ET) and plant growth, and primarily depend on crop-specific development and climatic factors. Irrigation water requirements are primarily determined by soil storage capacity and crop water requirements, but also depend on the characteristics of the irrigation system. The irrigation system must be designed properly so that the crop will get the right amount of water when it needs it the most. This will help maximize both crop yield and profit, while preventing wasteful water application.

Water taken from a reliable source and delivered to a crop via an irrigation system is known as water supply. With the exception of South Florida, most of the irrigation water used in Florida agriculture is withdrawn from underground, aquifer sources. Regardless of the source's origin, it is important to know the quantity and quality of the water source before designing and installing an irrigation system. Water quality analyses are performed at a number of private and public labs and can provide valuable clues to determine the potential for irrigation plugging problems, fertigation compatibility, and/or salinity trends. Settling ponds or basins may be used to remove large inorganic particles and can also be used for aeration of groundwater containing high amounts of iron or manganese.

It is also important to ensure that the water source does not become contaminated. Florida law requires backflow prevention assemblies on all irrigation systems injecting chemicals into irrigation water. For detailed information on these requirements, refer to IFAS Extension Bulletin 258, *Causes and Prevention of Emitter Plugging in Microirrigation Systems* which can be found at: <http://edis.ifas.ufl.edu/AE032>. Appropriate backflow prevention should include a check valve upstream from the injection device to prevent backward flow; a low-pressure drain to prevent seepage past the check valve; a vacuum relief valve to ensure that a siphon cannot develop; and, a check valve on the injection line.

Water management districts are responsible for projecting future water demand over a twenty-year time period for each major water use category. Where demand is expected to exceed available supplies, the districts develop regional water supply plans that identify water sources and water resource development projects sufficient to meet the expected needs. An effective water supply planning process is especially important to agriculture as they are typically "self-suppliers" of all water used on the farm. *Florida's Agricultural Water Policy Document (July 2003)* contains more details on water supply and planning and can be found at: www.floridaagwaterpolicy.com.

Irrigation System Design and Installation

Irrigation system design is a complex issue and should be handled by trained professionals. These professionals use existing standards and criteria, as well as manufacturers' recommendations, to design the most appropriate system for a location.

The irrigation design for a site depends on a number of factors, including location, soils, vegetation, water supply, and water quality. An irrigation system needs to be designed to meet a site's peak water requirements. However, it should also be flexible enough to adapt to various water demands and local restrictions. The two main types of irrigation systems are surface irrigation, which involves channeling water through canals and ditches to raise or lower the water table, and pressurized systems, such as sprinklers (micro, drip, and overhead irrigation).

An irrigation system generally consists of the following main components:

- Water supply -- this consists of a water source, pumps, filters, and valves (including backflow valves), and, for surface irrigation, water gates and level controls.
- Water conveyance -- in surface systems, these are canals and main ditches. Pressurized systems generally include a mainline, manifold, lateral lines, and isolation valves.
- Control system -- these may be manual or automatic and can be locally or remotely controlled, and may include float switches, computerized control systems, weather stations, soil moisture sensors, etc.

The design must account for different site characteristics and topographies. Adequate pressure (head) is important for irrigation systems to function properly. The design operating pressure must not exceed the available source pressure or the capacity of the water supply. The irrigation design should also account for any additional water that may be periodically needed to leach salt buildup caused by poor-quality irrigation water.

In pressurized systems, backflow prevention devices are needed to protect the water source from contamination. Water conveyance systems should be designed with thrust blocks and air release valves to prevent system damage. Water conveyance pipelines should provide the appropriate pressure required for maximum irrigation uniformity. Precipitation rates should be considered in order to not exceed the ability of the soil to absorb and retain the water applied during any one application.

Surface systems may be able to use gravity feed from the water source, or water may need to be pumped into a reservoir to provide adequate head. Tailwater recovery systems may be considered to recover runoff from the site for reuse, but the water should be treated to prevent crop disease incidence. The proper design and installation of the components listed above optimizes their efficiency and decreases off-site impacts as a result of too much water.

Irrigation System Operation

Using proper irrigation system design, installation, water management, and maintenance practices provides a multitude of benefits. An efficient irrigation system translates into cost savings and protection of Florida's water resources.

Irrigation management is the cornerstone of water conservation and reduced nutrient and pesticide movement. It includes both scheduling the amount and frequency of water applied and the maintenance of system components, both preventive and corrective. Irrigation scheduling must take plant water requirements and soil moisture capacity into account to prevent excess irrigation water that can lead to leaching and runoff. Plant water needs are determined by ET rates, recent rainfall, recent temperature extremes, and soil moisture. Whenever possible, cultural practices should be used to minimize plant stress and the amount of water needed. For example, fruit and nut growers can use monitoring of soil moisture, mulching and soil augmentation, nutrition, and other cultural practices to control water loss and to encourage conservation.

Irrigation Scheduling

Before a grower can properly develop an irrigation schedule, the system must be audited, or calibrated, so that the rate at which water is applied to each field is known. Once the water delivery rate is known, determining when and how much to water is the next important step. Irrigation should not occur on a calendar-based schedule but should be based on ET rates and soil moisture replacement. *Actual ET* rate will vary, but it is directly related to the *potential ET*. Therefore, it must be multiplied by the crop coefficient and compared to the given plant and growth stage. The use of soil moisture probes or *tensiometers* can enhance irrigation efficiency as well as visual symptoms.

Water loss rates decrease with reduced solar radiation, minimal wind, high relative humidity, and low air temperatures. A grower can take advantage of these factors by irrigating when conditions do not favor excessive evaporation. Irrigation should occur in the early morning hours before air temperatures rise and relative humidity drops. Irrigating at this time also removes dew from leaf blades and allows sufficient time for infiltration into the soil but does not encourage disease development.

Determining how much water to apply is the next step in water management. Enough water should be applied to wet the entire root zone. Wetting below the root zone is generally inefficient and promotes leaching. Soil moisture estimates can be determined by using a soil probe to feel the depth of moisture and show the depth of the root zone.

It is important to keep in mind that, while new technology makes many tasks easier or less labor intensive, it is the principles discussed in this BMP manual that are important. These principles may be applied to any farm at almost any level of technology.

Irrigation System Maintenance

Irrigation system maintenance involves four major efforts: calibration or auditing, preventive maintenance, corrective maintenance, and recordkeeping. Maintenance is necessary on any irrigation system, whether it be micro, drip, overhead or seepage irrigation. Uniformity of water application, efficiency, water conservation, and reduction of operation and maintenance costs are some of the benefits of a regular maintenance program. The overall goal is to maximize system performance. Maintenance programs vary according to the type of irrigation system; however, all farms should follow a regular, well documented, maintenance routine.

If an irrigation system is in disrepair or coverage is obviously poor, then time is wasted doing a detailed audit. A visual inspection should first be conducted to identify any necessary repairs or corrective actions, and it is essential to make any repairs before carrying out other levels of evaluation. A visual inspection should be part of ongoing maintenance procedures, and should include the following checks with the system on:

- Mainline breaks,
- Low pressure at the pump,
- Head to head spacing,
- Interference with water distribution,
- Broken heads,
- Misaligned heads,
- Rain sensor present and functioning,
- Backflow device in place and in good repair,
- Plant health for indications of irrigation malfunction or need for scheduling adjustments, and
- Make adjustments and repairs on items diagnosed during the visual inspection before conducting pressure and flow procedures

In many areas of the state, Mobile Irrigation Labs (MILs) are available to perform these audits at no charge. If such service is available, free audits are recommended. After the audit is complete, implement all repairs needed to improve distribution uniformity and adjust the irrigation schedule as needed based on the lab's recommendation. Contact your local Water Management District or USDA-NRCS for more information on MILs.

Maintenance of flood or seepage systems includes operational checks of pump stations and structures, including cleaning and maintaining all ditches. It is important to maintain optimum pressure ranges for pump station equipment. Water control structures like risers and culverts should be kept clean and operational to assist with water conservation. Maintenance programs for pressurized pipe systems generally involve filtration, chlorination/acidification, flushing, repair or replacement of clogged emitters, and observation. Nozzles need to be replaced when worn out, and replacements should have the same flow and pressure characteristics as the original design.

In summary, the benefits of maintaining your irrigation system in good condition include uniform crop production, water conservation, and reduced operation and maintenance costs. For more specific information on this topic, refer to the *Irrigation Management BMP* in this manual.

Stormwater Management

Stormwater is defined as the runoff from impervious surfaces and water-saturated surfaces, transporting sediments and dissolved chemicals into nearby waters. This runoff can be a major cause of nonpoint source pollution which negatively affects Florida's rivers, streams, and springs often leading to problems from turbidity and eutrophication. Fertilizers and pesticides can also contribute to stormwater runoff problems.

There are many mechanisms for stormwater treatment and control. A BMP "treatment train" approach yields excellent results and is often the preferred method. In this approach, water is conveyed from one treatment practice to another by conveyances which also contribute to the treatment process. For example, runoff can be directed across a vegetated filter strip into a wet detention pond, and then through a swale into a constructed or natural wetland. Vegetative buffers and swales are excellent sources of sediment and pesticide filtration.

The best solution to stormwater runoff is to prevent it in the first place. Land should be kept vegetated as much as possible to hold soil in place. When land is left uncovered, sedimentation barriers like silt screens should be employed. The banks of canals and ditches should be kept planted to hold soil in place. This helps to maintain the integrity of the bank side-slope thus preventing unnecessary erosion. Low maintenance vegetation is the best choice for vegetative buffers. Usually, these buffers do not need to be mowed or fertilized, as this practice may compound stormwater runoff issues. To prevent the movement of fertilizers and pesticides into water bodies, "no spray" zones should be established within a set distance of the water. Application should never be conducted right up to the water line, unless allowed by the label.

Another solution to stormwater runoff can be to develop a tailwater recovery system. This system can conserve water and improve water quality by collecting and reusing irrigation water or rainfall that runs off the surface of fields. A tailwater recovery system should be located at the low end of a field(s), so that water collection can be done by gravity. Capacity of tailwater recovery systems shall be determined by analysis of the expected runoff rate, the planned storage pond capacity, and the irrigation application rate(s) if the recovery pond is to supply irrigation water. The stored tailwater should be analyzed for nutrient content with the fertilization program adjusted accordingly. Unfortunately, the water collected from fields may also contain disease-causing fungal spores and bacteria, so disease should be monitored closely.

Permitting Considerations

Florida's five water management districts have the primary regulatory authority for issuing well construction, water use and surface water permits for agriculture. Well

construction permits, which are sometimes delegated and issued by county governments, are required prior to the drilling, construction and/or repair of a well. These permits ensure that wells are constructed by qualified, licensed contractors to meet safety, durability and resource protection standards. A water use permit allows the user to withdraw a specified amount of water, either from a groundwater well or from a surface water source. Statewide, Florida agriculture currently uses approximately 50 percent of all permitted freshwater withdrawals, and while public supply use is increasing rapidly in many parts of the state, agricultural water use is expected to remain relatively constant for the next twenty years. In general, before a user can receive a new permit to withdraw water, the permit applicant must establish that the proposed water use satisfies a three-prong test in Section 373.223, F.S., which requires:

- The proposed use is reasonable and beneficial;
- The proposed use will not interfere with any existing legal use of water; and,
- The proposed use is consistent with the public interest.

Almost all users who withdraw water from wells or surface water bodies require a water use permit. Whether the required permit is a general water use permit issued by rule or an individual water use permit issued by the Water Management District Governing Board or staff depends upon the location and the quantity requested. Generally, permits are issued from six to twenty years depending upon the region of the state and specific technical circumstances. These circumstances focus on items such as subsurface drawdown impacts, saltwater intrusion, and/or wetland hydrology impacts. Water use permits are important because they provide growers with a legal right or “instrument” to use the water for supplemental irrigation purposes and other related agricultural uses (e.g., frost protection or crop cooling). All permits have conditions placed upon them, and may also have specific reporting requirements. Pumping reports are usually required on some frequency, especially if the use is in a Water Resource Caution Area.

An Environmental Resource Permit is sometimes required for agriculture, especially if the activity affects wetlands, alters surface water flows, or contributes significantly to water quality pollution. These permits are fairly complicated, and require engineering analyses to demonstrate that the proposed design meets all permitting criteria.

The water management districts can declare special drought/water shortage restrictions that govern the amount and timing of irrigation. It is important to understand how water use restrictions can affect your farm. Agricultural users who are using reclaimed water or using low volume irrigation systems are often exempt from these restrictions.

Integrated Pest Management

IPM Strategies

A control strategy should be implemented that reduces pest numbers to an acceptable level while minimizing harm to non-targeted organisms. The strategy of Integrated Pest Management or IPM centers on prevention (keeping a pest from becoming a problem) and suppression (reducing pest numbers or damage to an acceptable level).

Consider all of the control measures available under IPM before using a chemical control method for an active pest infestation. Monitoring or *scouting* is the most important element of a successful IPM program. Scouting enables a grower to monitor pest presence and development throughout the growing season. By observing plant conditions regularly and noting which pests are present, an intelligent decision can be made regarding how damaging they are and what control strategy is necessary. Keep in mind that pests may be present for some time before damage occurs or is noticed. It is essential to record the results of scouting and monitoring in order to develop historical information, document patterns of pest activity, and document success or failure. IPM accomplishes pest management goals using prevention techniques along with a combination of cultural, biological, and chemical ones.

Cultural Controls

The use of cultural controls in an IPM program involves crop production methods that improve crop yield by reducing pest numbers. Crop husbandry practices, patterns of behavior, grower-based technology, and re-application of resources not originally intended for pest control are all a part of cultural controls as well. Although these practices may reduce pest numbers as well as pesticide use, their effectiveness is difficult to verify and is dependent on location and crop type.

Site selection, nursery establishment, and full production are the cultural control practice areas that can make a difference in pesticide use. Site selection should take into consideration the soil type and elevation to avoid prolonged surface flooding and to minimize cold damage to trees or shrubs. Planting schemes also influence the efficiency of pesticidal sprays applied after trees and shrubs reach maturity.

