

Florida Nursery Operations

2024 Edition

**Water Quality and
Water Quantity
Best Management
Practices**



FLORIDA NURSERY OPERATIONS, 2024 EDITION: WATER QUALITY AND WATER QUANTITY BEST MANAGEMENT PRACTICES

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Acronyms and Abbreviations

BMAP –	Basin Management Action Plan	OAWP –	Office of Agricultural Water Policy (FDACS)
BMP –	Best Management Practice	OFS –	Outstanding Florida Springs
CPS –	Conservation Practice Standard	P₂O₅ –	Phosphorus pentoxide
EDIS –	Electronic Data Information Source of UF/IFAS	P –	Phosphorus
EEF –	Enhanced Efficiency Fertilizer	TMDL –	Total Maximum Daily Load
EPA –	United States Environmental Protection Agency	UF/IFAS –	University of Florida, Institute of Food and Agricultural Sciences
ERP –	Environmental Resource Permit	WMD –	Water Management District
ET –	Evapotranspiration		
F.A.C. –	Florida Administrative Code		
F.S. –	Florida Statutes		
FAWN –	Florida Automated Weather Network		
FDACS –	Florida Department of Agriculture and Consumer Services		
FDEP –	Florida Department of Environmental Protection		
GPS –	Global Positioning System		
IV –	Implementation Verification		
MIL –	Mobile Irrigation Laboratory		
N –	Nitrogen		
N/A –	Not Applicable		
NOI –	Notice of Intent to Implement Best Management Practices		
NRCS –	Natural Resources Conservation Service		

PART A

Introduction

This manual is designed for use by container plant, field grown, and cut foliage production operations. The manual does not apply to retail-only establishments. Nursery operations enrolling in the Florida Department of Agriculture and Consumer Services (FDACS) Nursery Best Management Practices (BMP) program should be registered with the FDACS Division of Plant Industry. For the purposes of this manual, container plant production is defined as any type of container or greenhouse system, including citrus nurseries; field grown production as in-ground nursery plants grown to maturity, not including caladiums produced in ground; and cut foliage production of ferns, shrubs, or other flowers grown for the cut foliage industry.

Operations Applicable to this Manual

This manual applies to operations engaged in the production of nursery plants. A landowner or producer enrolled under this manual is also subject to the requirements of Rule Chapter 5M-1, F.A.C.

To benefit from and participate in the BMP Program, Nursery producers must work with a Florida Department of Agriculture and Consumer Services (FDACS) representative to complete, sign, and submit a Notice of Intent (NOI) (FDACS-04002, rev 06/24, incorporated in 5M-1.001(9), Florida Administrative Code (F.A.C.), and the BMP Checklist that is part of this manual.

A landowner or producer operating under one of the Equivalent Programs listed in Rule 5M-1.001(7), F.A.C., is required to complete a Notice of Intent and meet the other requirements for Equivalent Programs specified in Rule Chapter 5M-1, F.A.C.

Completing a BMP Checklist is not required for the enrolled lands subject to the permit or license issued pursuant to an Equivalent Program listed in Rule 5M-1.001(7)(a) or (b), F.A.C. Whether or not an enrollee under an Equivalent Program listed in Rule 5M-1.001(7)(c) or (d), F.A.C., is required to complete a Checklist depends on the specific requirements of the programs identified. References to the BMP Checklist in this manual apply to Equivalent Program enrollments only to the extent provided in Rule Chapter 5M-1, F.A.C.

Enrollees under an Equivalent Program listed in Rule 5M-1.001(7), F.A.C., and meeting the requirements for Equivalent Programs provided in Rule Chapter 5M-1, F.A.C., are provided all the benefits listed under "Benefits of Implementing BMPs" set forth below.

Best Management Practices and Water Quality

Section 403.067, Florida Statutes (F.S.), directs FDEP to develop water quality restoration goals for impaired waterbodies. These water quality restoration goals, or total maximum daily loads (TMDLs), are the maximum amount of a pollutant that a waterbody can assimilate and remain suitable for its designated use. Once a TMDL is adopted, FDEP may develop a basin management action plan (BMAP) that identifies enforceable strategies for restoring the impaired waterbody. The agricultural industry is one of many stakeholders identified in most BMAPs and plays an important role in helping to meet these water quality goals. Florida law requires agricultural producers and landowners located within BMAP areas to either enroll in the FDACS BMP Program and properly implement BMPs applicable to their property and operation or to conduct water quality monitoring activities as required by Rule Chapter 62-307, F.A.C. FDACS strongly encourages producers and agricultural landowners outside BMAP areas to also enroll in the BMP Program for the many benefits that enrollment provides. Proper implementation of the

FDACS agricultural BMPs is the industry's strategy to address agricultural nonpoint pollution sources.

The FDACS Office of Agricultural Water Policy (OAWP) administers the BMP Program for nursery operations. For the purposes of the OAWP BMP Program, the term "best management practice" means, a practice or combination of practices determined by the coordinating agencies (FDACS, FDEP, and water management districts (WMDs)), 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 discharges. BMPs must reflect a balance between water quality improvements and agricultural productivity. Section 403.067, F.S., authorizes and directs FDACS to develop and adopt by rule BMPs that will help Florida's agricultural industry achieve the reductions allocated in BMAPs. BMPs serve as part of a multidisciplinary approach to water resource restoration and protection that includes public/private partnerships, landowner agreements, and regional treatment technologies, which together form the comprehensive strategy needed to meet goals established in BMAPs.

Producers or agricultural landowners who are enrolled in the FDACS BMP Program and properly implementing the applicable BMPs identified on the BMP Checklist, or who are in compliance with the Equivalent Program requirements of Rule Chapter 5M-1, F.A.C., are entitled to a presumption of compliance with state water quality standards per section 403.067(7)(c)3., F.S. FDACS is required to perform BMP Implementation Verification (IV) site visits to enrolled operations every two years to ensure that BMPs are being properly implemented. Details on IV site visits are provided herein. Enrollees participating in Equivalent Programs demonstrate compliance with BMPs on the area(s) of the NOI property subject to the Equivalent Program instrument by fulfilling the requirements of Rule 5M-1.008(7), F.A.C.

Benefits of Implementing BMPs

FDACS works closely with the FDEP, WMDs, industry experts, and academic institutions to understand the environmental and agronomic effects addressed by BMPs. Benefits of enrolling in the FDACS BMP Program and implementing BMPs include:

- Reduction of agricultural production impacts on natural resources;
- Eligibility for cost share funding for certain BMPs (as funds are available);
- Availability of free services provided by the FDACS Mobile Irrigation Laboratories to evaluate irrigation system efficiency;
- Technical assistance with BMP implementation;
- Presumption of compliance with state water quality standards for the pollutants addressed by the BMPs;
- Release from the provisions of section 376.307(5), F.S., (fines for discharge damages) for pollutants addressed by the BMPs; and
- Avoidance of duplicative local regulation under section 163.3162, F.S.

In many cases, proper BMP implementation may also increase production efficiency, reduce operational costs, and support wildlife habitat.

Permit Exemptions

In most cases, FDACS BMPs do not replace or exempt agricultural operations from complying with applicable permitting or other regulatory requirements. If a permit is obtained, producers are still required to adopt and properly implement BMPs for the aspects of their operation not addressed by the permit.

Some agricultural activities, especially those that alter the hydrology of the land, may require an Environmental Resource Permit (ERP). Check with the appropriate WMD or FDEP before beginning construction activities for a stormwater management system or other onsite activity resulting in hydrologic alteration to determine if an ERP is required, or whether the activities may be exempt from permitting requirements. The following are possible exemptions.

- Section 373.406(2), F.S., authorizes any person engaged in the occupation of agriculture to alter the topography of land for purposes consistent with normal and customary practices of agriculture for the area. These activities, however, may not be for the sole or predominant purpose of diverting or impeding surface waters, or adversely impacting wetlands. If a formal dispute between a landowner and a WMD arises regarding the applicability of a permit exemption, FDACS has exclusive authority to make a binding determination, should either party request it.
- Section 373.406(3), F.S., authorizes any person engaged in the occupation of agriculture to construct an agricultural closed system. This exception, however, is limited to construction, operation, and maintenance of the agricultural closed system. Part II of chapter 373, F.S., regarding the consumptive use of water remains applicable, which includes the taking and discharging of water for filling, replenishing, and maintaining the water level in any such agricultural closed system.
- Section 373.406(6), F.S., exempts activities that will have only minimal or insignificant individual or cumulative adverse impacts on the water resources of the district as determined by FDEP or the WMD.
- Section 373.406(9), F.S., exempts environmental restoration activities on agricultural lands that have minimal or insignificant impacts to water resources from ERP permitting requirements. No activity may commence until the producer requests an exemption and the appropriate WMD or FDEP has provided written notice that the proposed activity qualifies for the exemption.
- Section 373.406(10), F.S., exempts interim measures or best management practices adopted pursuant to section 403.067, F.S., that are by rule designated as having minimal individual or cumulative adverse impacts to the water resources of the state.
- Section 373.406(13), F.S., exempts isolated man-made farm ponds up to 15 acres in size, constructed entirely in uplands, from ERP permitting requirements if the average depth of the pond is less than 15 feet and the pond is located at least 50 feet from a wetland.

Even if an exemption applies, agricultural producers located within an adopted BMAP area must either properly implement applicable BMPs or conduct water quality monitoring in accordance with section 403.067, F.S.

The Florida Right to Farm Act (section 823.14, F.S.) provides that a local government may not adopt any ordinance, regulation, rule, or policy to limit an activity of a *bona fide* farm operation on land classified as agricultural pursuant to section 193.461, F.S., whereon the activity is regulated through properly implemented BMPs or interim measures developed and adopted by FDEP, FDACS, or a WMD as part of a statewide or regional program. Not all activities conducted on a farm are addressed by adopted BMPs or interim measures, so this exemption may not apply to all activities.

BMP Implementation Verification

Florida law requires FDACS to conduct an IV site visit at least every two years to ensure that agricultural landowners and producers are properly implementing the applicable BMPs identified in their NOI. An IV site visit includes: review of nutrient records that producers must maintain to demonstrate compliance with the BMP Program; verification that all other applicable BMPs are being properly implemented; verification that cost share practices are being properly implemented; and identification of potential cost share practices, projects or other applicable BMPs not identified during enrollment. During the IV site visit, FDACS representatives also identify opportunities for achieving greater nutrient, irrigation, or water resource management efficiencies, including opportunities for water conservation.

FDACS must retain certain records pertaining to the application of nitrogen (N) and phosphorus (P) fertilizer from enrolled producers during IV site visits. OAWP adopted a Nutrient Application Record Form (NARF), (FDACS-04005, rev. 06/24, incorporated in 5M-1.008(4), F.A.C.), to help simplify the recordkeeping requirement. The form is available from FDACS staff or from <https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fforms.fdacs.gov%2F04005.xlsx&wdOrigin=BROWSELINK>. References to IV in this Manual apply to Equivalent Program enrollments only to the extent provided in Rule Chapter 5M-1, F.A.C.

Cost Share

Enrollment in and proper implementation of BMPs makes a producer eligible for cost share for certain BMPs, other practices, and projects. The availability of cost share funds depends on annual appropriations by the Florida Legislature and, therefore, the amount available can vary each year. Cost share applications may be submitted once a producer has enrolled in the BMP Program and has been assigned a NOI number. Cost share practices are categorized as nutrient management, irrigation management, or water resource protection. BMPs, other practices, and projects eligible for cost share funding may include precision agriculture technologies, variable rate irrigation methods, water control structures, and tailwater recovery systems.

OAWP seeks to leverage its cost share funding with other cost share programs offered by FDACS and other state and federal agencies. The United States Department of Agriculture NRCS offers funding through its Environmental Quality Incentives Program, and certain WMDs have agricultural cost share programs. Applicants are encouraged to use OAWP cost share in conjunction with other available conservation programs although funding cannot be duplicative.

This, and other BMP manuals, can be accessed electronically at:

<https://www.fdacs.gov/Agriculture-Industry/Water/Agricultural-Best-Management-Practices>.

Guide to Best Management Practice (BMP) Program Enrollment and Implementation

When enrolling, FDACS OAWP representatives will work with producers during an enrollment site visit.

Getting Started

- 1) **Request On-farm Technical Assistance.** Contact FDACS OAWP representatives for assistance with determining the BMPs that are applicable to the operation. For free assistance, call (863) 467-3250, email AgBmpHelp@FDACS.gov, or contact an FDACS OAWP office.
- 2) **Identify Applicable BMPs.** FDACS OAWP representatives will work with producers to identify all BMPs that are applicable to the operation and to document the BMPs on the NOI and BMP Checklist. The BMP Checklist will serve as the basis for subsequent implementation verification site visits to verify the proper implementation of the BMPs. If applicable, FDACS OAWP representatives will review other supporting materials such as an NRCS Comprehensive Nutrient Management Plan or FDEP approved Nutrient Management Plan for biosolids application.

Enrollees under an Equivalent Program listed in Rule 5M-1.001(7), F.A.C., will complete, update, and submit their NOI in accordance with Rule 5M-1.004(3), F.A.C.

- 3) **Submit an NOI.** FDACS OAWP representatives will assist producers in completing the NOI. Once the producer signs and submits the NOI with all the required information and the BMP Checklist, or documentation required of Equivalent Program Enrollees in accordance with Rule 5M-1.004(3), F.A.C., FDACS will review the information for completeness and enroll the Producer's operation in the BMP Program.
- 4) **Properly Implement the BMPs.** Producers must properly implement all applicable BMPs as soon as practicable, but no later than 18 months after completion and execution of the NOI and associated BMP Checklist.

BMPs indicated as "Planned" in the BMP Checklist must include a completion date. Enter the completion date agreed to by the producer and FDACS OAWP representatives in the "Planned" box. Projects must be initiated as soon as the BMP is identified, and cost share is available. The deadline for implementing BMPs that require cost sharing, engineering and design, permitting, or construction will be extended beyond 18 months, as needed. The proper implementation of BMPs requires ongoing record keeping and maintenance of BMPs (see the Record Keeping section below).

Proper implementation of the applicable nutrient management BMPs also requires that producers demonstrate that N and P are applied at appropriate agronomic rates, when available. Producers should utilize the appropriate calculations and technical assistance tools to demonstrate that nutrient management practices are compatible with appropriate agronomic rates.

For Enrollees under an Equivalent Program listed in Rule 5M-1.001(7), F.A.C., implementation verification shall be undertaken by the agency that issued the permit, license, or other instrument, pursuant to its statutory and/or rule authority.

Preparing for a Site Assessment/Enrollment Visit


- 1) Review the BMP manual and note any question(s) regarding specific BMPs, unfamiliar terms, or content. Be ready to confirm the parcels of land to be enrolled in the BMP Program to ensure the accuracy of the information that will be submitted on the NOI.
- 2) During the site visit, the FDACS OAWP representatives will assist the producer with identifying potential pollutant sources and the most likely pathways to surface waters and groundwater. Representatives may ask to review previous soil tests, past fertilization practices, and other data to help with identification.
- 3) The FDACS OAWP representative will observe production-related activities near water resources such as wetlands, streams, sinkholes, springs, ponded or poorly drained areas, and any conveyances that discharge off site, and will discuss the BMPs that apply to these areas. Having a preplanned route will make the assessment and enrollment process more efficient.

The following web resources can be helpful for creating an inventory of the property's natural features, structures, and other improvements. The reference material listed below is for informational purposes and is not incorporated by reference.

- United States Department of Agriculture Natural Resources Conservation Service (NRCS) soil survey maps (<http://websoilsurvey.nrcs.usda.gov/app/>).
- United States Geological Survey topographic maps (<https://www.usgs.gov/programs/national-geospatial-program/topographic-maps>).
- National Wetlands Inventory (<http://www.fws.gov/wetlands/>).
- County Property Appraiser (<http://floridarevenue.com/dor/property/appraisers.html>).

Make sure that someone who is familiar with the nutrient and irrigation regimen of the operation is available on the day of the enrollment site visit.

Record Keeping

Enrollees who submit a Checklist must document the proper implementation of the applicable BMPs and producers must keep records in accordance with Rule 5M-1.011, F.A.C., for BMPs noted with the pencil icon () on the BMP Checklist. Examples of records to be kept include the rates and locations of all N and P applications and all soil test results. All BMP records should be accurate, clear, and well-organized. Record keeping examples are provided in Appendix 3 but are not adopted as a rule.