Biological Controls

The use of biological controls in an IPM program involves the use of living natural enemies to control pests or the active manipulation of antagonistic organisms to reduce pest population densities to acceptable levels. Natural enemies help to reduce the amount of chemicals needed to control pests, thus improving water quality and costs of chemical management. Biological control techniques should be based on professional knowledge of the method of control, the pest's life cycle, environmental conditions, and historical data. Items that may effect pest populations are:

- Pest incidence and life cycle
- Weather patterns
- Predators and parasites

Predators and parasites are the most commonly used biological control agent and are known as beneficials (insects, mites, and pathogens). These alone will generally not prevent damage from pests, but can reduce their severity. A proper management plan for the use of beneficials must be maintained in order to be technically and economically effective long term. Unfortunately, many beneficial insects, mites and pathogens are more susceptible to commonly used pesticides than are the target pests, and spray applications can severely disrupt the balance between natural enemies and the pests. In some cases, outbreaks of pests occur because natural enemies of these pests were inadvertently destroyed by using the wrong pesticide. One important consideration in the selection of a pesticide in addition to its efficacy is its potential impact on beneficials.

Chemical Controls

The use of agrichemicals in an IPM program involves the use of pesticides as necessary and in a manner which is least disruptive to biological control. Choosing the proper pesticide requires familiarity with the product labels and performance. Among the factors which influence the selection of a pesticide, efficacy of the product against the target pest is perhaps the most important. Other factors to consider in selecting a pesticide include:

- Cost effectiveness
- Potential hazards to applicators, environment, orchard or fruit crop
- Limitations or restrictions on application
- Impact on development of pest resistance

Product selection may be influenced by the farm's location relative to residential areas, human traffic in the vicinity, or weather conditions favoring drift of materials to non-target sites. All possible precautionary measures must be observed when using materials labeled as *Restricted Use Pesticides* or RUPs. Other hazards of pesticide use include possible *phytotoxicity* to trees, foliage and/or crop. Phytotoxicity describes the deficient condition of a plant due to the toxic effect of a compound. Certain combinations of pesticides or overlapping applications of incompatible materials can cause severe damage. The chemistry of the pesticide as it relates to the development of pest resistance should be considered. Resistance develops because one or more individuals in any given pest population may tolerate or resist effects of exposure to a specific pesticide active ingredient. When used consecutively for several applications, the offspring of resistant individuals multiply to eventually establish a resistant population. Consequently, management decisions need to consider the class of product along with product efficacy when selecting pesticides. In general, repeated use of any pesticide should be avoided. Preventive applications are likely to control the target pest effectively while minimizing economic costs and environmental effects. Pesticide detections in water are of concern because of their potential toxicity to non-target plant, invertebrate, fish, and wildlife species. Lastly, always follow directions on the label. These directions have been developed after extensive research and field studies on the chemistry, biological effects, and environmental fate of the pesticide.

The label is the single most important document in the correct use of a pesticide, and state and federal pesticide laws require strict adherence to label directions.

Pesticide Record Keeping and Licensure Requirements

Proper records of all pesticide applications should be kept according to state and federal requirements. These records help to establish proof of proper use, facilitate the comparison of results of different applications, or find the cause of an error. Sample record keeping forms can be found at the FDACS Bureau of Compliance Monitoring at: <http://www.flaes.org/complimonitoring/pesticidecertification.html>.

Certain pesticides are classified as RUPs. The Florida pesticide law requires (licensed) applicators to keep records of all RUP use. Florida regulations require that information on RUPs be recorded within 2 working days of the application and maintained for two years from the application date.

Other Important Information

There are many other important issues involving pesticide use that deal with storage, calibration, mixing and loading, and spill management. For additional information, refer to *Best Management Practices for Agrichemicals and Farm Equipment Maintenance* at: <http://www.floridaagwaterpolicy.com/BestManagementPractices.html>

Hazardous Waste Management

There are many materials on a farm that can be considered as hazardous waste. The purpose of this section is to familiarize agricultural operations about BMPs and pollution prevention actions that can be implemented to reduce the risk of contaminating ground or surface water. Always be sure to check with state and local governments for rules dealing with safe removal and contamination prevention of hazardous waste because they are sometimes more stringent. The following section provides removal and contamination information on solvents, degreasers, oil, anti-freeze, batteries, gasoline, diesel fuel, and other general cleaning materials.

One of the key principles of pollution prevention is to reduce unnecessary use of potential pollutants. Over time, the routine discharge of even small amounts of solvents can result in serious environmental consequences due to the accumulation in soil or ground water. As little as 25 gallons per month of used solvent disposal can qualify you as a “small quantity generator” of hazardous waste, triggering *EPA* and FDEP reporting requirements. Whenever practical, replace solvent baths with recirculating aqueous washing units (which resemble heavy duty dishwashers). Blowing off equipment with compressed air instead of washing with water is often easier on hydraulic seals and can lead to fewer oil leaks. For more information on “small quantity generators” contact FDEP.

Solvents and Degreasers

Store solvents and degreasers in lockable metal cabinets in an area away from ignition sources and provide adequate ventilation. Keep basins or cans of solvents covered to reduce volatile organic compound (VOC) emissions and fire hazards. Keep an inventory of the solvents stored and the material safety data sheets (*MSDS*) on the premises. Emergency response equipment recommended by the manufacturer of the solvent should be in a place easily accessible and near the storage area. For displays, follow Occupational Safety and Health Administration (OSHA) signage requirements.

Always wear the appropriate personal protective equipment (PPE), especially eye protection, when working with solvents. Never allow solvents to drain onto pavement or soil, or discharge into water bodies, wetlands, storm drains, sewers or septic systems, even in small amounts. Solvents and degreasers should be used over a collection basin or pad that can collect all used material. Store the collected material in marked containers until it can be recycled or legally disposed. In the Southeastern Region of the country is the Southern Waste Information Exchange. This alternative can help reduce waste management costs. For more information contact the Southern Waste Information Exchange at 1-800-441-7949 or visit www.wastexchange.org.

Oil, Antifreeze, and Lead-Acid Batteries

In Florida, recycling is the only legal option for handling used oil. Collect used oil, oil filters, and antifreeze in separate marked containers and recycle. Oil filters should be drained and taken to a collection site. Antifreeze must be recycled or disposed as a

hazardous waste and commercial services are available to collect this material. Do not mix used oil with used antifreeze or sludge from used solvents.

Lead-acid batteries are classified as hazardous wastes unless they are recycled. All lead-acid battery retailers are required by law to accept returned batteries for recycling. Used acid from these batteries contains high levels of lead and must be disposed as hazardous waste, unless the acid is contained within a battery being recycled. Batteries should be stored on an impervious surface and under cover. Remember, used lead-acid batteries must be recycled to be exempt from strict hazardous waste regulations. For more information on lead-acid battery disposal please refer to the FDEP's website, <http://www.dep.state.fl.us/waste/categories/batteries/default.htm>.

Gasoline and Diesel Fuel

Design and manage fuel dispensing areas to prevent soil and water contamination. Place fuel pumps on concrete or asphalt surfaces. Fuel pumps with automatic shut off mechanisms reduce the potential for overflow and spillage during fueling. Do not locate the pumps where a spill or leak would cause fuel to flow onto the ground or into a storm drain or surface water body. Stationary fuel storage tanks should be in compliance with FDEP storage tank regulations (Chapter 62-761, F.A.C.).

While containment is not usually required for smaller tanks, it is still a good practice. Where permitted by local fire code, secondary containment structures should be roofed to keep out rainfall. Building the containment structure so that it is tall rather than wide will help minimize rainfall accumulation by reducing the exposed surface area. If the structure is not roofed, water that accumulates must be managed properly. The best option is to remove the water with a portable sump pump. If the containment structure has a discharge port (not recommended) make certain that it is closed and locked except when uncontaminated rain water is to be drained. If a discharge port is used, a spring loaded valve is the best method to prevent the port from being inadvertently left open. For rainfall, if the containment volume is adequate, evaporation of accumulated rainfall will often be sufficient. Critical levels at which discharge is considered should be established for each facility and the levels marked on the inside containment wall.

Treat contaminated water on-site using commercially available treatment systems, discharge to a FDEP permitted off-site industrial wastewater treatment system, or transport to a treatment facility. Never discharge to a sewer system without written permission from the utility and never discharge to a septic tank. If the water is not contaminated, it can be reused as *diluent*, or discharged to a permitted stormwater treatment system, such as a retention area, grassed swale, or wet detention pond, although this practice is not encouraged. Do not discharge it during or immediately after a rain storm, since the added flow may cause the permitted storage volume of the stormwater system to be exceeded. Call the nearest FDEP District office for information on these requirements.

BMPs for General Equipment Cleaning

Clippings and dust removed from machinery should be handled separately from other waste materials and equipment washwater. Many manufacturers now recommend the use of compressed air to blow off equipment. This is less harmful to the equipment's hydraulic seals, eliminates washwater, and produces dry material that is easy to handle. Wash equipment over a concrete or asphalt pad that allows water to be collected, or to run off onto grass or soil, but not into a surface water body or canal. After the residue dries on the pad, it can be collected and composted or spread in the field. To keep crop residue and other debris from becoming contaminated with pesticide, do not conduct such operations on a pesticide mixing and loading pad.

Minimize the use of detergents. Use only biodegradable non-phosphate detergents. The amount of water used to clean equipment can be minimized by using spray nozzles that generate high pressure streams of water at low volumes. Washwater generated from the general washing of equipment, other than pesticide application equipment, may not have to be collected. This washwater must not, however, be discharged to surface or ground water either directly or through ditches, storm drains or canals. Always check with local authorities to determine whether other requirements may apply. Equipment washwater can contain soaps, fertilizer residues, solids, and lubricating oil residues. BMPs for disposal of washwater (from other than pesticide application equipment, and with no degreasers or solvents) depend on several factors, such as volume of washwater generated, nature of the surrounding area, and the frequency of the operations. For regular washdown of ordinary field equipment, allow the washwater to flow to a grassed retention area or swale. Any discharge to a surface water body may require a FDEP industrial wastewater permit. Discharge to a septic system is not legal.

If you decide to use a washwater recycling system, care must be taken to operate it properly. Cleaning of pesticide application equipment using these systems is not recommended. The introduction of pesticide residues into these systems may result in contamination of the systems and high costs for disposal of contaminated filters and sludges as hazardous wastes.

BMP SELECTION AND IMPLEMENTATION

This manual contains Level I BMPs that are largely applicable to all growers, and Level II and III BMPs that will apply under specific circumstances. The manual includes a self-assessment tool to help growers determine which Level II and III BMPs are applicable to their operation.

The selection of BMPs begins with a basic inventory of the farm's natural features, which will help you determine how the operation of your farm may affect environmentally sensitive areas. When developing the inventory, sketch your farm/facility, noting buildings, production areas, electrical and plumbing lines, and water sources. Identify areas of particular concern that need to be addressed. These include streams, wetlands, springs, sinkholes, and poorly drained ponded areas. You can use this list of concerns in selecting which BMPs in the next chapter are applicable to your farm.

To help you conduct your inventory effectively, the following tools are available:

- Aerial photographs (<http://earth.google.com/index.html>, or other providers)
- USDA-NRCS soil survey maps (<http://websoilsurvey.nrcs.usda.gov/app/>)
- *USGS topographic maps* (<http://www.topozone.com/find.asp>)
- FEMA floodplain maps (<http://www.fema.gov/hazard/map/firm.shtm>)
- National Wetlands Inventory (<http://wetlandsfws.er.usgs.gov/NWI/index.html>)
- Historic rainfall records (<http://www.ncdc.noaa.gov/oa/ncdc.html>)
- Local tax maps from property appraiser (<http://www.propertyappraiser.com/>)

It is advisable to consolidate your inventory and all your BMP decision-making, including the BMP Checklist, into a simple implementation plan. This plan will serve as a record of scheduled and completed BMPs, including operation and maintenance activities. A well thought-out, written plan enables managers and owners to schedule their activities and accomplish their objectives.

BMP Identification and Selection

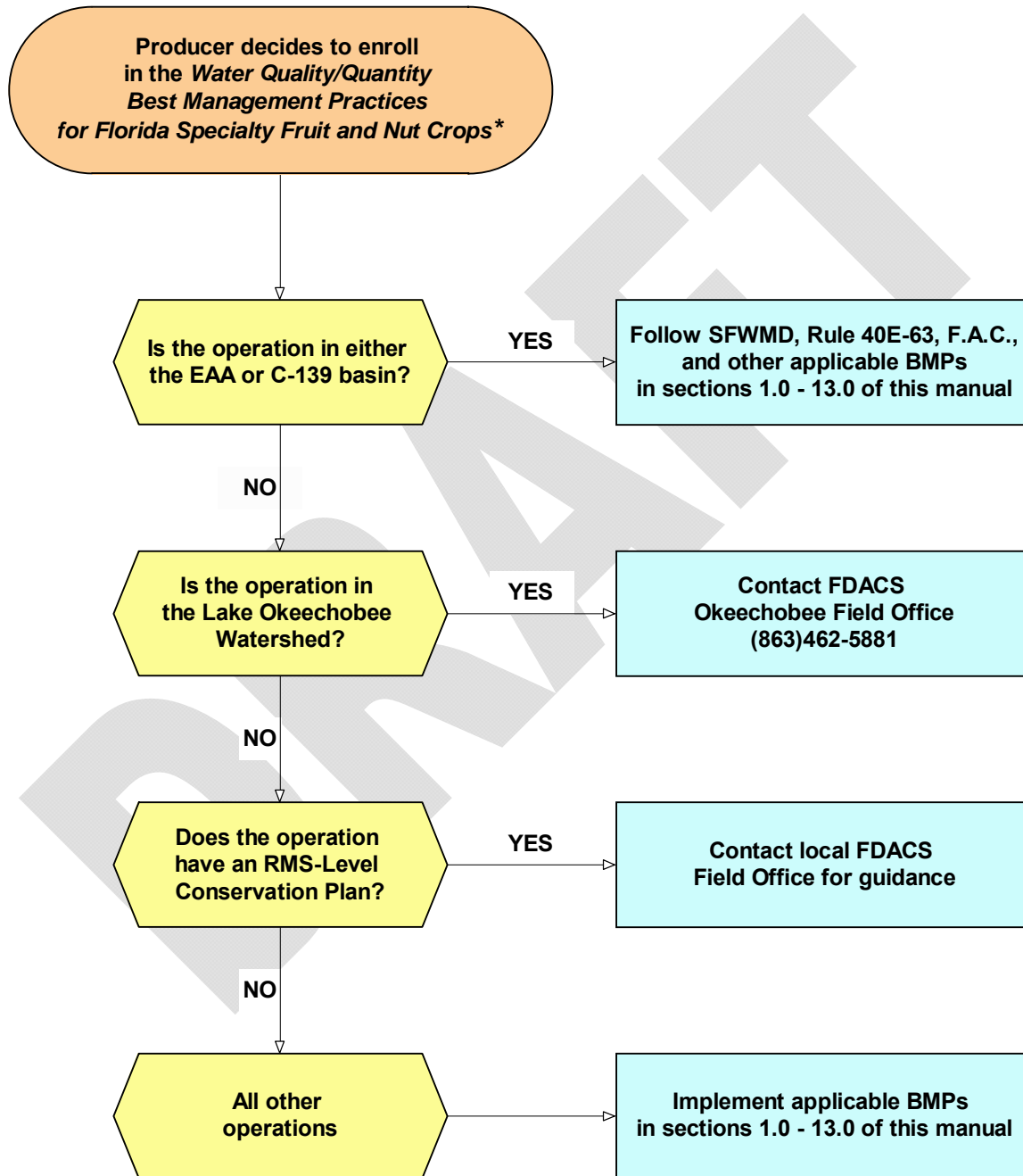
Proper identification and selection of BMPs involves the following steps:

- Use the decision-tree to determine special situations that may apply
- Choose the applicable practices from the "Level I" set of BMPs and implement them within the first 12 months
- Complete the *Advanced-Level BMP Needs Assessment* to determine whether Level II and III BMPs are applicable to your operation, or whether you need or would like to develop a Conservation Plan
- Request on-farm technical assistance, as needed

FDACS has co-located field staff positions in all five water management districts to assist agriculture producers in BMP enrollment and implementation.