Enrolled producers must retain the applicable records for at least five years. Enrolled producers shall use the NARF, incorporated by reference in Rule 5M-1.008(4), F.A.C., or a substantially similar form that meets the criteria therein, to aggregate nutrient records. Enrolled producers are required to provide records regarding the application of N and P fertilizers on the enrolled property parcel to FDACS. The NARF will be collected and retained by FDACS during an implementation verification site visit every two years. Producers must maintain aggregate records in electronic or digital form unless justification is provided as to why the use of electronic or digital recordkeeping is not feasible. Although OAWP has developed a producer recordkeeping tool that may be used, it is not the only tool that can be used to meet this requirement.

All documentation required to verify the proper implementation of applicable BMPs are subject to inspection. Please note that falsification of records is a first-degree misdemeanor under Florida law.

In accordance with section 403.067(7)(c)6., F.S., agricultural records relating to processes or methods of production, costs of production, profits, other financial information, or N and P fertilizer application records collected by the Department during implementation verification are confidential and exempt from disclosure. Any such claim must be asserted at the time of submission by stamping the words "confidential and exempt information" on each page containing such information so the Department may handle them appropriately.

Best Management Practices (BMP) Checklist






BMP Checklist Instructions




With the exception of those enrolling under one of the Equivalent Programs listed in Rule 5M-1.001(7), F.A.C., producers must work with an FDACS representative to identify the applicable BMPs to be implemented on the subject parcel and to complete the BMP Checklist. Refer to the [Guide to BMP Program Enrollment and Implementation](#) section above. Failure to properly implement the applicable BMPs may subject your operation to compliance measures including referral to FDEP for enforcement.


- 1) Check “In Use” for BMPs that are currently being implemented and can be observed on the operation at the time of enrollment or the IV site visit.
- 2) Check “Planned” for BMPs that will be implemented within a specific timeframe, but no later than 18 months after completion and execution of the NOI. ***The producer understands that they are expected to implement this practice by the completion date entered into the “Planned” box. Projects must be initiated as soon as the BMP is identified, and cost share becomes available. However, the deadline for implementing BMPs that require cost sharing, engineering and design, permitting, or construction will extend beyond 18 months as needed. Include practices that can’t be observed at the time of site visit.***
- 3) Check “N/A” for BMPs that are not applicable to the operation. This status may be selected for individual BMPs or categories of BMPs where N and P are not applied in any form (Nutrient Management section), or where the operation does not include an irrigation system (Irrigation Management section). Producers are required to provide justification for any BMPs that are marked “N/A.”
- 4) Enter the anticipated completion date for any planned practices (month and year) in the “Planned” box of the BMP Checklist during enrollment.
- 5) Producers must keep records of items indicated on the BMP Checklist. BMPs that require record keeping are noted by the pencil icon (✎). Enrolled producers are required to provide records upon request for review during a BMP implementation verification site visit. The NARF will be collected during the IV site visit by the FDACS representative.
- 6) After completion of all of the above steps, including the site visit and assessment, producers are enrolled upon submitting to FDACS the NOI and the BMP Checklist. Producers enrolling under one of the Equivalent Programs are enrolled upon submitting to FDACS the NOI and documentation required of Equivalent Program Enrollees in accordance with Rule 5M-1.004(3), F.A.C. FDACS will provide written confirmation of enrollment. Keep a copy of each document.
- 7) Producers will work with the FDACS representative to modify the NOI or BMP Checklist, if needed, after initial enrollment. FDACS will provide written confirmation of any proposed changes.

Best Management Practices Checklist for Florida Nursery Operations

The producer agrees to implement the following items either checked as “In Use” or “Planned”:

Nutrient Management					
Do you apply nitrogen (N) or phosphorus (P) or plan to apply N or P in any form on the operation associated with this NOI?			Yes	No	-
			In Use	Planned	N/A
1.1	Right Source				
	1	If using commercial fertilizer (including Class AA biosolids), identify and document the nitrogen (N), and phosphorus (P) concentrations using the guaranteed analysis or product label information prior to application.			
	2	If using reclaimed water and the supplier provides the guaranteed nutrient content, adjust N and P fertilization rates as appropriate.			
	3	Apply conventional fertilizers based on commodity, soil characteristics, and operation or use controlled released fertilizer (CRF) products.			
1.2	Right Rate				
	1	Perform soil tests, tissue tests, or both to appropriately plan and manage fertilizer applications.			
	2	Use a soil extraction method listed in Appendix 2 appropriate for the soil type to perform soil test in 1.2.1. The use of other soil extraction methods must be approved by FDACS. Maintain documentation to justify using that method.			
	3	Regardless of which soil extraction method is used, base the P fertilization rate on recommended rates in the crop-specific University of Florida, Institute of Food and Agricultural Sciences (UF/IFAS) publication(s), where available, or another credible source with scientific support (e.g., a calibrated crop response curve for the soil type and crop). Supplemental application may be justified based on current tissue testing results, soil variability, P availability, or cultivar-specific requirements, or other substantiated production data that demonstrate crop need. Maintain documentation to support application amounts, particularly documentation used to justify application amounts above the recommended rates.			
	4	Base the N fertilization rate on recommended rates in the crop-specific UF/IFAS publication(s), where available, or another credible source with scientific support (e.g., a calibrated crop response curve for the soil type and crop). Supplemental application may be justified based on current tissue testing results, results from other technological testing methods, cultivar-specific requirements, or other substantiated production data that demonstrate crop need. Maintain			

		documentation to support application amounts, particularly documentation used to justify application amounts above the recommended rates.			
	5	Record data, using the NARF or similar form, of all nutrient applications that contain N or P, including the date, and the N and P ₂ O ₅ applied to each field.			
1.3	Right Time				
	1	<p>Match plant growth stage N and P requirements and minimize N and P loss through leaching or runoff by using seasonal applications, split applications, or controlled release/enhanced efficiency fertilizer.</p> <p>If rainfall exceeds 3 inches in 3 days or 4 inches in 7 days, Producers may apply a single supplemental application of N (up to 30 pounds per acre). This supplemental application must occur as soon as practicable following the event but cannot occur within 10 days of the next regularly scheduled application of N. Producers must keep copies of all application records as well as rainfall data and any other records used to justify the supplemental N application</p>			
1.4	Right Place				
	1	Ensure all fertilizer application equipment is calibrated according to the manufacturer's specifications for the type of fertilizer used.			
	2	Prevent application of fertilizer or other nutrient sources directly to surface waters and sinkholes.			
	3	Use windbreaks or other means (e.g., pot-in-pot) to minimize plant blow-over when applicable.			
1.5	Fertilizer Storage and Handling				
	1	Store fertilizer material (defined as all composted animal waste, biosolids and/or commercial N or P sources) under a waterproof cover and impermeable barrier below, unless used or applied as soon as practicable after delivery.			
	2	Load fertilizer at a location and in a manner that prevents adverse effects on surface waters or sinkholes.			
COMMENTS					
Irrigation Management					
Do you have an irrigation system or plan to install an irrigation system associated with this NOI?			Yes	No	-
	If you answered "Yes" to the previous question, is the system pressurized?		Yes	No	-
			In Use	Planned	N/A
2.1	Crop Water Requirements and Irrigation Scheduling				
	1	Manage irrigation based on electronic soil moisture sensors equipped with electrical capacitance probes. If			

		electronic soil moisture sensors are not used, follow practices 2.1.2 or 2.1.3 below.			
	2	Maintain the water table (saturated zone) at a level in proximity to plant rooting depths when using seepage irrigation.			
	3	Use decision support tools and information to plan irrigation events and describe these tools in the Comments line below. Tools may include weather stations, rain gauges, or others.			
2.2	Irrigation System Maintenance and Evaluation				
	1	Contact a Mobile Irrigation Laboratory (MIL) or other qualified analyst approved in writing by FDACS to schedule an irrigation efficiency evaluation of your pressurized irrigation system at least every five years.			
	2	Keep records of MIL evaluations, recommendations, major maintenance and repairs, and system changes made to comply with MIL recommendations.			
	3	Establish minimum efficiencies and timeframes for repair and recheck, depending on system.			
	4	Clean and maintain filtration equipment so that it operates within the recommended pressure range.			
	5	Inspect sprinkler nozzles or emitters annually for wear and malfunction and replace as necessary.			
	6	Flush and treat irrigation lines regularly to prevent clogging.			
	7	Ensure that flow meters are properly calibrated and correctly measuring water usage or use other acceptable methodologies.			
2.3	Additional Irrigation System BMPs for Nursery Operations				
	1	Based on the stage of plant growth, space containers and flats as close as possible to maximize irrigation efficiency.			
	2	Calculate the leachate fraction and adjust irrigation run times to minimize the leaching of nutrients.			
	3	Use micro-irrigation or drip irrigation on containers when feasible.			
	4	Use pulse or cyclic irrigation to decrease the amount of water applied.			
	5	Test irrigation source water quality annually for water chemistry that may result in irrigation system plugging if using micro-spray, micro-drip, mist or other irrigation systems with small emitter openings.			
	6	If your container operation has a watering station used to irrigate plants immediately after potting, collect runoff in a small basin, direct the runoff to an existing basin, or route runoff through an onsite vegetative treatment area.			

	7	When using irrigation for frost/freeze protection, monitor wet-bulb temperatures to determine when to turn off the system.			
COMMENTS					
Water Resource Protection					
			In Use	Planned	N/A
3.1	Stream and River Protection				
	1	On fields adjacent to perennial streams, rivers, or regional canal systems flowing through the enrolled property, use riparian buffers, field borders, filter strips, or non-fertilized vegetated filter strips that are not less than 25 feet wide.			
	2	Maintain the above riparian buffers, field borders, filter strips, or non-fertilized vegetated filter strips to ensure those features function as designed.			
	3	Revegetate bare areas in the above riparian buffers, field borders, filter strips, or non-fertilized vegetated filter strips if the bare areas reduce the function of the buffer.			
3.2	Springs and Sinkholes				
	1	Buffer springs and spring runs with a minimum of 100 feet of non-fertilized vegetation.			
	2	Buffer sinkholes and other visible karst features with a minimum of 50 feet of non-fertilized vegetation.			
	3	Never dispose of any materials into sinkholes.			
	4	In Outstanding Florida Springs BMAPs adopted by FDEP, do not exceed appropriate fertilizer rates for N, based on crop nutrient requirements as described in practice 1.2.4 above.			
3.3	Wetlands and Lakes				
	1	Buffer wetlands with a minimum of 25 feet of non-fertilized vegetation or consistent with ERP buffers when they are established by permit.			
	2	Buffer impaired waterbodies located within adopted BMAP areas with a minimum of 50 feet of non-fertilized vegetation or consistent with ERP buffers when they are established by permit.			
3.4	Ditch and Canal Maintenance and Water Management				
	1	Maintain perennial herbaceous vegetation on all ditch and canal banks to protect them from erosion or provide an alternative means for preventing sediment from moving off site.			
	2	When sediments are observed in runoff moving off site, work with FDACS to evaluate the feasibility of implementing appropriate settling measures.			

	3	Operate and maintain water control structures to minimize the movement of N, P, and sediment off site.			
	4	Operate and maintain water control structures to minimize the admission of aquatic vegetation into downstream public waterways.			
	5	Do not remove sediments below the ditch's original invert elevation unless installation or maintenance of sumps or sediment traps is required. Original invert elevations can be determined by engineering drawings or changes in soil characteristics and color.			
	6	Ensure that pump intakes are sufficiently elevated from the bottom of water conveyances, or consistent with an ERP to reduce sediment and debris in offsite discharges.			
3.5	Erosion Control				
	1	Construct and maintain above-grade access roads so that they minimize the impeding or diversion of surface water flow.			
	2	Maintain vegetative cover or alternative means for stabilizing road banks to prevent sediments from moving off site. Describe the alternative means in the Comments section.			
	3	Locate and size permanent crossing areas over surface waters to minimize adverse effects to water resources.			
	4	Stabilize all crossings over streams and creeks using rocks, culverts, bridges, or other methods to prevent erosion.			
	5	Utilize cover crops on fields not in production for preventing soil erosion in field grown nursery operations.			
	6	Ensure that plant row orientation is compatible with topographic features of the site.			
	7	Maintain vegetation between rows to prevent soil erosion.			
3.6	Wellhead Protection				
	1	Inspect wellheads and pads for significant leaks or cracks and make any necessary repairs.			
	2	Prevent contamination by using backflow prevention devices at wellheads if injecting fertilizer or chemicals, or if shared with a potable use source.			
	3	Cap or valve any existing flowing wells.			
3.7	Non-Fertilizer Material Storage and Handling				
	1	Store pesticides, separate from fertilizers, in an enclosed, roofed structure with an impervious floor and lockable door, at least 100 feet away from wells, surface waters, or sinkholes.			

	2	Mix and load pesticides on an impermeable surface, use portable mix/load stations, or conduct any field mix/load activities at random locations in the field.			
	3	Recycle or properly dispose of used oil, solvent bath waste, and antifreeze in accordance with state and federal laws.			
3.8	Additional Water Resource Protection Practices for Nursery Operations				
	1	Compost vegetation debris, or properly dispose of the material.			
	2	If composting, establish a nursery composting area that is at least 100 feet away from wetlands, delineated floodplains, and other water bodies.			
COMMENTS					

PART B

Best Management Practices for Nursery Operations

The purpose of the narrative set forth below is to provide information for producers to consider while implementing the BMPs established in their BMP Checklist and to assist in planning, development, and production efforts for their operation. The contents of the narrative shall not be interpreted or construed as creating additional obligations or requirements that exceed the BMPs detailed in the BMP Checklist. The reference materials cited in the narrative have been utilized for technical and scientific support for the manual but are not incorporated by reference herein.

In implementing BMPs, it is recognized that each producer's operation is unique and individual. The information set forth in the manual is not exhaustive and does not address or identify all the factors that may affect production practices and land management for nursery operations. Producers may determine that it may be necessary to add practices to the BMP Checklist to fit specific production unit needs. In doing so, the producer may consult the BMP manual and other publications and information as part of the analysis of the site's individual characteristics, historical uses, economic and technical considerations, market factors, and changes in production.

1.0 Nutrient Management


Beneficial nutrient management decisions for nursery production are based on consideration of nutrient inputs, including commercial fertilizers, organic materials like manure, compost and biosolids, and any irrigation water used (especially reclaimed water). Producers are encouraged to develop a nutrient management plan for the operation to reduce potential effects on water resources.

The 4Rs of Nutrient Management

The scientific principles of the 4R nutrient stewardship framework involve applying the **Right Source** of fertilizer at the **Right Rate**, at the **Right Time**, and in the **Right Place**. The effective application of the 4R framework depends on site-specific characteristics such as soil type, cropping system, management techniques, and weather. The 4R nutrient stewardship provides a framework to achieve cropping system goals, such as increased production, increased farmer profitability, enhanced environmental protection and improved sustainability. The 4R nutrient stewardship framework requires the implementation of BMPs that optimize the efficiency of fertilizer use. The goal is to match nutrient supply with crop requirements and to minimize nutrient losses from fields while taking into consideration local soil and climatic conditions, crop, management conditions and other site-specific factors.

Other agronomic and conservation practices such as no-till farming and the use of cover crops play a valuable role in supporting the 4R nutrient stewardship framework. As a result, fertilizer BMPs are most effective when applied with other agronomic and conservation practices.

1.1 Right Source: Nutrient Composition and Bioavailability

	Right Source 1.1.1.	If using commercial fertilizer (including Class AA biosolids), identify and document the nitrogen (N) and phosphorus (P) concentrations using the guaranteed analysis or product label information prior to application.
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Guidance: The right source involves ensuring an adequate supply of nutrients in plant-available forms by using the right product based on specific crop needs. Nutrients may already be available in the soil (e.g., if cover crops were planted) but soil properties may interact with certain fertilizer sources to affect nutrient availability. Commercial nutrient sources include liquid, dry, solution, and enhanced efficiency fertilizers (EEF). Conventional fertilizers are usually formulated as water soluble products. An EEF is a blanket term for fertilizers with characteristics that allow for increased plant uptake while reducing the potential for nutrient losses to the environment compared with soluble fertilizers. EEFs may be slow release such as sulfur-coated urea, animal manures, and biosolids; controlled release, such as polymer-coated urea; or stabilized N sources such as urease and nitrification inhibitors.

Container and Greenhouse Grown Production


Container-grown plants must be fertilized because very few nutrients are available from mineralization of the potting substrate materials. Fertilizer material may be in dry or liquid formulation and is usually a complete fertilizer (N-P-K) that includes micronutrients. Fertilizer can be applied either by incorporating it into the potting substrate prior to potting, placing or “dibbling” it into the bottom of the planting hole, or “topdressing” (applying it to the surface).