Decision-Tree

Growers should use the BMP Decision-Tree below to help make all key decisions related to the use of this manual. This tool is intended to be used like a standard flow chart, in that users start at the top and work their way through all “decision steps” until an endpoint is reached. The decision-tree addresses special considerations that may apply to your operation, and also provides an awareness of other regulatory requirements.



***Note:** If operation is in an area where a BMAP has been adopted, producer must implement BMPs for all applicable commodities or monitor water quality. Contact FDACS Field Office for more information.

Level I BMPs

All growers shall implement the applicable **Level I BMPs**, contained in the next chapter, to establish a foundation for environmental protection. Use the checklist in Appendix 7 to identify the BMPs that are applicable to your operation. Depending on the site-specific conditions or geographical location of the farm, not all of the Level I BMPs may be applicable to every site.

Advanced-Level BMPs

Growers may have to implement additional BMPs based on their “score” after completing the *Advanced-Level BMP Needs Assessment*. The assessment identifies water quality risk features that require special attention or protection, and also identifies specific groups of BMPs that address these issues. These **Level II and III BMPs** focus on erosion control and drainage and address the need for grade stabilization structures for sediment control.

Conservation Plans

Conservation Planning is a natural resource problem-solving and management process, with the goal of sustaining natural resources for future generations. A well-written Conservation Plan incorporates the goals and objectives of the landowner along with associated natural resource concerns. The plan includes strategies to maintain or improve yields, while also protecting soil, water, air, plant, animal, and human resources. Usually, Conservation Plans address all of the major activities on the farm, but can be developed to target specific concerns. Practices included in a Conservation Plan are designed in accordance with the USDA-NRCS **FOTG**, and cannot be developed without technical assistance. Because all BMPs in this manual are not contained in the FOTG, Conservation Plans must also include the applicable Level I, II, and III BMPs.

Conservation Plans can also be developed in an area that crosses land boundaries in order to adequately address resource concerns. This collective decision making benefits all parties involved in achieving natural resource management goals. Assistance in developing a plan can be obtained through the local **SWCD**, the USDA-NRCS, the Cooperative Extension Service, and private consultants who function as technical service providers. However, the decisions included in the Conservation Plan are the responsibility of the owner or manager of the farm.


Required Documentation

Notice of Intent to Implement BMPs

The Notice of Intent to Implement form or **NOI** (Appendix 7) contains a checklist of all BMPs contained in the manual, on which you must identify all the BMPs applicable to your operation that are technically and economically feasible for you to implement. If you are developing a Conservation Plan, these will be part of the plan. There is space provided at the end of the checklist for you to list any additional BMPs contained in the plan.

Once received by FDACS, the Notice of Intent formally enrolls your operation under the BMP program. Implementation of the BMPs according to the NOI schedule provides a presumption of compliance with state water quality standards. Implementation includes ongoing maintenance of the BMPs.

Record Keeping

FDACS rule requires record keeping to document BMP implementation. Growers must keep accurate written records and retain them for at least five years. Fertilizer applications and rainfall amounts are two types of record keeping. Other record keeping requirements in the manual are highlighted using this figure.  All BMP records should be clear and logically structured. You may develop your own record keeping form or use the one provided in Appendix 6.

BMP Implementation and Follow-Up

Growers are ultimately responsible for implementing the BMPs submitted on their NOIs. Growers should use on-farm technical assistance if self-implementation of BMPs is problematic. FDACS, *UF-IFAS* BMP Implementation Teams, Soil and Water Conservation Districts (SWCD), USDA-NRCS and/or UF-IFAS Extension staff are available to assist growers with the mechanics of BMP identification, selection and implementation.

Quality Assurance

FDACS has developed a BMP “quality assurance” program to ensure that BMPs are being properly implemented, operated, and maintained. On a staggered schedule by commodity, FDACS will mail surveys to all BMP program participants and conduct site visits on selected operations. The benefits of this effort include:

- Demonstrating the level of producer compliance with BMPs.
- Identifying needs for additional education and implementation assistance for producers.
- Reinforcing to producers the importance of BMP implementation.
- Updating FDACS NOI records.

BEST MANAGEMENT PRACTICES

Note: All BMPs that follow are Level I BMPs unless otherwise noted. You must complete the Advanced-Level BMP Needs Assessment on page _____ to determine the applicability of Level II BMPs and/or Level III BMPs.

1.0 NUTRIENT MANAGEMENT

Insert Image of Fertigation

Modern fertility programs are complex in nature, resulting from the interaction of many factors. One important factor is fertilizer cost, which comprises an increasingly large portion of the total production expense. Because of this and the potential for nutrient-related adverse environmental effects on water resources, growers must understand the specific crop nutrient requirement (CNR) for their particular variety of specialty fruits and nuts and must also fertilize wisely using scientific principles.

One of the first steps in developing a sound fertilization management program involves a basic knowledge of soils. Many of Florida's soils naturally contain the required amount of phosphorus, assuming the pH levels are within the range to make this nutrient available. As such, routine soil testing and analysis is considered to be a cornerstone of any nutrient management program. Nitrogen, which is not analyzed as part of a routine soil test, is a critically important macronutrient for vegetative growth. Plant tissue testing, which can detect plant nitrogen levels, can be used in conjunction with soil testing to diagnose the overall effectiveness of a fertilization program. Tissue testing is especially useful to help a grower fine-tune their fertilizer application program.

Working Definition:

Nutrient management is the judicious application of fertilizers to meet the crop nutrient requirement without adding excess nutrients that may cause water quality problems.

1.1 Soil and Tissue Testing

Refer to Appendix 4 for important information on soil and tissue sampling.


- √ 1. Use a soil test from a lab that uses the Mehlich-1 or another method approved by the UF-IFAS Extension Soils Testing Laboratory.
- √ 2. Use tissue testing to diagnose the effectiveness of a fertilization program and to determine the need for supplemental applications.

 Maintain records of all soil and tissue test results and sample locations.

1.2 Standard Fertilization Practices

- √ 1. Know the CNR for N, P, and K as specified in IFAS fertilization recommendations or other credible research and target this amount for total crop fertilization.
- √ 2. Calibrate fertilizer application equipment. To the extent practicable, match the fertilizer bulk density to the equipment for maximum distribution uniformity.
- √ 3. When applying soluble fertilizers, use smaller, more frequent (split) applications to minimize the potential for leaching, and only apply when plants are actively growing.

- √ 4. When possible, locate fertilizer loading activities away from ground water wells, ditches, canals, wetlands, sinkholes, and other sensitive areas. Follow recommended buffer practices around these areas to prevent contamination and protect water quality.
- √ 5. Only apply a supplemental application of N and/or K, if needed, when rainfall exceeds 3 inches in 3 days, or 4 inches in 7 days, or when the results of a tissue analysis fall below the standard sufficiency ranges.

 Maintain records of the amount and types of fertilizer used per application.

1.3 Fertigation Requirements

- √ 1. Test irrigation water for constituents that may interact with fertilizers and/or chemically precipitate to plug the irrigation system emitters.
- √ 2. Calibrate the injection system while the irrigation system is operating, since operating pressures and flow characteristics will influence the injection rate.
- √ 3. Use highly water soluble fertilizer sources and inject fertilizer on a daily or weekly basis depending on the fertilization and irrigation schedule.
- √ 4. Contact an area Mobile Irrigation Lab to schedule an irrigation evaluation since fertigation efficiency is dependent on irrigation system application uniformity.

1.4 Special Fertilizer Application BMPs

- √ 1. Apply micronutrients only when a specific deficiency has been clearly diagnosed. Use foliar applications of micronutrients, including Fe, Mn, and B, especially on calcareous soils that tend to fix micronutrients in unavailable forms.
- √ 2. Obtain a soil survey and identify whether the soil series in the table below exist on your property. These soils are very prone to leaching P and are more common in areas of Central and South Florida.

Common <i>Uncoated Soils</i>			
Archbold	EauGallie	Myakka	Ridgeland
Allanton	Eglin	Narcoosee	Satellite
Ankona	Estero	Nettles	St. Lucie
Basinger	Hallandale	Oldsmar	Smyrna
Broward	Hobe	Palm Beach	Valkaria
Canaveral	Immokalee	Pepper	Wabasso
Dade	Jonathan	Pomello	Wauchula
Deland	Lawnwood	Pomona	Waveland
Duette	Leon	Pompano	Zolfo

- √ 3. Use controlled-release fertilizer and incorporate it into the soil when planting young trees, and continue this for a period of 3 years.

1.5 Other Fertilizer Sources

- √ 1. If using reclaimed water, adjust nitrogen and phosphorous fertilization rates as appropriate, and follow all food safety requirements.
- √ 2. If using composted manure, treated domestic wastewater residuals, or other biosolids, analyze these products before using them to determine their nutrient concentrations.

Operation and Maintenance:

- Store nitrogen-based fertilizers separately in a secure building away from solvents, fuels and pesticides. Many fertilizers are oxidants and can accelerate a fire.
- Excessive irrigation can result in fertilizer leaching. Remember that fertilizer and water management programs are linked. Maximum fertilizer efficiency is achieved only with close attention to water management.

Key References:

- (1) UF/IFAS Standardized Fertilization Recommendations for Agronomic Crops, <http://edis.ifas.ufl.edu/SS163>
- (2) Agronomic Crops and Forages, http://jefferson.ifas.ufl.edu/ag_pages/cropspage.htm
- (3) UF/IFAS Agronomy Department, <http://agronomy.ifas.ufl.edu/AGPUBS.HTML>
- (4) Fertilization of Agronomic Crops, <http://edis.ifas.ufl.edu/AA130>
- (5) Soil and Plant Nutrition, <http://edis.ifas.ufl.edu/MG091>
- (6) Use of Controlled-Release Fertilizers for Young Citrus Trees; UF-IFAS, Mongi Zekri and R.C.J. Koo
- (8) USDA-NRCS Conservation Practice Standard, Code 590, Nutrient Management

2.0 IRRIGATION MANAGEMENT

Insert Image of Soil Moisture Probe

Most specialty fruit and nut growers use drip or micro-sprinkler as their primary means of irrigation. Regardless of irrigation type, the system should be well-maintained and operated at the highest practicable level of irrigation efficiency and uniformity. Without proper maintenance, system efficiency and uniformity tend to decrease over time because of aging, weathering, and component breakdown. The goal of irrigation management is to maintain and maximize system performance and improve efficiency through irrigation scheduling.

Maintenance programs vary according to the type of irrigation system. For example, maintenance of flood or seepage systems may be limited to a pre-season operational check of pump stations and ditches. Maintenance programs for pressurized pipe systems generally involve filtration, chlorination/acidification, flushing, repair or replacement of clogged emitters, and observation. Ultimately, irrigation systems that are managed efficiently help ensure crop uniformity, conserve water, and reduce operation and maintenance costs.

Irrigation scheduling consists of a collection of technical procedures developed to forecast the timing and amount of irrigation events. Often, irrigation scheduling also relies on local experience and other site-specific factors resulting from water delivery and irrigation system infrastructure. Technical approaches to irrigation scheduling are complex because they require an understanding of many factors, including: crop water needs, soil types, climate, irrigation method(s), management objectives, and regulatory constraints. All irrigation scheduling methods are ultimately based on one of two approaches:

1. Monitoring soil and/or plant water status, or
2. Determining a water budget that forecasts irrigation scheduling events based on climatic conditions and estimated water depletion in the root zone.

In many instances, using non-technical approaches such as the “feel and appearance” method may result in reduced yields because of crop water deficits, or nutrient leaching from over-irrigation. Proper irrigation management can significantly improve your chances to positively affect water quality since water is the carrier for most dissolved nutrients of concern in Florida.

Working Definition:

Irrigation management involves maintaining irrigation system components in good working condition, and involves irrigation scheduling to best determine a crop’s irrigation water needs.

2.1 GENERAL IRRIGATION MANAGEMENT

- √ 1. Contact the irrigation system designer or provider to obtain your irrigation system application efficiency, and to obtain the system's design operating pressure and flow.
 - √ 2. Test irrigation water quality at least once each year, since changes in water chemistry can affect maintenance requirements and frequency.
 - √ 3. Inspect sprinkler heads and orifices for wear and malfunction and replace as necessary.
 - √ 4. Clean and maintain pump and filtration equipment, so that the system operates at the optimum pressure ranges as recommended by the manufacturer.
- Establish a documented maintenance schedule that includes inspection of the backflow prevention device and other mechanical components, pump and power unit and irrigation lines. Keep written records of flow rates, pressure, and energy consumption of the power unit.