Cut Foliage Production

A primary nutrient that is often deficient and limits growth in leatherleaf ferns is N. Both N and K must be supplied through fertilization. The P in soils is usually sufficient for the commercial production of leatherleaf ferns. N must be managed very carefully because the nitrate (NO₃⁻) ion and soil are both negatively charged, making nitrate very prone to leaching in sandy soils. P has low solubility at the ideal pH level recommended for leatherleaf ferns (5.5 to 6.5), making it much less prone to leaching.

Most fertilization of leatherleaf ferns occurs weekly through overhead fertigation. This allows small amounts of fertilizer to be applied at frequent intervals. Some of the fertilizer applied through this method can potentially end up outside the root zone (e.g., in aisles and roadways) and emitters should be adjusted to minimize this potential. Fertilizers, whether liquid or dry, should not be administered in a single large application as this can result in nutrient leaching and contribute to ground water contamination. Fertilizer applications in smaller, more frequent amounts or use of a controlled-release fertilizer (CRF) will reduce the potential for leaching.

Fern growers that have a mature stand with a solid root mass that extends approximately four inches below the soil surface should fertigate weekly, at a rate of no more than 300 lbs. N/acre/year. The exact rate will depend upon the age of the fernery and the amount of disease pressure from Anthracnose and/or nematodes. Fern growers that recently have rejuvenated their beds should use a rate of no more than 80 lbs N/acre/year until they can demonstrate that the beds have a uniform solid root mass (approximately 6 months).

	Right Source 1.1.2.	If using reclaimed water and the supplier provides the guaranteed nutrient content, adjust N and P fertilization rates as appropriate.
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Guidance: Nursery producers using reclaimed water on their operations should obtain copies of the wastewater treatment facility's permit, which outlines the authorized range of nutrients allowed in the final effluent and use this information to adjust fertilization rates.

	Right Source 1.1.3.	Apply conventional fertilizers based on commodity, soil characteristics, and operation or use controlled released fertilizer (CRF) products.
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Guidance: Whether a nursery plant is an annual or perennial, the source and amount of fertilizer applied, its placement, and the timing of application are key factors that affect how much the plant actually uses. As such, slow-release and controlled-release fertilizers (SRFs and CRFs) are viable alternatives to conventional soluble sources. Both release nutrients more slowly over a period of time, which means the nutrients will more likely be available when the plant needs them, and that the potential for nutrients to be lost into the environment is lessened. These benefits are particularly important in sandy soils with comparatively low nutrient- and water-holding capacities. Use of SRFs and CRFs can reduce total nutrient inputs, labor costs (through fewer applications), and water quality impacts to receiving waters. As a result, these forms of fertilizers have become more popular over time.

Slow-release fertilizers allow the release of the nutrient at a slower rate than is usual, but in which the rate, pattern, and duration of release are not well-controlled. The term controlled-release fertilizer is applied to fertilizers in which, during preparation, the key factors affecting the rate, pattern, and duration of release are well-known and controllable. The mechanisms for SRFs and CRFs are discussed below.

Slow-Release Fertilizers

Slow-Release Fertilizers activate in response to water solubility, microbiological decomposition, and chemical hydrolysis. Particle size, soil temperature, and microbial activity are key factors in decomposition and hydrolysis. Most SRFs are only slightly soluble in water or are broken down slowly by microbial action.

Non-manufactured SRF materials include manures, composts, and biosolids, which release nutrients through mineralization of organic matter based on moisture and soil temperature. As soil moisture and temperature increase, so does nutrient availability; consequently, SRFs are most effective in warmer weather. The release of these nutrients normally happens over a period of two to three years. Soil fumigation inhibits decomposition because it reduces populations of bacteria required for mineralization.

Some manufactured SRFs rely on particle size to delay delivery of nutrients. Larger pellets have less combined surface area than the same volume of smaller pellets, which reduces the points of contact for soil microorganisms and delays surface breakdown. As the fertilizer material is released gradually from the larger pellet or fertilizer granule, it is exposed to chemical and biological processes that render it soluble (through oxidation) and available to plant roots.

Another group of SRFs is comprised of reaction products of urea and aldehydes. Nitrogen is released through hydrolysis, which is accelerated by low pH and high soil temperatures. Because this mechanism is not microbe-dependent, nutrients can become available at low temperatures; consequently, SRFs in this group are favored for cool-season application. One example of this

type of product is isobutylidene diurea (IBDU), for which nutrient availability also depends on particle size.

Two microbe-dependent manufactured SRF materials are ureaformaldehyde (UF) and methylene urea (MU). Due to their low solubility, these materials enter the soil solution slowly, where they convert to plant-available N through microbial decomposition or hydrolysis.

Controlled-Release Fertilizers

Controlled-release fertilizers are coated materials (often urea); products with a soluble-fertilizer core covered with a water-insoluble, semi-permeable, or impermeable coating, or a combination thereof. CRF release rates are a function of temperature and soil water content. The coating limits the rate at which water penetrates to the fertilizer core, slowing the release of the fertilizer to the soil. CRFs fall into three categories based on the coating material: sulfur, polymer, and sulfur/polymer hybrids.

Sulfur has low water solubility, relatively low cost, and value as a secondary nutrient. In sulfur-coated urea (SCU), water penetration through micropores and imperfections in the coating release N, triggering a rapid release of dissolved urea from the particle's core. Coating thickness affects release rate, as more thickly coated particles have fewer imperfections to penetrate. Wax sealants may be used to create a dual-release mechanism whereby soil microbes must break through to the imperfections in the sulfur coating. SCU has been in production for nearly 50 years.

Polymer-coated fertilizers are the most advanced with regard to managing release rate and nutrient use efficiency. Coated materials may consist of urea alone or a composite of N, phosphorus, and potassium. Most polymer-coated products are released by diffusion through a semi-impermeable membrane, and the rate of release is a function of coating composition and thickness, as well as soil moisture and temperature. As water vapor penetrates the coating it dissolves the fertilizer core, and the nutrients diffuse through the coating into the soil.

Although manufactured SRFs and CRFs are usually more expensive than conventional soluble sources, they often weigh less and are more convenient to use. CRF applications are generally limited to one time per year, which saves money on equipment and labor costs. This is the norm for most container nursery operations as the CRF product is incorporated into the potting substrate. Field-grown nursery operations may benefit from using a mixture of SRF/CRF products and conventional soluble sources, especially when growing high-value crops in environmentally sensitive areas.


Nitrogen Inhibitors

Nutrient release also may be slowed through fertilizer additives generally referred to as nitrification and urease inhibitors. Nitrification inhibitors slow down the conversion (biological oxidation) of ammonium (ammoniacal nitrogen) to nitrate by soil bacteria. Urease (an enzyme) inhibitors are also used on urea to delay the conversion process. Inhibitors can offer even more nutrient management precision based on soil conditions and high crop-value considerations. Inhibitors may be more practical for certain row crop operations as opposed to nurseries. Questions remain as to its usefulness even in a field setting. This depends upon the form, rate, and method of N application. The use of urease inhibitors may be effective with surface application of dry urea in high-residue situations.

The table below summarizes some of the main attributes of common SRF/CRF product classes.

Product Class	Release Characteristics	Cost
Organic Fertilizers	Mineralization Book Values	Low
Low-Solubility Compounds	Microbial, Particle Size	Low to Medium
Sulfur-Coated Urea	Coating Thickness	Low to Medium
Resin-Coated Urea	Temperature	High
Coated N-P-K	Coating Thickness, Temperature, Moisture	High

1.2. Right Rate: Calculating application rates using soil and tissue testing

	Right Rate 1.2.1.	Perform soil tests, tissue tests, or both to appropriately plan and manage fertilizer applications.
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Guidance: Appropriate rates of N or P applications for crops are determined using recommended rates in the crop-specific University of Florida, Institute of Food and Agricultural Sciences (UF/IFAS) publication(s), where available, or based on another credible source with scientific support (e.g., a calibrated crop response curve for the soil type and crop) and accounting for soil test results prior to planting. Additional N and P may be justified during the growing cycle based on plant tissue testing results. Soil testing provides pH values, indices of phosphorus, potassium, calcium, and magnesium, micronutrients available in the soil, and nutrient rate recommendations for nursery production needs. Nitrogen is not analyzed in soil tests in Florida because it changes forms and is highly mobile. Instead, recommended N application rates are based on many years of crop research. A soil test that is less than one year old is required and must demonstrate a need for P prior to any application of P. If not applying P, it is still good practice to conduct soil tests every three to five years to gauge changes that may occur over time, especially changes in soil pH.


Soil pH is one of the most important properties that affect nutrient availability to the plant and soil microbial activity. Soil pH can be increased by adding lime or dolomite or lowered by adding acidifying materials like elemental sulfur or ammonium fertilizer. The pH of irrigation water should also be considered as it can affect soil pH over the long term. Producers can use soil test results to manage soil pH to improve uptake of N and P. Consider crop nutrient requirements and other current conditions before adding amendments to adjust soil pH.

Plant tissue testing can be used in conjunction with soil testing to diagnose the overall effectiveness of a fertilization program. Due to the mobility of most essential nutrients in soils, plant tissue analysis is one of the best indicators of plant health and nutrition. Potential nutrient deficiencies can be detected with tissue analysis before visual symptoms appear. Leaf tissue analysis may also provide information on induced deficiencies and inferences on plant uptake.


Cut Foliage Production

For cut foliage production, nutrient contributions from water, soil, and pesticides must be determined to aid in planning fertilizer inputs. Water and soil can be analyzed in a lab, and pesticide labels will list the amount of active ingredients – all of which may contain plant nutrients. Soil samples should be taken at the bottom of the effective root zone, which is four to six inches on average, and analyzed by a soil testing lab. Tissue analysis of the elemental composition of


leatherleaf fern fronds can be used throughout the growing season to help determine the effects of nutrient management and aid in diagnosing problems. The lab's turnaround time for results may be problematic for fertilizer application scheduling, depending on the stage of fern growth.

	Right Rate 1.2.2.	Use a soil extraction method listed in Appendix 2 appropriate for the soil type to perform soil test in 1.2.1. The use of other soil extraction methods must be approved by FDACS. Maintain documentation to justify using that method.
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Guidance: When submitting soil samples, request the appropriate soil test extraction method based on soil type (see Appendix 2). If a method other than those set forth in Appendix 2 is requested, be prepared to provide justification for the method used. Follow the fertilization rates in UF/IFAS publications applicable to the crops you are producing, where available, or another credible source with scientific support such as a calibrated crop response curve for the soil type and crop. Retain all documentation used.

	Right Rate 1.2.3.	Regardless of which soil extraction method is used, base the P fertilization rate on recommended rates in the crop-specific University of Florida, Institute of Food and Agricultural Sciences (UF/IFAS) publication(s), where available, or another credible source with scientific support (e.g., a calibrated crop response curve for the soil type and crop). Supplemental application may be justified based on current tissue testing results, soil variability, P availability, or cultivar-specific requirements, or other substantiated production data that demonstrate crop need. Maintain documentation to support application amounts, particularly documentation used to justify application amounts above the recommended rates.
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Guidance: Many of Florida's soils may contain adequate amounts of P, assuming the soil pH is within the correct range to make it available to plants. Managing pH may be impracticable for some commodities. Further, pH may not be the best indicator of P availability in organic and mineral soils in Florida. Applying P in starter fertilizer is warranted. Otherwise, supplemental P is only applied when supported by a calibrated soil test or by tissue testing results or when substantiated production data such as yield, delayed harvest conditions, or marketable crop quality, demonstrate the need for supplemental P.

	Right Rate 1.2.4.	Base the N fertilization rate on recommended rates in the crop-specific UF/IFAS publication(s), where available, or another credible source with scientific support (e.g., a calibrated crop response curve for the soil type and crop). Supplemental application may be justified based on current tissue testing results, results from other technological testing methods, cultivar-specific requirements, or other substantiated production data that demonstrate crop need. Maintain documentation to support application amounts, particularly documentation used to justify application amounts above the recommended rates.
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Guidance: Tissue analysis of the elemental composition of leatherleaf fern fronds can be used throughout the growing season to help determine the effects of nutrient management and aid in


diagnosing problems. The lab's turnaround time for results, however, may be problematic for fertilizer application scheduling, depending on the stage of fern growth.

Field-Grown Production

The amount of fertilizer applied per application and the number of applications per year depend on plant size, species, number of plants per acre, projected market, soil tests, and soil characteristics. The total amount of fertilizer applied per year to plants grown on one acre of land commonly is referred to as the fertilizer application rate. Because nitrogen is the primary growth-limiting nutrient in most production systems, the fertilizer application rate often is given in terms of the amount of nitrogen applied rather than fertilizer applied. When recommended per-tree rates are available, the amount of nitrogen per acre per year to be applied can be calculated using the following formula:

(Rate) lb N per tree × (no.) applications/year × (no.) trees per acre = (Amount) lb N per acre


Granular fertilizers with N-P₂O₅-K₂O ratios of 3-0-2 or 3-0-3 should be applied to trees and shrubs 3 to 4 times per year unless a soil test justifies the addition of phosphorus. Fertilizers should contain 20 to 30 percent long-term or controlled-release nitrogen (e.g., sulfur coated urea). For palms, fertilizers with N-P₂O₅-K₂O-Mg ratio of 4-1-6-2 are needed. The nitrogen, potassium, and magnesium should be supplied as long-term release components. Small amounts of fertilizer applied more frequently to the soil surface should be used to minimize significant quantities of fertilizer moving into surface water or leaching during storm events. Shallow incorporation of fertilizers into the soil can be used to minimize granule movement. Fertilizer applied in the irrigation water (fertigation) in small, frequent amounts also may reduce the potential for surface movement or leaching of fertilizer. For example, if the crop needs 200 pounds of nitrogen per acre per year and 100 irrigation applications are used to supply the nitrogen, then each irrigation application would deliver 2 pounds of nitrogen to 500 plants per acre, or the equivalent of 0.004 pounds of nitrogen per plant per application.

	Right Rate 1.2.5.	Record data, using the NARF or similar form, of all nutrient applications that contain N or P, including the date, and total N and P ₂ O ₅ applied to each field.
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Guidance: Producers must have all required nutrient records ready for FDACS representatives to inspect. The FDACS representative will retain the NARF pertaining to N and P application. When IV site visits are conducted every two years, producers are required to have the following nutrient records ready for inspection to ensure compliance with BMPs.

- Soil and tissue test results as required for each field being fertilized which clearly indicate the crop being grown.
- Justification for using the selected soil test method.
- Area fertilized in acres for each field.
- Amount of fertilizer applied to each field in gallons if using liquid fertilizer or in pounds if using dry fertilizer.
- Fertilizer receipts with formulation, and the density of liquid fertilizer if used.

1.3. Right Time: Timing of fertilizer application

	Right Time 1.3.1.	<p>Match plant growth stage N and P requirements and minimize N and P loss through leaching or runoff by using seasonal applications, split applications, or controlled release/enhanced efficiency fertilizer.</p> <p>If rainfall exceeds 3 inches in 3 days or 4 inches in 7 days, Producers may apply a single supplemental application of N (up to 30 pounds per acre). This supplemental application must occur as soon as practicable following the event but cannot occur within 10 days of the next regularly scheduled application of N. Producers must keep copies of all application records as well as rainfall data and any other records used to justify the supplemental N application.</p>
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Guidance: Schedule fertilizer applications based on the dynamics of plant growth and nutrient demand during the growing season, nutrient loss risks, and field operations. Forecasted rain, potentially leaching rain events (when rainfall exceeds 3 inches in 3 days or 4 inches in 7 days), and other weather events must be considered before applying N or P to nursery stock. Avoid applying fertilizer when soils are saturated. Nursery growers may apply a supplemental application of N (up to 30 pounds per acre) following a leaching rain event that occurs within ten (10) days of a regularly scheduled application. This should not be considered a standard practice.

Avoid applying fertilizer in the days preceding forecasted, potentially leaching rain events or when soils are saturated. Supplemental application of N following a leaching rain event should not be considered a standard practice. Producers should carefully evaluate previous and planned applications of N and their specific situation to determine whether supplemental N is needed following a potentially leaching rain event.

Splitting N or P into several, smaller applications can help maintain available nutrients to the crop for longer time periods and minimize leaching or runoff following rain events. The use of enhanced efficiency fertilizers (EEF) or organic soil amendments that depend on biological processes to release nutrients also reduces risks to water quality when properly managed. The use of EEF sources also influences the timing of fertilization, in that fertilization is required less frequently.

One of the most important principles of fertilizer timing is to avoid fertilizer application to dormant plants or non-growing fields. During dormancy, plants take up little to no nutrients, so any applied N or P is more likely to leach or run off.