2.2 MICRO-IRRIGATION SYSTEMS MAINTENANCE

- √ 1. Use filters that are compatible with the type of irrigation system.
- √ 2. Use chlorine or scale inhibitors, such as chelating and sequestering agents, to prevent plugging. Chlorination is the most common method for treating bacterial slimes and should be done prior to filtration. A regular maintenance program of inspection and flushing will help significantly in preventing emitter plugging.
- √ 3. Flush the irrigation system by opening the end of each lateral, or by using automatic flushing end-caps on the laterals.

2.3 IRRIGATION SCHEDULING

- √ 1. Monitor the available soil moisture content as part of the crop's water needs. Use tensiometers, capacitance sensors or electrical-resistance gypsum blocks, or other soil moisture sensor devices to obtain soil moisture.
 - √ 2. Minimize application losses due to evaporation and wind drift by irrigating early in the morning or late in the afternoon, or when cloud cover is significant and wind speed is minimal.
 - √ 3. Keep irrigation events smaller than the amount of water that can be stored in the root zone. When irrigation needs are greater (during long, warm days when the crop is near harvest), irrigation application should be split into 2 or 3 daily applications.
 - √ 4. Use totalizing water meters or equivalent measuring devices to determine how much water is actually applied to an irrigated area of predetermined size.
- Keep records of irrigation amounts applied and total rainfall received.

2.4 WATER CONSERVATION

- √ 1. Contact the Mobile Irrigation Lab to have an evaluation of the irrigation system. MIL services are available free of charge and provide an irrigation system

evaluation with recommendations regarding system upgrades, irrigation scheduling, and other management and scheduling items. See Appendix 2 for contact information for the MIL closest to your location.

- √ 2. Use proven methodologies, such as historical evapotranspiration values, class A pan evaporation, and/or computer-model assisted irrigation scheduling to fine tune irrigation events.

Operation and Maintenance:

- A uniformity of 80% or greater is recommended before fertilizer injection through a microirrigation system.
- Monitor water quality regularly or retrieve data from other agencies that monitor water quality. Water used in microirrigation systems should be tested for hardness (calcium carbonate), hydrogen sulfide, iron and manganese, pH, and TDS, to prevent clogging. In addition, surface water used in microirrigation systems should be tested for organic material.
- If your soils are conducive, consider performing a dye test to determine the actual wetting zone and water holding capacity of the soil where the root zone is.

Key References:

- (1) Causes and Prevention of Emitter Plugging in Microirrigation systems, <http://edis.ifas.ufl.edu/AE032>
- (2) Efficiencies of Florida Agricultural Irrigation Systems, <http://edis.ifas.ufl.edu/AE110>
- (3) IFAS Extension Bulletin 217, <http://edis.ifas.ufl.edu>
- (4) IFAS Extension Bulletin 248, Backflow Requirements When Using Public Water Supplies, <http://edis.ifas.ufl.edu/>
- (5) Agricultural Engineering Fact Sheet AE-73, Potential Impacts of Improper Irrigation System Design, <http://edis.ifas.ufl.edu/>
- (6) Design of Agricultural Irrigation Systems in Florida, <http://edis.ifas.ufl.edu/AE064>
- (7) Microirrigation on Mulched Bed Systems: Components, System Capacities, and Management, <http://edis.ifas.ufl.edu/AE042>
- (8) NRCS Conservation Standard, Irrigation System (Sprinkler), Code 442 and Well Decommissioning, Code 351, <http://www.nrcs.usda.gov/>
- (9) ASAE Standard Practice No.: S395, S436.1, S447, and EP458.
- (10) Irrigation Scheduling for Water & Energy Conservation in the 80's, ASAE Publ.23-81, Am. soc. Agric. Engr., St. Joseph, MI.
- (11) Irrigation Scheduling with Evaporation Pans, <http://edis.ifas.ufl.edu/AE118>
- (12) Field Evaluation of Microirrigation Water Application Uniformity, <http://edis.ifas.ufl.edu/AE094>
- (13) Tensiometers for Soil Moisture Measurement and Irrigation Scheduling <http://edis.ifas.ufl.edu/AE146>
- (14) Tensiometer Service, Testing and Calibration, <http://edis.ifas.ufl.edu/AE086>
- (15) FAO 56 - Crop Evapotranspiration, Food and Agricultural Organization, www.wcc.nrcs.usda.gov/nrcsirrigh/Handbooks_Manuals/handbooks_manuals.html or www.fao.org/icatalog/inter-e.htm
- (16) USDA - NRCS Practice, Irrigation Water Management, Code 449

- <http://www.nrcs.usda.gov/>
(17) ASCE, Evaporation and Irrigation Water Requirements, www.pubs.asce.org/

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3.0 SEDIMENT AND EROSION CONTROL MEASURES

Insert Image of properly installed silt fence

Some farm practices may inadvertently affect the quality of water discharged off-site. Removal of natural vegetation and topsoil increases the potential for soil erosion, which can change runoff characteristics and result in loss of soil and increased turbidity and sedimentation in waterbodies. Sediments along with *sorbed* nutrients and pesticides may be carried in runoff, and can negatively affect adjacent surface waters.

The first step in preventing erosion and sediment transport is to limit the amount of land that is cleared of vegetation. When clearing vegetation to develop crop areas, re-vegetation should occur as quickly as possible to limit erosion. Whenever possible, land clearing activities should be planned and conducted during the dry season. The second step in preventing erosion and sediment transport involves the use of BMPs. Examples of sediment and erosion control BMPs are discussed below; however, keep in mind that installing these may require technical assistance.

The use of more common erosion-control devices (e.g., vegetation, mulch, land leveling) and sediment control devices (e.g., silt fences, check dams, sediment traps) should be employed progressively. This means that whenever growers are conducting activities that create a significant risk to water resources, they should use the most appropriate BMPs based on site-specific conditions. Consider using more passive, erosion control devices first in order to prevent sediment transport. Afterwards, assuming more protection is needed, sediment control devices can be used to capture sediment-laden water and allow enough time for larger particles to settle out. By following these practices, growers can prevent erosion and sedimentation impacts, which will not only protect the water resources but also will ensure long-term productivity of agricultural farmland.

Working Definition:

Sediment and erosion control measures are permanent or temporary practices to prevent sediment loss from fields, *attenuate* water flow, and/or trap and collect debris and sediments in runoff water.

3.1 GENERAL EROSION AND SEDIMENT CONTROL MEASURES

- √ 1. Minimize the amount of vegetation that is cleared when doing construction work.
- √ 2. Conduct land clearing activities during the dry season, when feasible.
- √ 3. Vegetate new road banks and other disturbed areas within 14 days of construction. As an alternative to seeding, consider using bermudagrass plugs, sprigs, or sod.
- √ 4. Use rock crossings when constructing roads across streams and creeks that have low-flow conditions.

3.2 SILT FENCES

- √ 1. Use silt fences when protection is needed for 3 months or less. They are especially useful under *sheet-flow* conditions and do not work in channelized flow conditions. They should be used during construction activities and installed at property boundary lines when a discrete point of discharge exists.
- √ 2. Install silt fences below disturbed areas and install them perpendicular to the direction of water flow. Trench in, backfill and compact silt screens in accordance with the Florida Erosion and Sediment Control Inspector's Manual referenced below.

Note: *Do the Advanced-Level BMP Needs Assessment to determine whether to implement the BMPs below.*

3.3 LEVEL II - CHECK DAMS

- √ 1. Install check dams in drainage ditches that have defined flow and experience recurring sedimentation problems. Install them downstream from the disturbed area, perpendicular to the direction of flow. These devices can be created using a variety of materials such as rock, rip rap, or sand bags. Check dams should be spaced so that the bottom of the uphill dam is the same height as the top of the downstream dam.

3.4 LEVEL II – SEDIMENT TRAPS

- √ 1. Install sediment traps within the water conveyance system when recurring sedimentation problems occur.
- √ 2. Retrofit water control structures associated with sediment traps with flashboard risers.

Operation and Maintenance:

- Remove any sediment deposits on screens when they reach one half the height of the barrier.
- Keep heavy equipment off of newly vegetated areas until they are established.
- Consider reusing captured water for routine irrigation needs, so long as water volumes and quality warrant.

Key References:

- (1) USDA-NRCS Sediment Basin, Code 350, Water and Sediment Control Basin Code 638, Structure for Water Control Code 587, FOTG-Section IV
<http://www.nrcs.usda.gov/technical/efotg>
- (2) Farming for Clean Water in South Carolina: A Handbook of Conservation Practices <http://www.epa.gov/owow/nps/bestnpsdocs.html#agriculture>
- (3) The Florida Erosion and Sediment Control Inspector's Manual
http://www.dep.state.fl.us/water/nonpoint/ero_man.htm
- (4) USDA Planning and Design Manual for the Control of Erosion, Sediment, and Stormwater <http://www.abe.msstate.edu/Tools/csd/p-dm/index.php>

4.0 SITE SELECTION AND PREPARATION

Insert Image of Land Leveling

Proper site selection and preparation are extremely important in successfully establishing fruit and nut crops. Eliminating potential problems before planting can lower inputs; thereby reducing pollutant loading in the environment and production costs. Site selection and preparation can vary between regions of the state depending on soil conditions, topography, and weather. Sites should be selected based on previous agricultural use, drainage characteristics, flooding history, residual pest populations, and whether or not the planting medium (soils) is suited to the commodity. Site preparation for fruit and/or nut crops is dependent on the site selected. When preparing the site, growers should utilize tools such as soil test, fumigation, soil amendments, proper bedding, and land leveling. Use the BMPs below to address general site preparation, bed preparation, and land leveling practices that may be appropriate based on the particulars of your site.

Working Definition:

Site preparation involves practices that consider and alter the layout and native conditions found at the selected site, in order to minimize impacts while maintaining an efficient production system.

4.1 GENERAL SITE PREPARATION GUIDELINES

- √ 1. Choose a site that has good air circulation, but also has adequate windbreaks to control pest and disease vectors.
- √ 2. Design production area layout to maintain a buffer area between crops and environmentally sensitive areas.
- √ 3. Follow proper spacing requirements per fruit and nut crop. Contact your local Cooperative Extension agent for more information on specific crop spacing.
- √ 4. Follow state and local regulations for sterilization of the soil to control soilborne diseases and pests, such as nematodes.

 Maintain records of production area layout.

4.2 BED PREPARATION

- √ 1. Adjust fertilizer and irrigation application amounts as bedding material ages resulting in reduced nutrient and water holding capacity.
- √ 2. Limit bed height to the minimum needed for production of the commodity in order to prevent excess nutrient loss, when applicable. Contact your Cooperative Extension Agent for crop specific information.
- √ 3. Manage soil amendments, such as pH-adjusting materials and organic matter, and incorporate this into your nutrient management plan and water conservation strategies.

■ Maintain records of decomposition rate and age of bedding materials.

4.3 LAND LEVELING

- √ 1. Develop a plan for land leveling with consultation from a public or private engineer to discuss your specific needs and considerations.
- √ 2. If possible, utilize laser technology and deposit *spoil* material in an upland location. You may also consider material reuse on the field.
- √ 3. Follow appropriate plans and grades as specified during land leveling operations.
- √ 4. Balance cut and fill amount for most efficient use of local materials.
- √ 5. Carry out land level activities during the dry season to minimize sedimentation and erosion effects.

■ Maintain records of current design grades.

Operation and Maintenance:

- Reseed buffer areas, as needed, between crops and environmentally sensitive features to prevent erosion and improve water quality.
- When utilizing land leveling, periodic grading or floating may be needed to eliminate mounds or depressions that form.

Key References:

- (1) Water and Environmental Considerations for the Design and Development of Citrus Groves, <http://edis.ifas.ufl.edu/CH163>
- (2) Deciduous and Tropical/Subtropical Fruits; Jeffrey Williamson and Jonathan Crane, UF/IFAS Publication 2007
- (3) USDA-NRCS FOTG Practice No. 462 and 464

5.0 INTEGRATED PEST MANAGEMENT

Insert Image of scouting activity

Integrated pest management (IPM) is a philosophy of managing pests that aims to reduce farm expenses, conserve energy, and protect the environment. IPM does not mean that pesticides will be excluded. Instead, it means that pesticides are just one of many tools used to manage pests; however, pesticides should be used judiciously and only when needed. The goals of an IPM program are improved control of pests, more efficient pesticide management, more economical fruit and nut protection, and reduction of potential hazards to humans and the environment through reduced pesticide exposure.

IPM accomplishes these goals through the use of resistant plant species, improved cultural practices, biological control agents (parasitoids, predators), and selective use of pesticides. Although detailed IPM programs have not been developed for all types of cropping systems, IPM principles can be applied in many cases using applied science and logic. Finally, it is important to predict economic losses and risks so the cost of various treatments can be compared to the potential losses.

Working Definition:

IPM is a broad, interdisciplinary approach to pest management using a variety of methods to systematically control pests which adversely affect specialty fruit and nut crop production and quality.


Planning Steps for an IPM Program

- √ 1. Identify key pests and beneficial organisms, their life cycles, and factors affecting their populations.
- √ 2. Select preventive cultural practices to minimize pests and enhance biological control strategies. These practices may include soil preparation, crop rotation, resistant species, proper field sanitation, disposal of diseased fruits (mummies), modified irrigation methods, and augmenting beneficial insects.
- √ 3. Develop biological and economic action thresholds to determine the appropriate IPM course of action.

Specific IPM Practices

- √ 1. Routinely monitor or scout fields, borders, and adjacent vegetation for pests and disease activity.
- √ 2. Conduct scouting at the appropriate time of the day and year to better observe pest *signs* and *symptoms*.
- √ 3. Select pesticides that will control target pests and use them responsibly because they can also harm beneficial insects. Rotate the use of insecticide and fungicide classes to delay resistance development. Consider the use of other alternative practices such as dormant oils on deciduous fruit trees.