1.4. Right Place: Fertilizer application and equipment calibration

	Right Place 1.4.1.	Ensure all fertilizer application equipment is properly calibrated according to the manufacturer's specifications for the type of fertilizer used.
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Guidance: Regular equipment calibration helps ensure proper fertilizer placement. Calibration methods vary based on the type of fertilizer and fertilizer application equipment used. For granular materials, it may be necessary to recalibrate equipment whenever using a new material that has different particle density, size, or flow characteristics. Calibrate equipment according to the manufacturer's recommendations and whenever wear or damage is suspected to have altered

the delivery rate or pattern. When using a spreading service, ensure that the service provider has calibrated the equipment for your site specifications.

Right Place 1.4.2.	Prevent application of fertilizer or other nutrient sources directly to surface waters and sinkholes.
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Guidance: Target nutrient applications in or very near the root zone to maximize plant uptake and limit potential losses from the field. Producers must not apply nutrient sources directly to surface water resources and must observe the applicable setbacks established in this manual. Consult with your FDACS representative to identify those water resources and associated areas where the application should not occur.

Many producers use precision agriculture tools, such as global positioning systems (GPS) and associated navigation instruments (e.g., light-bar system) to guide field application equipment more precisely. Fertilizers can be applied at variable rates throughout a field for more efficient application to reduce water quality effects and provide cost savings.

Field-Grown Production

Soil amendments should be broadcast-incorporated prior to planting, or directed applications used after planting. fertilizer should be placed where the majority of the plant roots are located. This is typically within an area where roots were pruned or within the drip line of the canopy. Fertilizer can be broadcast on the soil surface along the rows of plants or placed in bands or rings around each plant. Care should be taken not to apply fertilizer to areas susceptible to surface erosion.

Right Place 1.4.3.	Use windbreaks or other means (e.g., pot-in-pot) to minimize plant blow-over when applicable.
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Guidance: There is significant potential for water and nutrient leaching in container production nurseries. Using windbreaks or other methods to minimize blow-over helps reduce the risk nutrients being lost. The pot-in-pot method uses a production container nested inside a holder or “socket” container, both of which are buried in the ground. This production method buffers root zone temperatures from extremes, reduces blow-over of large canopy trees, provides insulation in cold climates, and reduces irrigation water amounts compared to conventional containers.

1.5. Fertilizer Storage and Handling

Fertilizer Storage and Handling 1.5.1.	Store fertilizer material (defined as all composted animal waste, biosolids, and/or commercial N or P sources) under a waterproof cover unless used or applied as soon as practicable after delivery.
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Guidance: Fertilizer material (defined as all composted animal waste, biosolids, and/or commercial nutrient sources) can be a significant source of water pollution if not properly handled. Protect fertilizer material from rainfall and other risks of nutrient leaching by covering with impervious material or storing under a roof unless justification is provided (such as sampling or monitoring) to demonstrate that existing storage will not result in nutrient leaching to water

resources. Fertilizer materials should be stored on an impervious surface unless it is demonstrated that it is adequately protected from rainfall and water flowing across the property. Nitrogen-based fertilizer material must always be stored separately from solvents, fuels, and pesticides since many fertilizers are oxidants and can accelerate a fire. When feasible, it is advisable to order or stock only as much dry fertilizer material as needed per application.

Fertilizer Storage and Handling 1.5.2.	Load fertilizer at a location and in a manner that prevents adverse effects on surface waters or sinkholes.
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Guidance: Load fertilizer into application equipment away from wells or waterbodies to prevent possible runoff and water quality effects. Loading over a concrete or asphalt pad with rainfall protection is the preferred practice and makes it easier to recover any spilled material. If this is not feasible, load at random locations in the field to prevent a buildup of any spilled nutrients in one location. Clean up spilled material immediately. Collected material may be applied as fertilizer.

2.0 Irrigation Management

Because water management and nutrient loading to surface and groundwater are linked, good irrigation management involves properly planning for water supply needs for nursery production, maintaining irrigation systems to ensure optimal performance, and protecting wellhead areas to prevent contamination of the water supply. Nursery producers' farms can demonstrate exemplary irrigation management by maintaining the water table at the ideal depth and by irrigating to sustain available soil moisture based on plant water requirements. Contact the appropriate WMD to determine whether a consumptive use or water use permit is required.

2.1 Crop Water Requirements and Irrigation Scheduling

Crop Water Requirements and Irrigation Scheduling 2.1.1.	Manage irrigation based on electronic soil moisture sensors equipped with electrical capacitance probes. If electronic soil moisture sensors are not used, follow practices 2.1.2 or 2.1.3 below.
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Guidance: Soil moisture sensors are some of the best irrigation management tools available. These sensors can be equipped with probes that measure the electrical capacitance of the soil column and aid a producer with managing soil water content to meet production requirements. While soil plasticity has been used historically as an estimation of when to irrigate, such “feel tests” require training and experience and the interpretation is not as accurate or precise as using calibrated and maintained soil moisture sensors.

Crop Water Requirements and Irrigation Scheduling 2.1.2.	Maintain the water table (saturated zone) at a level in proximity to plant rooting depths when using seepage irrigation.
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Guidance: Subsurface (seepage) irrigation involves raising the water table to a desired level by pumping water into ditches or canals and using water control structures to manipulate the water table and reduce the volume of discharge and sediments. Proper design is needed for an effective and efficient system. Ongoing maintenance is also needed to ensure that ditches and water control structures continue to function as designed. Cost share may be available to those producers that require additional water management as an applicable BMP to improve seepage irrigation efficiency to reduce discharges. A water table observation well is an inexpensive management tool used in some parts of Florida that provides a visual indication of surficial (near to the surface) groundwater levels.

Crop Water Requirements and Irrigation Scheduling 2.1.3.	Use decision support tools and information to plan irrigation events and describe these tools in the Comments line [on the BMP Checklist]. Tools may include weather stations, rain gauges, or others.
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Guidance: Evapotranspiration (ET) and other climatic factors affect plant irrigation requirements. Specific ET rates can be obtained for your growing area from the UF/IFAS Florida Automated Weather Network (FAWN) or by using other weather station data. FAWN stations also measure air temperature, soil temperature, wind speed and direction, rainfall, relative humidity, and solar radiation. This information is available at: <http://fawn.ifas.ufl.edu>. Rainfall can also be easily monitored using rain gauges.

Irrigation scheduling consists of determining the correct timing, duration, and frequency of irrigation and is based on factors such as soil water-holding capacity, potential ET rates, and total and projected rainfall. Irrigation system water loss rates are affected by sunlight, wind speed, relative humidity, and air temperatures. Water loss can be reduced by irrigating when conditions do not favor excessive evaporation, especially when overhead irrigation systems are used. When possible, irrigate in the early morning before air temperatures rise and relative humidity drops. This allows sufficient time for infiltration into the soil and for the plant canopy to dry, thereby reducing evaporative losses and disease development. Apply only enough water to wet the entire root zone without leaching water, N, and P.

2.2 Irrigation System Maintenance and Evaluation

Irrigation System, Maintenance, and & Evaluation 2.2.1.		Contact a Mobile Irrigation Laboratory (MIL) or other qualified analyst approved in writing by FDACS to schedule an irrigation efficiency evaluation of your pressurized irrigation system at least every five years.
	2.2.2.	Keep records of MIL evaluations, recommendations, major maintenance and repairs, and system changes made to comply with MIL recommendations.
	2.2.3.	Establish minimum efficiencies and timeframes for repair and recheck, depending on system.
	2.2.4.	Clean and maintain filtration equipment so that it operates within the recommended pressure range.
	2.2.5.	Inspect sprinkler nozzles or emitters annually for wear and malfunction and replace as necessary.
	2.2.6.	Flush and treat irrigation lines regularly to prevent clogging.
	2.2.7.	Ensure that flow meters are properly calibrated and correctly measuring water usage or use other acceptable methodologies.

Guidance: The uniformity of water application and efficiency of an irrigation system tend to decrease over time because of aging, weathering, clogging, and component breakdown unless proper system maintenance is performed. Therefore, the irrigation system itself should be well maintained and operated at the highest irrigation efficiency and uniformity that is practicable.

Maintenance programs for pressurized irrigation systems generally involve filtration, chlorination/acidification, flushing, repair or replacement of clogged nozzles, and observation of performance. Irrigation systems that are well maintained help ensure uniform plant growth, conserve water, and reduce operation and maintenance costs.