- √ 4. Evaluate the feasibility of spraying certain pesticides at night to protect day-active (diurnal) beneficial insects.
- √ 5. Choose a chemical compound that has lower toxicity to aquatic organisms when applying a pesticide close to a stream, canal, pond or other sensitive site and observe appropriate buffer requirements.
- √ 6. Coordinate pesticide applications with appropriate soil moisture conditions, weather forecasts, and irrigation scheduling requirements for effective application.
- √ 7. Monitor pest populations to evaluate treatment results.

 Maintain records to measure the effectiveness of IPM strategies.

Mix and Load Activities

- √ 1. Store crop protection products in a well-ventilated roofed concrete or metal structure with a lockable door, and locate this at least 50 feet from other structures and 100 feet from surface waters.
- √ 2. Use portable mix/load stations to reduce the risk of concentrating pesticides resulting from spills. Loading activities should be conducted at random locations in the field with the aid of nurse tanks.
- √ 3. When practical, construct a permanent mix/load facility with an impermeable surface, and locate it away from wells and/or surface waters. Where permanent facilities are not practical, use portable mix/load stations, and randomize field locations with the aid of a nurse tank.
- √ 4. Develop and implement procedures to appropriately rinse, recycle, or dispose of empty crop protection product containers.

Key References:

- (1) Best Management Practices for Agrichemical Handling and Farm Equipment Maintenance by the Florida Department of Agriculture and Consumer Services and the Florida Department of Environmental Protection, <http://www.floridaagwaterpolicy.com/BestManagementPractices.html>
- (2) Integrated Pest Management Program at the University of Florida, <http://ipm.ifas.ufl.edu/>
- (3) USDA Regional Pest Management Centers Information System, <http://www.ipmcenters.org>
- (4) Southern Region Pest Management Center, <http://www.pmcenters.org/southern/>
- (5) Integrated Pest Management in the Southern Region, <http://ipm-www.ento.vt.edu/nipmn/>
- (6) Biocontrol Web Site, <http://cmave.usda.ufl.edu/biocontrol/>
- (7) University of Florida, Entomology and Nematology Department, <http://entnemdept.ifas.ufl.edu/>
- (8) IFAS Circular PI-1, Use Management Practices to Protect Groundwater from Agricultural Pesticides, <http://edis.ifas.ufl.edu/PI001>
- (9) IFAS Circular 1149, Integrated Pest Management Strategies, <http://edis.ifas.ufl.edu/LH080>

- (10) IFAS Pest Control Guide for Turfgrass Managers
http://jefferson.ifas.ufl.edu/ag_pages/2006TurfPestControlGuide.pdf
- (11) NRCS Conservation Practice Standard Nos. 595, 702, 703

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6.0 WELLHEAD PROTECTION

Insert Image of Wellhead

With the majority of Florida's water supply originating from underground sources, or *aquifers*, it is extremely important that growers make every effort to protect source waters. Successful wellhead protection ultimately involves the use of regulations and common-sense measures that address well placement and agricultural practices near wells. For new well construction, the initial focus should be on appropriate well location and sound well-construction practices. For all wells, it is important to conduct management activities near the wellhead that are aimed at reducing the potential for contamination. Wellhead protection is one of the most effective ways of protecting ground water quality and preventing human exposure to accidental contamination.

Working Definition:

Wellhead protection is the establishment of protection zones and safe land use practices around wells to protect source waters from accidental contamination.

6.1 WELL PLANNING AND PROTECTION

- √ 1. Construct new wells up-gradient as far as possible from likely pollutants such as petroleum storage tanks, septic tanks, chemical mixing areas and/or other potential contaminant sources.
- √ 2. Contact your regional water management district to see if the well requires a consumptive use or water use permit. Wells that serve public water systems must also meet the rule requirements of Chapter 62-521, *F.A.C.*
- √ 3. Cap or valve any existing *artesian* (flowing) wells, in accordance with water management district requirements.
- √ 4. For potable wells, exclude storage tanks, septic tanks, and chemical mixing areas within a 75-foot radius of the wellhead.

6.2 WELL CONSTRUCTION AND OPERATION

- √ 1. Use a licensed Florida water well contractor and drill new wells according to local government code and water management district well construction permit requirements.
- √ 2. At a minimum, surround new wells with a concrete slab approximately four (4) inches thick and two (2) feet wide in all directions. Extend the casing above the ground surface a minimum of 12".
- √ 3. Retrofit existing functional wells with a concrete collar and fence to protect them from damage.
- √ 4. Use backflow prevention devices at the wellhead to prevent contamination.

- Maintain records of new well construction or modifications to existing wells. Proper records are important for future reference, in case problems arise with the well.

Operation and Maintenance:

- Try to maintain permanent vegetation within a 75-foot radius around wells.
- Inspect wellheads and pads regularly for leaks or cracks, and make any necessary repairs.

Key References:

- (1) USDA-NRCS Water Well, Code 642, and Diversion, Code 362, FOTG-Section IV
<http://www.nrcs.usda.gov/technical/efotg>
- (2) Farm-A-Syst Program
- (3) SJRWMD Aquifer Protection Program
- (4) FDEP Rule 62-532, F.A.C.

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7.0 WETLANDS AND SPRINGS PROTECTION

Insert Image of Wetland or Spring

Wetlands and springs are important components of Florida's water resources. They often serve as spawning areas and nurseries for many species of fish and wildlife, perform important flood-storage roles, cycle nutrients in runoff water, contribute moisture to the hydrologic cycle, add plant and animal diversity, and offer valuable recreational opportunities for the public.

Wetlands are complex transitional ecosystems that provide a link between aquatic and terrestrial environments. Under Florida Law, "wetlands" are defined as areas that are inundated or saturated by surface water or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soils. Florida wetlands generally include swamps, marshes, bayheads, bogs, cypress domes and strands, sloughs, wet prairies, riverine swamps, hydric seepage slopes, tidal marshes, mangrove swamps and other similar areas. They generally do not include longleaf or slash pine flatwoods with an understory dominated by saw palmetto.

Chapter 62-340, F.A.C., entitled "Delineation of the Landward Extent of Wetlands and Surface Waters" contains the methodology that must be used by all state and local governments in Florida to determine the boundary between wetlands and uplands and other surface waters. The federal government (U.S. Army Corps of Engineers and USDA-NRCS) uses the "1987 Manual" to determine the boundary between uplands and waters of the United States, which includes wetlands in natural areas. The Food Security Act manual is used by USDA-NRCS to determine wetlands on agricultural lands. In most cases, the boundaries determined by both methodologies are the same or very close. Unauthorized impacts to wetlands may jeopardize USDA-NRCS cost-share benefits pursuant to the Food Security Act's Swampbuster provisions.

Springs, spring runs, and associated sinks are unique freshwater systems that emerge from the underlying limestone that is at or near the land surface. Springs are unique natural resource features and deserve special protection. Prior to substantial development in Florida, wetlands and spring systems once covered about half of the state's surface. That area has been greatly reduced, primarily because early water management efforts in Florida focused on draining wetlands to facilitate urban and agricultural lands development.

Working Definition:

Wetlands are defined in the glossary of this manual, and are typically low landform areas with seasonal or permanent standing water that provide wildlife habitat and natural filtration. *Springs* are mostly clear surface waters that are naturally low in nutrients and originate from ground water that emerges to the land surface.

7.1 WETLANDS PROTECTION AND IMPACT AVOIDANCE

- √ 1. Use a county soil survey map to help identify “wetland” or hydric soil types and/or other depressional or frequently flooded areas.
- √ 2. Use preservation, practical design alternatives, or modifications to eliminate or reduce adverse impacts to wetlands and springs. Follow the buffers prescribed below unless you have an existing water management district permit (*ERP*, *MSSW*). In this case, follow the buffers set forth in the permit.
- √ 3. Maintain a minimum 25-foot vegetative buffer exterior to the *landward* extent of all wetlands that meet the state’s delineation methodology.
- √ 4. Obtain a USDA-NRCS wetland determination before doing anything that might degrade or convert an area that may be a wetland. Doing so, may prevent jeopardizing federal cost-share eligibility.

7.2 WATER QUALITY TREATMENT AND FIELD DISCHARGES

- √ 1. Minimize adverse water quality impacts to receiving wetlands by using pretreatment practices such as filter strips, conservation buffers, swales, or holding water onsite. This can substantially reduce pollutants, especially suspended solids, and allow the wetland to more naturally assimilate nutrients.
- √ 2. On steep slopes with a history of sedimentation impacts, consult with NRCS or FDACS staff to design and install upland sediment sumps landward of upland buffers to prevent scouring and minimize sediment transport.
- √ 3. Use *spreader swales* or other means to encourage sheetflow through the wetland buffer prior to discharging water from existing farm ditches.

7.3 SPECIAL CRITERIA FOR FIRST AND SECOND MAGNITUDE SPRINGS

- √ 1. Maintain a 100-foot vegetative buffer from springs, spring runs, and wet sinks.
- √ 2. Implement all measures in the Nutrient Management BMP Category (1.0).
- √ 3. Utilize split-applications for fertilizers on farm areas that contribute surface water directly to springs, spring runs, and wet sinks.

Operation and Maintenance:

- Limit the use of pesticides and fertilizers in and around wetlands and springs, and be careful to avoid spray drift impacts.

Key References:

- (1) USDA-NRCS Wetland Enhancement, Code 659, Nutrient Management, Code 590, Filter Strip, Code 393, Diversion, Code 362, FOTG-Section IV
[659, http://www.nrcs.usda.gov/technical/efotg/659](http://www.nrcs.usda.gov/technical/efotg/659)
- (2) Applicable Water Management District’s Environmental Resource Permitting Rule and Basis of Review
- (3) Department of Community Affairs, Protecting Florida’s Springs, Land Use Planning Strategies and Best Management Practices
www.dca.state.fl.us/fdcp/DCP/publications

8.0 CONSERVATION BUFFERS

Insert Image of Filter Strip

For the purposes of this manual, conservation buffers include field borders, filter strips, and *riparian* buffers. They are generally non-tilled areas and can be selectively used in specialty fruit and nut operations to provide an additional level of water quality treatment, especially near sensitive discharge areas. Field borders are strips of permanent vegetation, either natural or planted, at the edge or perimeter of fields. They function primarily to help reduce erosion from wind and water, protect soil and water quality, and provide wildlife habitat. Filter strips are areas of permanent vegetation between farm fields and adjacent to environmentally sensitive areas. Their main purpose is to decrease the velocity of runoff water and remove sediment particles before they reach surface waters. *Riparian* buffers are areas of trees and/or shrubs located adjacent to natural streams, which help reduce excessive amounts of sediment, organic material, nutrients, and pesticides in surface water sheetflow. Riparian buffers are most effective on highly sloped lands when positioned next to perennial or intermittent streams with high ground water recharge potential.

Working Definition:

Conservation buffers are permanently vegetated, non-cultivated areas that function to retain water and soil on site to help reduce pollutants in surface water runoff.

8.1 FIELD BORDERS

- √ 1. Locate borders around the perimeter for optimum benefit or, at a minimum, in areas where runoff enters or leaves the field(s).
- √ 2. Plan and design your field borders so that they are wide enough to allow them to function as turn rows for equipment.
- √ 3. Plant borders during the time of year that will assure the most success for survival, and consider using native species and/or over-seeding the border with legumes for plant diversity and wildlife benefits.

8.2 FILTER STRIPS

- √ 1. Install a filter strip(s) in primary outlet or discharge areas where sediment, particulate matter and/or dissolved contaminants may enter environmentally sensitive areas.
- √ 2. Design the area based on peak discharge from the field(s), and generally base this calculation on a 2-year, 24-hour rainfall event.
- √ 3. Construct the area wide enough to convey the flow at a depth of 0.5 feet or less, with the length sufficient to provide at least 15 minutes of flow-through time.

8.3 RIPARIAN BUFFERS

- √ 1. Specialty fruit and nut operations should maintain a riparian buffer or filter strip on cropland areas that exceed 1% slope and discharge directly to streams. If so:
- Maintain an existing riparian buffer and select shrub and tree species based on the anticipated duration of *saturation* and/or *inundation* of the site.
 - Locate and size any stream crossings to minimize impacts to riparian buffer vegetation and function. Refer to USDA-NRCS Stream Crossing, Code 578 for design criteria.
 - Consider other in-field BMPs that may enhance the importance and function of the riparian buffer(s).

Contact FDACS, USDA-NRCS or a Technical Service Provider approved by the USDA-NRCS for assistance in properly designing the riparian buffer in accordance with USDA-NRCS Codes 390 and/or 391 in the Key References section below.

Operation and Maintenance:

- Inspect conservation buffers periodically, and restore as needed in order to maintain their intended purpose.
- Do not overuse fertilizers, pesticides, and other chemicals in maintaining buffers.
- Repair rills and small channels that may develop across the buffers, and reseed as necessary.
- Use proper management practices to maintain the integrity of grassed waterways, if applicable.
- If roller chopping, conduct these activities in accordance with USDA-NRCS guidelines and use prescribed burns as necessary to maintain the native vegetation within the buffer and to discourage the establishment of nuisance exotic vegetation.

Key References:

- (1) USDA-NRCS Field Border, Code 386, Riparian Herbaceous Cover, Code 390, Riparian Forest Buffer, Code 391, Filter Strip, Code 393 and Grassed Waterway, Code 412, FOTG-Section IV
<http://www.nrcs.usda.gov/technical/efotg>
- (2) EPA's National Management Measures for the Control of Nonpoint Pollution from Agriculture
- (3) USDA-NRCS FL Technical Note Forestry FL-17, General Specifications for Establishing Riparian Forest Buffers, USDA, <http://www.usda.nrcs.gov/>
- (4) Agricultural Experiment Station, Auburn University, Auburn, Alabama
- (5) Farming for Clean Water in South Carolina – A Handbook of Conservation Practices.
- (6) Predicting Soil Erosion by Water, A Guide to Conservation Planning with the Universal Soil Loss Equation (RUSLE). USDA Agricultural Research Service, Agricultural Handbook No. 703.

9.0 FROST AND FREEZE PROTECTION

Insert Image of iced blueberry plant

Protecting specialty crops from occasional frost and deadly freezes is a challenge for growers in Central and South Florida. Viable frost and freeze protection options include sprinkler irrigation, soil banking, and establishment of row covers. Each method has application in certain areas for specific crops. The proper application of frost and freeze quantities will reduce inadvertent water quantity impacts.

Working Definition:

Frost and freeze protection consists of various methods to protect plants from cold temperatures and the associated damage to plant tissues.

9.1 FROST AND FREEZE PROTECTION

- √ 1. In general, start the irrigation system if the weather prediction is showing a continuous drop in temperature, or as soon as the air temperature drops to 30°F. Remember that water freezes at 32° F, but most fleshy plant tissues freeze at lower temperatures (approximately 28° F).
- √ 2. Monitor air temperatures and wind speed on each farm and on a regional basis using television, radio reports and/or an internet site (e.g., using the Florida Agriculture Weather Network (FAWN) accessed at <http://fawn.ifas.ufl.edu>).
- √ 3. If using sprinkler irrigation systems, continuously provide water to protect the plant, as long as the air temperature is below 32° F. This will allow you to take advantage of the latent heat of fusion that is released when irrigation water is changed from liquid to ice. Remember that sprinkler irrigation is less effective under windy conditions.
- √ 4. Monitor crop nutritional status after repeated frost protection since mobile nutrients may have been leached or their oxidation state may have changed.

9.2 IRRIGATION SYSTEM DESIGN FOR FROST PROTECTION

- √ 1. Design the irrigation system for high uniformity of water application. Remember that wind adversely affects the uniformity of water applied through an overhead sprinkler system.
- √ 2. Overlap each adjacent sprinkler pattern down and between the laterals for frost protection. The spacing of the sprinklers must be closer in areas where high winds are frequent.
- √ 3. Use sprinkler head nozzle sizes that minimize application rates, but maximize coverage area. Water applied at too low a rate can cause more damage than no protection during a freeze. In general, higher application rates are required for *advective freezes*.

Operation and Maintenance:

- Formation of a “milky-white” ice without icicles, and incomplete coverage of the plant suggests too low a rate of water application. Clear ice and icicles are usually an indication of successful cold protection.
- Row covers can offer protection down to 25° F and currently cost around \$1000 per acre; most materials can be used for at least two or more seasons.

Key References:

- (1) Row Covers for Commercial Vegetable Culture in Florida, <http://edis.ifas.ufl.edu/CV201>
- (2) Row Covers for Growth Enhancement, <http://edis.ifas.ufl.edu/CV106>
- (3) Cold Protection by Irrigation: Dew Point and Humidity Technology, <http://edis.ifas.ufl.edu/CH054>
- (4) Sprinkler Irrigation for Cold Protection, University of Florida, Cooperative Extension Service Institute of Food and Agricultural Sciences, Circular 348
- (5) Use of Water in Florida Crop Production Systems, <http://edis.ifas.ufl.edu/AE036>

10.0 DITCH CONSTRUCTION AND MAINTENANCE

Insert Image of vegetated ditch bank

Agricultural ditches and/or grassed waterways are essential components of the field site plan and layout. As such, they can vary from field ditches to laterals and mains, which are sometimes connected to larger canal systems. Depending upon their configuration, ditches have an engineered limit or *conveyance capacity* that governs how much water the ditch can store or convey. It is important to know the type of fruit or nut crop you are growing and its specific water requirements so that you can capitalize on existing soil moisture conditions before designing ditches.

An effective field ditch network functions primarily to convey and distribute water without causing excessive erosion, water losses, and/or degradation of water quality to the downstream receiving system. Properly designed and constructed agricultural ditches are very important; however, equally important is the implementation of an appropriate maintenance program to ensure that the ditches function as designed.

Working Definition:

Ditch construction and maintenance involves agricultural ditches, which are constructed trenches dug for the purpose of removing excess water from the land and/or providing irrigation water for use by the crop(s).

10.1 GENERAL PLANNING AND DESIGN ISSUES

- √ 1. Use mapping tools such as topographic maps, soil survey maps, and basic knowledge of the landscape to identify land contours, seasonal high water table limitations, and/or natural drainage outlets in order to plan the proposed ditch system.
- √ 2. Use appropriate setback distances when drainage ditches are in close proximity to jurisdictional wetlands to avoid lowering the water table.

10.2 DITCH CONSTRUCTION

- √ 1. Stake the proposed ditch run and remove obstacles beforehand as needed. Construct ditches with spacing, depth, and side-slope consistent with on-site soil types. Refer to the USDA-NRCS Florida Drainage Guide for information on recommended construction based on specific soil types.
- √ 2. Follow appropriate plans and grades, as specified during ditch construction. Spoil material shall be deposited in an uplands location or reused on the farm field.
- √ 3. Stabilize bare soils and newly constructed ditch banks through the establishment of native grasses or other appropriate vegetative cover.
- √ 4. Irrigation ditches should be constructed so that flow velocities do not exceed 1.5 feet per second in coarse sandy soils, or up to 0.5 feet per second in fine soils.

10.3 SYSTEMATIC ROUTINE AND CUSTODIAL MAINTENANCE

- √ 1. Maintain a permanent vegetative cover where shallow water furrows are used. Selectively control broadleaf vegetation on ditch banks to maintain a grass cover.
- √ 2. Protect ditch banks from erosion in areas subject to high water velocities, using *rip-rap*, concrete, headwalls, or other buffering materials.
- √ 3. Consider establishing a permanent record of the design cross-sectional area using basic survey techniques to define the ditch profile. This would be a useful exercise on large ditches that have a propensity to “fill in” over time, and may assist you in dealing with regulatory agencies having jurisdiction over surface waters.
- √ 4. Routinely remove any accumulated aquatic weeds at the riserboard control structure(s) to maintain proper drainage and prevent secondary environmental impacts.
- √ 5. Use a combination of physical control (e.g., floating barriers, screens, etc.), biological control (e.g., herbivorous fish), and chemical control (e.g., selective herbicides labeled for aquatic applications) to suppress and reduce weed problems.

Operation and Maintenance:

- Maintain ditch bank side-slopes per the applicable soil type.
- Remove sediments down to the original invert elevation of the ditch when necessary.

Key References:

- (1) USDA-NRCS FOTG Conservation, Irrigation Field Ditch - Code 388, Surface Drainage (Field Ditch) - Code 607, and Surface Drainage (Main or Lateral) - Code 608, <http://www.nrcs.usda.gov/>
- (2) American Society of Agronomy: Drainage for Agriculture, <http://www.agronomy.org>
- (3) The Florida Stormwater, Erosion, and Sedimentation Control Inspectors' Manual
- (4) Water Management Districts' Environmental Resource Permitting Rule and Basis of Review

11.0 STORMWATER MANAGEMENT

Insert Image of Storm Water Control

Florida receives an average of 53 inches of rain per year. However, rainfall amount varies across the state by region, season, and year. Average rainfall tends to decrease as you move toward the central and southeastern parts of the state, and increase as you move toward the northwestern part of the state. In general, rainfall tends to occur more frequently during the summer months in Florida, especially in the central and southern areas of the state. Alteration of the land, which may include construction of impervious surfaces such as roads, driveways, parking lots, urban and agricultural structures, etc., increases stormwater runoff during rainfall events. Improper stormwater management leads to on-site and offsite flooding, increased pollutant loading to surface and ground waters, erosion and sedimentation, and the loss of valuable fresh water resources. The need to address these stormwater impacts has led to the implementation of a comprehensive stormwater management program that is implemented cooperatively by FDEP and the water management districts (WMDs) to minimize flooding and stormwater pollution effects. Additionally, local governments and property owners have specific stormwater management responsibilities. All new development activities, and some agricultural activities, especially those that alter on-site hydrology, are required to obtain an Environmental Resource Permit (ERP). The construction of a stormwater management system (e.g., retention or detention pond) may require an ERP or other WMD surface water management permit. Therefore, please check with your water management district before beginning construction of any stormwater management system.

While specialty fruit and nut production generally does not lead to stormwater problems, there may be individual farm circumstances that create the need for specific stormwater management practices. Some farms may already have an ERP or other WMD surface water management permit that incorporates onsite stormwater management requirements. However, if stormwater problems exist and are not addressed by a WMD permit, it is important that a producer develop and implement a stormwater management plan suited to the farm's unique circumstances.

Working Definition:

Stormwater management is the on-site management of rainfall and runoff through the use of nonstructural and structural BMPs to provide flood protection and water quality protection in the most cost-effective manner.

11.1 Stormwater Management Planning and Implementation

- √ 1. If stormwater problems exist and are not addressed by an ERP or other WMD surface water management permits, develop and implement a written stormwater management plan that specifically addresses various levels of rainfall, with the

goal of reducing the volume of off-site discharge while maintaining an adequately drained root zone. Include guidelines for regular inspection of BMPs, and steps to implement operation and maintenance provisions.

- √ 2. Operate and maintain the stormwater management system to meet design performance criteria.
- √ 3. Evaluate the effectiveness of the plan, and make adjustments as needed.

In developing a stormwater management plan:

- Contact your local NRCS District Conservationist to obtain information about the soil types for the proposed or existing farm location. The District Conservationist can identify soil types that are historically prone to flooding or standing water. Evaluate the storage capacity, size, and elevations of existing ditches, ponds, creeks, rivers, and wetlands, and the size, layout, and elevations of the fields. You should also contact your county or water management district to obtain maps (FEMA, FIRM) or other information related to flooding issues at the proposed or existing location. You can access this information via the web at <http://www.fema.gov/hazard/map/firm.shtm>.
- Determine the maximum storm size for which you want to provide flood protection. The flood control design storm addressed by WMD ERP regulations varies from a 25-year, 24-hour storm to a 100-year, 3-day storm. For example, a 25-year, 24-hour storm produces from 8 to 10 inches of rainfall in a 24-hour period. Generally, the larger the design storm event used, the more extensive the stormwater management system needs to be. Factors that will affect this decision include land availability, the existence of internal natural features such as creeks, rivers, ponds, or wetlands, the potential to flood downstream property owners, and costs.
- Consult with a public or private agricultural engineer to discuss your stormwater management needs and considerations, especially if you are farming on marginal lands. Find an engineer qualified to provide an appropriate stormwater runoff analysis for your site.
- Include both nonstructural pollution prevention BMPs and structural BMPs, as needed.

Key References:

- (1) NRCS Conservation Practice Standard Nos. 554 and 570, <http://www.nrcs.usda.gov/technical/Standards/nhcp.html>
- (2) Water Management Districts ERP Manuals, Basis of Review, Appendices
NFWMD <http://www.nfwmd.state.fl.us/permits/ruleform.htm>;
SFWMD https://my.sfwmd.gov/portal/page?_pageid=734,1456414,734_1456346&_dad=portal&_schema=PORTAL&navpage=regulatoryguidance;
SWFWMD http://www.swfwmd.state.fl.us/rules/files/40d_basis_of_review.pdf;
SJRWMD http://www.sjrwmd.com/govboard/pdfs/ERP_gen_conditions.pdf;
SRWMD http://www.srwmd.state.fl.us/resources/40b-4-+atvofficialupdate10-25-05_2_.pdf

- (3) ASABE Standard No. EP302.4
<http://asae.frymulticom/abstract.asp?aid=14738&t=2>
- (4) Florida Engineering Society Directory and Guide
<http://www.fleng.org/pubs.cfm#FICEdandg>

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APPENDICES

APPENDIX 1 – ADDITIONAL BMP REFERENCES

General BMP References

- (1) *South Florida Tropical Fruit Growers Perspectives: Water Conservation Management Practices*, University of Florida – IFAS

This publication summarizes research done on Miami-Dade's tropical fruit production and provides general information on the most common water quality and quantity Best Management Practices done by growers.

<http://edis.ifas.ufl.edu/pdffiles/AE/AE39600.pdf>

- (2) *Protecting Florida's Springs: Land Use Planning Strategies and Best Management Practices*, Florida Department of Community Affairs and Florida Department of Environmental Protection, November 2002.

This guide provides an introduction on the hydrologic importance of springs, comprehensive planning strategies, other information to manage development impacts, and specific criteria for other industries.

<http://www.dca.state.fl.us/fdcp/DCP/publications>

- (3) *The Florida Irrigator's Pocket Guide*, National Center for Appropriate Technology, USDA-Natural Resources Conservation Service, 2005

This guide lists both water management and equipment management practices and includes a schedule of common maintenance tasks. The guide also focuses on conserving and protecting water, soil, energy and natural resources. Currently, this guide does not reside on any website.

- (4) *A Guide to Tropical Fruit Trees & Vines*

This guide was created by Brevard Counties Rare Fruit Council in Indialtlantic, FL. It covers everything from fertilization to pest management and can be obtained by contacting the council through their website at www.brevardrarefruit.org.

- (5) *Mid Atlantic Berry Guide*

This is a very extensive guide developed by Penn State and can be found at <http://pubs.cas.psu.edu/freepubs/MABerryGuide.html>.

- (7) *The Florida Stormwater, Erosion, and Sedimentation Control Inspector's Manual*

To improve the lack of compliance with BMPs for Florida's stormwater regulatory program, the Department of Environmental Protection has developed a training program curriculum on the use, installation, and maintenance of erosion,

sedimentation, and stormwater BMPs. The training program is primarily directed towards inspectors and contractors, however, permit reviewers and public works personnel will also benefit from this program. The manual can be found at http://www.dep.state.fl.us/water/nonpoint/ero_man.htm.

University of Florida – Institute of Food and Agricultural Sciences References

- (1) *Integrated Pest Management Strategies*, UF-IFAS, Circular 1149

This circular describes the principles of integrated pest management (IPM) and advises strategies for implementation. This publication is no longer available on the web. Contact your local extension agent.

- (2) *The Pecan Tree*, UF-IFAS, Publication HS229

This publication describes strategies for production of pecans in Florida and can be found at <http://edis.ifas.ufl.edu/HS229>.

USDA – Natural Resources Conservation Service References

All of these practices may be found at <http://www.nrcs.usda.gov/technical/standards/nhcp.html>

- (1) Conservation Practice Standard No. 314 (Brush Management)
- (2) Conservation Practice Standard No. 330 (Contour Farming)
- (3) Conservation Practice Standard No. 342 (Critical Area Planting)
- (4) Conservation Practice Standard No. 362 (Diversion)
- (5) Conservation Practice Standard No. 464 (Irrigation Land Leveling)
- (6) Conservation Practice Standard No. 460 (Land Leveling)
- (7) Conservation Practice Standard No. 412 (Grassed Waterway)
- (8) Conservation Practice Standard No. 393 (Filter Strip)
- (9) Conservation Practice Standard No. 441 (MicroIrrigation)

APPENDIX 2 – CONTACT INFORMATION

Emergency Reporting

State Warning Point (24hrs.) 800-320-0519

Nat'l Response Center (24hrs.) 800-424-8802

Federal law requires the NRC to be immediately notified when a reportable quantity of a hazardous substance is released into the environment.

State Emergency Response Commission

(NOT a 24 hr No.) 800-635-7179

(Follow-up reporting only. In an emergency call the State Warning Point.)

Help line numbers for chemical hazard information and regulatory questions

CHEMTREC Hot Line (Emergency only, 24 hrs) 800-424-9300

SARA Title III help line 800-535-0202

CERCLA / RCRA help line 800-424-9346

Non-Emergency Numbers

Florida Fruit & Vegetable Association 321-241-5200

Email: information@ffva.com

www.ffva.com

Tropical Fruit Growers of South Florida, Inc. 305-401-1502

Email: tropicalfruitgrowers@earthlink.net

www.tropicalfruitgrowers.com

Blueberry Growers Association 352-481-5558

Email: fbgaweb@aol.com

www.floridablueberrygrowers.com

Grape Growers Association 386-329-0318

Email: admin@fgga.org

www.fgga.org

FDEP Stormwater

Nonpoint Source Management Section (Tallahassee).... 850-245-7513

FDEP Hazardous

Waste Management Section (Tallahassee) 850-245-8705

FDEP Northwest District 850-595-8300

FDEP Northeast District 904-807-3300

FDEP Central District 407-894-7555

FDEP Southwest District 813-632-7600

FDEP South District 239-332-6975

FDEP Southeast District 561-681-6600

FDACS

Bureau of Pesticides 850-487-0532
Bureau of Compliance Monitoring 850-488-3314
Division of Agriculture and Environmental Services .. 850-488-3731
Office of Agricultural Water Policy BMP Hotline 850-617-1727
www.floridaagwaterpolicy.com

OAWP Field Offices

West Palm Beach..... 561-682-6040
Okeechobee 863-462-5881
Sarasota..... 800-320-3503
Tampa 800-863-0797
Palatka 386-329-4812
Live Oak 800-226-1066
Mariana 850-482-9915

National Pesticide Telecommunications Network ... 800-858-7378

Provides information on pesticides and poisonings (7 days/week 6:30AM–4:30PM)

University of Florida

Pesticide Information Office (Gainesville)..... 352-392-4721
Agricultural Law Policy Office (Gainesville) 352-392-1881
BMP Implementation Teams.....772-468-3922 ext 122

USDA, Natural Resources Conservation Service

Gainesville 352-338-9500
www.fl.nrcs.usda.gov/

Agricultural Mobile Irrigation Labs

Hillsborough SWCD

Lisa Jannetti
201 S Collins Street, Suite 202
Plant City, FL 33563
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Email: lisa.jannetti@fl.nacdnet.net

Broward SWCD

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West Palm Beach, FL 33415-3963
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South Dade SWCD

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1450 North Krome Avenue, Suite 103
Florida City, FL 33034
Phone: (305)242-1218
Email: rperez@southdadeswcd.org

Suwannee River RC&D

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Live Oak, FL 32064
Phone: (386)364-4278
Email: dalebryant@alltel.net

Treasure Coast SWCD

Bruce Camplin
8400 Picos Rd., Suite 202
Ft. Pierce, FL 34945
Phone: (772)461-4546
Email: bruce.camplin@fl.nacdnet.net

West Coast RC&D

Mark Miles
2944 Penn Avenue, Suite E
Marianna, FL 32448-2708
Phone: (850)482-5888
Email: mmiles115@earthlink.net

APPENDIX 3 – ACRONYM LIST AND GLOSSARY

Actual Evapotranspiration – Usually no greater than precipitation, with some buffer in time depending on the soil's ability to hold water. It will usually be less because some water will be lost due to percolation or surface runoff. An exception is areas with high water tables, where capillary action can cause water from the groundwater to rise through the soil matrix to the surface. If potential evapotranspiration is greater than actual precipitation, then soil will dry out, unless irrigation is used.

Advective Freezes – Occurs when a cold air mass moves into an area bringing freezing temperatures. Wind speeds are usually above 5 mph and clouds may be present. The thickness of the cold air layer ranges from 500 to more than 5,000 feet above the surface. Attempts to protect crops by modifying the environment are very limited under these conditions.

Aquifers – Soil or rock formations that contains ground water and serves as a source of water that can be pumped to the surface.

Artesian – A well from which water is forced out naturally under pressure. Artesian wells are bored where water in a layer of porous rock is sandwiched between two layers of impervious rock. Water flows up to the surface because distant parts of the aquifer are higher than the well-head.

Attenuate – To weaken or reduce in force, intensity, effect, quantity, or value.

Best Management Practices – means a practice or combination of practices determined by the coordinating agencies, based on research, field-testing, and expert review, to be the most effective and practicable on-location means, including economic and technological considerations, for improving water quality in agricultural and urban discharges. Best management practices for agricultural discharges shall reflect a balance between water quality improvements and agricultural productivity.

BMAP – Basin Management Action Plan

BOD – Biochemical Oxygen Demand

Composite Sample – A combined water sample consisting of a series of discrete water samples taken over a given period of time and mixed according to a specified weighting factor such as flow. A composite sample is often collected with the use of an automated sampler over the duration of a runoff event.

Conveyance capacity – The amount of flow (generally expressed in cubic feet per second) that a canal/ditch can carry based on the size, shape, slope, and condition of the canal/ditch.

Diluent – A diluting substance.

Deciduous Crops – These include trees, shrubs and herbaceous perennials, which lose all of their leaves for part of the year. This process is called abscission. In some cases leaf loss coincides with winter - namely in temperate or polar climates. While in other areas of the world, plants lose their leaves during the dry season or during other seasonal variations in rainfall, including tropical, subtropical and arid regions of the world.

EDIS – Electronic Document Information System

EPA – Environmental Protection Agency

ERP – Environmental Resource Permit

Eutrophication – A condition where a water body is characterized by an overabundance of nutrients that feed a dense growth of algae and other organisms, and often results in oxygen depletion of the water body as the algae decays.

Evapotranspiration – The combined process of water evaporation and the loss of water from plants.

F.A.C. – Florida Administrative Code

FCWA – Federal Clean Water Act

FDACS – Florida Department of Agriculture and Consumer Services

FDEP – Florida Department of Environmental Protection

FDH – Florida Department of Health

FOTG – Field Office Technical Guide

F.S. – Florida Statutes

FWRA – Florida Watershed Restoration Act

Inundation – A condition where standing water regularly or periodically covers the land surface.

IPM – Integrated Pest Management

Landward – Inland of the high water line of a stream or waterbody.

MSDS – Material Safety Data Sheets

MSSW – Management and Storage of Surface Waters

N-P-K – Nitrogen, Phosphorus and Potassium

NOI – Notice of Intent

NPS – Nonpoint Source

Phytotoxicity – The toxic effect of a compound on plant growth. Such damage may be caused by a wide variety of compounds, including trace metals, pesticides, or salinity.

POC – Presumption of Compliance

Potential Evapotranspiration – A representation of the environmental demand for evapotranspiration and represents the evapotranspiration rate of a short green crop, completely shading the ground, of uniform height and with adequate water status in the soil profile. It is a reflection of the energy available to evaporate water, and of the wind available to transport the water vapour from the ground up into the lower atmosphere. Evapotranspiration is said to equal potential evapotranspiration when there is ample water.

PPM – Parts per Million

Restricted Use Pesticides – Pesticides registered by EPA that may only be applied by or under the direct supervision of trained and certified applicators.

Rip-rap – Large, loose angular stones that serve as a permanent erosion-resistant ground cover.

Riparian – Belonging or relating to the bank of a river or stream; of or on the bank.

Saturation – A condition where all available soil pore space within a portion of the soil profile is filled with water.

Scouting – Routinely monitoring fields, borders, and adjacent vegetation for insects and disease activity.

Sheet-flow – Water flowing in a thin layer over the land surface; also, known as overland flow.

Signs – Evidence of disease in plants as indicated by the presence of disease-producing organisms or any of their parts.

Sorbed – The action of a substance which is either adsorbed or absorbed onto another substance.

Spreader swale – A depressional area positioned parallel to the receiving waterbody that allows indirect discharge of stormwater into the waterbody without scouring.

Spoil – The soil material obtained from excavating an area to construct such works as canals/ ditches and/or ponds. This material is typically used to build berms and/or dikes along or in the vicinity of the excavation site.

SWCD – Soil and Water Conservation District

Symptoms – Evidence of disease in plants as expressed by the reaction of the plants to the presence of the irritating factor or organism.

Tensiometers – A device used to determine soil moisture tension in the vadose zone, which extends from the top of the ground surface to the water table.

TMDL – Total Maximum Daily Loads

Topographic maps – Detailed, graphic representation of the land surface elevations of a region.

Treatment Train – A combination of nonstructural and structural practices which have been determined to be effective for reducing or preventing pollution.

Turbid – In relation to water, it is described by having an opaque and cloudy appearance and containing suspended solids or other pollutants that may limit light penetration.

UF-IFAS – University of Florida, Institute of Food and Agricultural Sciences

Uncoated sands – Sand particles that lack clay and organic matter coating, and have poor water and nutrient holding capacities.

USDA-NRCS – United States Department of Agriculture, Natural Resources Conservation Service

USGS – United States Geological Survey

Watersheds – Described as drainage basins or regions of land where water drains downhill into a specified body of water.

Waters of the State – Defined in section 403.031(13), Florida Statutes, to include, but not limited to, rivers, lakes, streams, springs, impoundments, wetlands, and all other waters or bodies of water, including fresh, brackish, saline, tidal, surface, or underground waters. Waters owned entirely by one person other than the state are included only in regard to possible discharge on other property or water. Underground

waters include, but are not limited to, all underground waters passing through pores of rock or soils or flowing through in channels, whether manmade or natural. Solely for purposes of s. 403.0885, waters of the state also include navigable waters or waters of the contiguous zone as used in s. 502 of the Clean Water Act, as amended, 33 U.S.C. ss. 1251 et seq., as in existence on January 1, 1993, except for those navigable waters seaward of the boundaries of the state set forth in s. 1, Art. II of the State Constitution.

Wetlands – As defined in section 373.019(25), Florida Statutes, wetlands means those areas that are inundated or saturated by surface water or groundwater at a frequency and a duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soils. Soils present in wetlands generally are classified as hydric or alluvial, or possess characteristics that are associated with reducing soil conditions. The prevalent vegetation in wetlands generally consists of facultative or obligate hydrophytic macrophytes that are typically adapted to areas having soil conditions described above.

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APPENDIX 4 – SOIL AND TISSUE TESTING INFORMATION

Soil Testing

Often the benefits of a soil test are assumed. The soil testing process comprises four major steps and understanding each one clearly will increase the reliability of the process tremendously. The steps in the soil testing process are:

- soil sampling
- sample analysis
- interpretation of test results
- nutrient recommendations

Soil Sampling:

- √ Divide your farm into areas for sampling. Separate sample areas with different crop growth, history or patterns, soil color, or lime or fertilizer histories. The sample you collect should represent the average for a uniform portion of the area sampled, and should be taken in a consistent fashion each year.
- √ Use the proper sampling tools, such as a sampling tube or soil auger. If it is necessary to use a shovel or trowel, dig a V-shaped hole in the soil and slice a small slab from one side of the hole.
- √ Identify samples by letter or number and keep a record of where the samples were taken.
- √ Use a competent soil testing laboratory that uses calibrated soil test methodologies. Not all laboratories can provide accurate fertilizer recommendations for Florida soils. The Mehlich-1 soil test has been calibrated for sandy soils in Florida.

Soil samples need to be representative of the field and soil types; the soil analysis results will be only as good as the submitted sample. Samples collected from areas that differ from typical characteristics of the farm should be submitted separately and should not be consolidated with the primary samples. Using a management zone (area on the farm that is managed similarly) as a guiding factor to collect and consolidate samples is strongly recommended to optimize resources. For more information please see IFAS publication SS186, Producer Soil Test Info Sheet, Soil and Water Science Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida, at: <http://edis.ifas.ufl.edu/SS186>

Sample Analysis:

The soil samples that are submitted to the testing laboratories undergo a series of physical and chemical processes that are specific to the soil types, crops, and management regimes. Once the soil samples are homogenized through grinding and/or sieving, a precise volume of the sample will be extracted for plant nutrient through an extraction procedure. The following standard methods are followed at the IFAS Soil Testing Laboratories for different soils in Florida:

- a) Mehlich-1 extraction - this method is performed on all acid-mineral soils up to a soil pH of 7.3.
- b) AB-DTPA extraction - this method is performed on alkaline (calcareous) soils with a pH of 7.4 and above.
- c) Water extraction - this method is used for extraction of P in all organic soils.
- d) Acetic acid extraction - this method is performed on all organic soils for extraction of K, MG, Ca, Si, and Na.

It is extremely important that procedures used at the laboratories are well understood before submitting the samples since most BMPs are tied to the standardized procedures used by the labs at the land-grant universities in the state such as UF/IFAS. Similarly, it is also very important to note that the IFAS laboratory does not offer any test for N since there is no reliable test for plant available N under Florida conditions. N recommendations are based on crop nutrient requirements found in the research literature. More information regarding the procedures used at the IFAS Extension Soil Testing Laboratory in Gainesville can be found in the extension publication, Circular 1248.

Interpretation of Test Results:

The primary goal of state laboratories in offering the soil testing service is to provide interpretation of the soil test results based on soil test-crop response trials and field calibration of the test results with the optimum economic yields of the various plant species. Economic yield increases resulting from added nutrients cannot be obtained once the test results are interpreted as 'High' resulting in no recommendation for that particular nutrient. The interpretations provided are specific to the soil and plant species. Current interpretation tables can be obtained from SL 189 - IFAS extension fact sheet.

Tissue Testing

Tissue testing is the analysis and diagnosis of the plant's nutritional status based on its chemical composition. It is commonly performed as analyses on dried blades, leaves or dried *petioles* or on sap from fresh *petioles*, with results compared to recommended nutrient ranges.

Timely tissue testing is an important tool used in fertilizer management through monitoring the plant's nutritional status, and such testing is also used in diagnosing suspected problems like nutritional deficiency, toxicity or imbalance. As a management tool, tissue testing can increase a grower's return by preventing deficiencies that can reduce yield(s), market quality, and profitability.

Methodology:

Begin sampling soon after the crop is established and continue at regular intervals (weekly or biweekly). Individual plants, even side-by-side, may have different nutritional status. Therefore, by sampling a sufficiently large number of plants, the effect of this error due to inherent variability should be minimized. It is preferable to include a soil sample together with a tissue sample when submitting samples to a diagnostic lab, since the soil sample may indicate other factors - such as pH - that may influence crop

growth, nutrient availability, and uptake. Avoid plant tissue testing if the field has received foliar nutrient sprays containing micronutrients or nutrient-containing pesticides. Also, avoid sampling plants damaged by pests, diseases, or other chemicals when trying to monitor the nutritional status.

Whole-leaf sampling will be most useful early in the season, while later in the season, it can help to point to changes in fertilization practices that are needed for the next season. Fresh petiole sap testing for N and K, practiced regularly throughout the season, can help manage the current crop as well as provide guidance for the next crop. Sample a recently matured leaf blade. Collect enough leaf material so that the sample is representative of the crop stand, and that the sample is large enough to perform the required analyses.

If a deficiency is suspected, collect one *composite sample* from the area exhibiting the disorder and a second sample from an otherwise “normal” section for comparison when trying to diagnose a nutrient deficiency. Separate and properly label the “disorder” sample and the “normal” sample in order to make a valid comparison after analyses. Keep notes on condition of the plants and stage of growth, weather, and other variables for future reference.

Be careful not to crush or damage samples during cleansing. Avoid using tap water to rinse blade samples, since it can be high in nutrients such as calcium, iron, magnesium, or sulfate sulfur. Use distilled water instead. In most situations, cleansing is not needed. Blot the samples dry with absorbent paper after rinsing, and air-dry the samples several hours before shipment. Wrap the samples in absorbent paper and place them in a large envelope if a plant analysis kit is not available, and mail immediately.

Select a reputable laboratory that provides interpretations and recommendations based upon test results, which are appropriate for your growing region. Interpretation guidelines should be based on actual field research, not on “typically observed” or historical lab databases. The laboratory should be reliable and accredited and also offer a routine turnaround of less than 48 hours.

For more information please see SL 131, Plant Tissue Information Sheet, Soil and Water Science Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. Last revised July 2005.
<http://edis.ifas.ufl.edu/SS182>.

References:

Mylavarapu, R.S. and E.D. Kennelley. 2002. UF/IFAS Extension Soil Testing Laboratory Analytical Procedures and Training Manual. Soil and Water Science, Circular 1248, Cooperative Extension Service, IFAS, <http://edis.ifas.ufl.edu/SS312>.

Mylavarapu, R.S. 2002. The Process of Standardized Nutrient Recommendation Development for Successful Crop Production and Environmental Protection. SL 189,

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APPENDIX 5 – INCENTIVE PROGRAMS FOR QUALIFYING FARMS

The implementation of BMPs can reduce nonpoint sources of pollution, conserve valuable soil and water resources, and improve water quality. The implementation of these management practices can also be expensive and, in some cases, may not be economically feasible for agricultural producers. To reduce the financial burden associated with the implementation of selected practices, several voluntary cost-share programs have been established. The narrative below is intended to provide basic information regarding the primary federal, state, and regional cost-share programs. Sources of additional information have also been included, and growers are encouraged to contact the identified agencies or organizations for current information about each program.

I. Programs Administered by USDA - Farm Services Agency (FSA)

Conservation Reserve Program (CRP) This program encourages growers to convert highly erodible cropland or other environmentally sensitive lands to vegetative cover including grasses and/or trees. This land use conversion is designed to improve sediment control and provide additional wildlife habitat. Program participants receive annual rental payments for the term of the contract in addition to cost share payments for the establishment of vegetative cover. CRP generally applies to highly erodible lands and is more applicable to North Florida.

Conservation Reserve Enhancement Program (CREP)

CREP uses a combination of federal and state resources to address agricultural resource problems in specific geographic regions. This program (which is not limited to highly erodible lands) is designed to improve water quality, minimize erosion, and improve wildlife habitat in geographic regions that have been adversely impacted by agricultural activities.

For further information on CRP and CREP, including eligibility criteria, please contact your local USDA Service Center. Information is also available on the Internet at www.fsa.usda.gov.

II. Programs Administered by USDA - NRCS

Environmental Quality Incentives Program (EQIP)

EQIP provides financial assistance (generally up to 75 percent cost share) to growers for the implementation of selected management practices. Eligibility for the program requires that the farm have a NRCS approved Conservation Plan. Practices eligible for EQIP cost share are designed to improve and maintain the health of natural resources and include water control structures, conversion of seep to overhead irrigation systems, nutrient management and other erosion control measures. The 2002 Farm Bill made numerous improvements to the program and significantly increased available funding. When enacted, the 2007 Farm Bill may provide additional funding and incentive programs.

Emergency Conservation Program (ECP):

The ECP provides financial assistance to growers and ranchers for the restoration of farmlands on which normal farming operations have been impeded by natural disasters. More specifically, ECP funds are available for restoring permanent fences, terraces, diversions, irrigation systems, and other conservation installations. The program also provides funds for emergency water conservation measures during periods of severe drought.

Watershed Protection & Flood Prevention Program (PL-566)

The program works through to assist local government sponsors to help participants solve natural resource problems in watersheds of 250,000 or fewer acres. Technical and financial assistance is available for flood prevention, sediment control, water supply, water quality, fish and wildlife habitat enhancement, and wetlands creation and restoration.

Wetlands Reserve Program (WRP)

WRP is a voluntary program designed to restore wetlands. Program participants can establish easements (30-year or perpetual) or enter into restoration cost-share agreements. In exchange for establishing a permanent easement, the landowner usually receives payment up to the agricultural value of the land and 100 percent of the wetland restoration cost. Under the 30-year easement, land and restoration payments are generally reduced to 75 percent of the perpetual easement amounts. In exchange for the payments received, landowners agree to land use limitations and agree to provide wetland restoration and protection.

Wildlife Habit Incentives Program (WHIP)

The Wildlife Habitat Incentives Program provides financial incentives for the development of fish and wildlife habitat on private lands. Program eligibility requires that landowners develop and implement a Wildlife Habitat Development Plan. Participants enter multi-year (5 to 10 year) agreements with USDA-NRCS.

For further information on these programs, including eligibility criteria, please contact your local USDA Service Center. Information is also available on the Internet at the following web site: www.nrcs.usda.gov

III. Programs Administered by State and Regional Entities:

Soil and Water Conservation Districts

In order to assist agricultural producers in the implementation of BMPs, the Florida Department of Agriculture and Consumer Services has executed a number of cost-share contracts with several of the state's Soil and Water Conservation Districts and Resource Conservation and Development Councils, Inc. Many of these cost-share contractors administer cost-share programs using *Applicant's Handbooks* which include reimbursement rates and grower selection criteria.

Water Management District Cost Share Memoranda:

The Department of Agriculture and Consumer Services has executed Memoranda of Agreement (MOA) with certain Water Management Districts to provide coordination for BMP cost-share programs. Each MOA will identify the primary program areas within the District's geographical boundaries, and designates the agency responsible for program administration.

For further information on these programs, including eligibility criteria, please contact your local Water Management District, Soil and Water Conservation District or the Florida Department of Agriculture and Consumer Services. Information and links to other sites are also available on the Internet at the following web site:
www.floridaaqwaterpolicy.com

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APPENDIX 6 – EXAMPLE RECORD KEEPING FORMS

Producers are required to keep accurate records to document BMP implementation. Record keeping also aids producers in operating and maintaining BMPs. The tables below correspond to all the mandatory record-keeping requirements contained in this manual. They serve as both a reference sheet and a set of templates to develop your own record-keeping system. You may maintain your records as hard copies or in an electronic format, depending on your preference. You may use these tables or choose commercially available record-keeping software suited to your commodity. However, at a minimum, your records should include the information categories in these tables.

Soil Sample Records

DATE	GROVE LOCATION	# OF SAMPLES	NAME OF LAB	RECORDS LOCATION

Tissue Sample Records

DATE	GROVE LOCATION	# OF SAMPLES	NAME OF LAB	RECORDS LOCATION

Fertilization/Nutrient Records

DATE	LOCATION	ACREAGE COVERED	TYPE ¹	FORMULATION ²	GRADE ³	RATE (LBS/ACRE)

¹ Organic, Inorganic, Chemical

² Granular, Water Soluble, etc.

³ e.g. 10-10-10

Rainfall (in.)

JAN.	FEB.	MAR.	APRIL	MAY	JUNE	JULY	AUG.	SEP.	OCT.	NOV.	DEC.

Well Records

LOCATION	YEAR CONSTRUCTED	CONSTRUCTED BY	LAST MODIFIED	MODIFIED BY	RECORDS LOCATION

Irrigation Events

DATE	LOCATION	AMOUNT APPLIED (GALLONS)	RUN TIME (HR.)	CONDITIONS ⁴

Irrigation Maintenance

DATE	LOCATION	LAST INSPECTED	MOTOR VALUES ⁵	WITHDRAW RATE (GPM)	PUMP VALUES ⁶	CURRENT SYSTEM EFFICIENCY ⁷	RECORDS LOCATION

⁴ Temperature, Wind Speeds, Cloud Cover, Time of Day
⁵ Energy Consumption (Kwh) and Motor Amperage (Amps)
⁶ Discharge Rate (GPM) and PSI (lb/in²)
⁷ Ratio, Source Withdraw vs. Crop Available (V₁:V₂)

Integrated Pest Management / Crop Yield and Rotations

SEASON	LOCATION	CROP	YIELD

Integrated Pest Management / Pesticide Application

DATE	LOCATION	ACREAGE COVERED	CROP	TOTAL AMOUNT ⁸	FORMULATION ⁹	PESTICIDE CLASS ¹⁰	PEST TARGETED ¹¹

⁸ Lbs/ac, gal/ac, etc.

⁹ Dry, Liquid, Aerosol

¹⁰ Nematicide, Fungicide, etc.

¹¹ Be Specific, e.g. Thrips

APPENDIX 7 – NOTICE OF INTENT AND BMP CHECKLIST



CHARLES H. BRONSON
COMMISSIONER

Florida Department of Agriculture and Consumer Services
Office of Agricultural Water Policy

**NOTICE OF INTENT TO IMPLEMENT
WATER QUALITY/QUANTITY BMPs
FOR
FLORIDA SPECIALTY FRUIT AND NUT CROPS**

**FDACS-OAWP
1203 Governor's Sq. Blvd.
Suite 200
Tallahassee, FL, 32301**

Rule 5M-X.004, F.A.C.

- Submit a separate NOI for each county in which you are enrolling property.**
- Submit this **Notice of Intent to Implement (NOI)**, along with the **BMP Checklist**, to the Florida Department of Agriculture and Consumer Services (FDACS), as provided below.
- Keep a copy of both of these documents in your files.** These documents must be completed, maintained, and available for inspection by FDACS, as one of the conditions for a presumption of compliance with state water quality standards. A submitted NOI and checklist are also required to be eligible for some sources of BMP cost-share funding.

If you would like assistance in completing this NOI form or the BMP Checklist, or in implementing BMPs, contact FDACS staff at (850) 617-1727 or AgBmpHelp@doacs.state.fl.us .

Mail or fax this completed form and the BMP Checklist to:
FDACS Office of Agricultural Water Policy
1203 Governor's Square Boulevard, Suite 200
Tallahassee, Florida 32301
Fax (850) 617-1701

Landowner or **Leaseholder Information**

Name: _____

Physical Address of enrolled property: _____

City: _____ State _____ Zip Code: _____

Mailing Address, if different: _____

City: _____ State: _____ Zip Code: _____

Telephone: _____ FAX: _____

Email: _____

Authorized Contact Information

NOTE: If the Authorized Contact is the same as the landowner/leaseholder listed previously, please check: **Same as above.** If not, complete the authorized contact information below.

Name: _____

Mailing Address: _____

City: _____ State: _____ Zip Code: _____

Telephone: _____ FAX: _____

Email: _____

Complete the following information for the property associated with this NOI. You may list multiple parcels located within the same county.

Grove/Farm/Nursery Name(s): _____

County: _____

Total acres on which BMPs will be implemented: _____

Tax Parcel Identification Number(s) from County Property Appraiser: Please submit a copy of your county tax bill(s) for the enrolled property, with your name, address, and the tax parcel ID number(s) clearly visible. If you cannot provide a copy of your tax bill(s), please write the tax parcel ID number(s) below in the format the county uses.

Parcel No.: _____

Parcel No.: _____

Parcel No.: _____

(If necessary, use an additional sheet to complete your list of parcel identification numbers within the county.)

All or part of this property is already enrolled by me or a previous owner/operator under one or more existing NOI(s) in a Department BMP program.

Yes - Program(s): _____

Enrolled Owner/Operation: _____

No, not already enrolled **I don't know whether it is already enrolled**

In accordance with section 403.067(7)(c)2, Florida Statutes, I submit the foregoing information and the BMP Checklist as proof of my intent to implement the BMPs applicable to the parcel(s) enrolled under this Notice of Intent.

Print Name: _____

Landowner *Leaseholder* *Authorized Agent* *(Check one)*

Signature: _____ **Date** _____

Name of IFAS or FDACS Staff Assisting with NOI: _____

NOTES:

1. You must keep records of BMP implementation, as specified in the BMP manual.
2. Please remember that it is your responsibility to stay current with future updates of this manual. Visit the following website periodically to check for manual updates:
www.floridaagwaterpolicy.com
3. **You must notify the Department if any of the following circumstances occur with regard to the parcel(s) enrolled under this NOI:**
 - a. Full or partial change in ownership following a real estate transaction
 - b. Change in BMPs or BMP implementation schedule, including non-implementation of BMPs

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