Even the best designed, most efficient irrigation system will perform poorly if its components are not properly maintained. Depending upon the extent of irrigation, mobile irrigation laboratories (MILs) will help nursery producers evaluate their system's irrigation uniformity and identify maintenance needs, free of charge. A pressurized system evaluation is recommended every five

years. Nursery producers should also develop and follow an irrigation maintenance program that includes periodic calibration of water meter(s), visual inspections to identify any necessary repairs or corrective actions, minimum efficiencies for pressurized systems, and maintenance timeframes. Producers are encouraged to keep records of all inspection and maintenance activities.

Agricultural irrigation water sources include groundwater, surface water, or non-conventional sources like reclaimed water. Water with elevated chloride and/or dissolved salt concentrations that has an electrical conductivity measurement greater than 1,200 micro-Siemens per centimeter can significantly stress plants, leading to low yield, leaf drop, dieback, and reduction in growth. This condition is especially true for irrigation systems that wet the plant canopy. Moreover, runoff from highly saline irrigation water may cause adverse effects on downstream water resources. It is good practice to obtain routine water quality analyses to help determine whether the water is appropriate to use on nursery plants.

2.3. Additional Irrigation System BMPs for Nursery Operations

Additional Irrigation BMPs for Nursery Operations 2.3.1.	Based on the stage of plant growth, space containers and flats as close as possible to maximize irrigation efficiency.
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Guidance: Efficient use of space while accommodating production operations that have minimal impact on native soils, natural features of the site, and surrounding areas is key to site development and layout. In some cases, regulations and codes govern site development and layout, and must become a part of the operation's prospectus regardless of efficiency.

The amount of irrigation water needed per application will depend on container size, plant size, potting substrate water content, plant spacing, weather conditions, and the ability of the plant's canopy to capture irrigation water that falls between containers.

Container-grown grafted or budded trees are often produced in greenhouses. Nutrition and irrigation management practices are used that ensure successful propagation and growth of marketable trees. Citrus trees are mandated to be grown in closed greenhouses and the duration of production often exceeds many other greenhouse crops. In addition to the applicable BMPs in this manual, nurseries propagating citrus must follow the guidelines of the certification program administered by FDACS, Division of Plant Industry (DPI) pursuant to Rule Chapter 5B-62, F.A.C., and must follow the procedures in the Citrus Nursery Stock Certification Procedure Manual (rev. 08/14), as incorporated by reference in Rule 5B-62.004, F.A.C.

Additional Irrigation BMPs for Nursery Operations 2.3.2.	Calculate the leachate fraction and adjust irrigation run times to minimize the leaching of nutrients.
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Guidance: Container substrate (potting substrate) sampling helps ensure that adequate nutrient levels are maintained throughout the plant's growing period. An easy method to use, developed at Virginia Polytechnic Institute and State University (Virginia Tech), is the "pour-through" method, which involves testing the leachate for nutrient levels. Most fertilizers (except urea) are salts and conduct electricity. Thus, the electrical conductivity (EC) of the leachate is indicative of the fertilizer level within the container.

Additional Irrigation BMPs for Nursery Operations 2.3.3.	Use micro-irrigation or drip irrigation on containers when feasible.
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Guidance: Compared to overhead irrigation, micro-irrigation of container plants can result in water savings. Equipment costs can also be reduced because micro-irrigation systems require smaller pumps and pipe sizes. Micro-irrigation systems have higher initial costs and maintenance requirements, however, and overhead irrigation may still be needed to relieve heat stress during high temperature months.

Additional Irrigation BMPs for Nursery Operations 2.3.4.	Use pulse or cyclic irrigation to decrease the amount of water applied.
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Guidance: Cyclic irrigation also helps avoid exceeding the water-holding capacity of the potting substrate because smaller amounts are applied at timed intervals until the daily water allotment is reached. Compared to continuous irrigation events, cyclic irrigation has been shown to reduce the volume of irrigation runoff and the amount of nitrate leached from containers. Cyclic irrigation can be used with overhead and micro-irrigation, but automation usually is necessary.

Nursery irrigation zones are used to group plants with similar water requirements (e.g., conifer/deciduous, 1gal/7gal, young/old).

Additional Irrigation BMPs for Nursery Operations 2.3.5.	Test irrigation source water quality annually for water chemistry that may result in irrigation system plugging if using micro-spray, micro-drip, mist or other irrigation systems with small emitter openings.
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Guidance: Irrigation water quality is a critical factor in the production of container-grown nursery plants. Poor quality water applied with overhead sprinkler irrigation can damage foliage, change potting substrate pH, or create unsightly foliar residues or stains. Poor quality water can also clog micro-irrigation emitters and cause non-uniform applications. Annual testing of the irrigation water source will help growers characterize their source water quality.

Additional Irrigation BMPs for Nursery Operations 2.3.6.	If your container operation has a watering station used to irrigate plants immediately after potting, collect runoff in a small basin, direct the runoff to an existing basin, or route runoff through an onsite vegetative treatment area.
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Guidance: A central potting location is common for nurseries that produce container plants outdoors or under shade. At this location, containers are filled with potting substrate and plants are transplanted, after which they are moved to a watering station where plants are irrigated thoroughly. Irrigation water is applied rapidly with high-volume, shower like nozzles that are elevated above the plants. Plants are passed through the water station several times. A large volume of water is applied to “settle” the potting substrate around roots and ensure that it achieves maximum water-holding capacity. Water not retained by the container becomes runoff in addition to the water that fell between containers. Soluble nutrients from the potting substrate along with extraneous fertilizer granules can be readily transported in this runoff. Use of a catch basin to collect runoff provides retention time to capture nutrients.

If you are considering incorporating a water recovery system into the nursery, be aware that daily fluctuations can occur in nutrient content of leachates, especially when fertigating. During a yearly production cycle, water quality should at least be monitored:

- Right after potting activities
- Once during the winter and summer periods
- Once during dry or wet periods.

Additional Irrigation Maintenance BMPs for Nursery Operations 2.3.7.	When using irrigation for frost/freeze protection, monitor wet-bulb temperatures to determine when to turn off the system.
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Guidance: The wet bulb temperature can be used to determine when it is safe to shut down irrigation systems used for cold protection. When the wet bulb temperature is 32°F or higher, the irrigation system can be stopped without danger to any part of the plant.

There is always a risk when using irrigation systems - micro-sprinkler or conventional sprinkler - for cold/frost protection. Low humidity and wind can produce weather conditions that result in a wet bulb temperature - the lowest temperature to which air can be cooled by evaporating water into it - 5°F to 6°F lower than the air temperature. Therefore, plant surfaces that have been wetted by irrigation systems, and subsequently exposed to evaporation, can end up 5°F to 6°F cooler than the air temperature. This may result in plant damage if the wet bulb temperature is below the critical minimum temperature (CMT) for your particular crop. When the wet bulb temperature is equal to or above your CMT, there is no risk of cold-air damage due to evaporative cooling. Therefore, irrigation systems can be safely turned off when the wet bulb temperature reaches your CMT or higher.

The Wet Bulb-Based Irrigation Cutoff Temperature calculator calculates an air temperature at which the wet bulb and your CMT would be equal. It is based on a user-selected critical temperature and the difference between the observed air and wet bulb temperatures, and is calculated for each FAWN site. Once the cutoff temperature has been reached and irrigation

systems have been turned off, it is not necessary to continue irrigation until all ice has melted from the plant.

Overhead sprinkler irrigation has proven to be one of the most effective means of protecting a variety of crops against frost/freeze damage. A properly designed system can protect crops to temperatures as low as 20° F. In order to be effective in protecting crops, the sprinkler system must be properly designed. For this reason, it is always advisable to have the system designed by a competent irrigation designer. In addition, the system must be operated correctly to achieve the desired results. It is the grower's responsibility to see that he is properly informed to operate the system effectively. Timing is critical in protecting crops from frost/freeze damage.

3.0 Water Resource Protection

The following section describes several types of waterbodies and methods for protecting them from potential water quality effects.

3.1 Stream and River Protection

Stream and River Protection 3.1.1.	On fields adjacent to perennial streams, rivers, or regional canal systems flowing through the enrolled property, use riparian buffers, field borders, filter strips, or non-fertilized vegetated filter strips that are not less than 25 feet wide.
3.1.2.	Maintain the above riparian buffers, field borders, filter strips, or non-fertilized vegetated filter strips to ensure those features function as designed.

Guidance: One of the most effective ways to prevent P, N, sediments, and pollutants from entering streams and rivers is by establishing non-fertilized vegetated buffers. Vegetated buffers are non-cultivated areas that retain water and soil onsite to help reduce pollutants in surface water runoff. Vegetated buffers may include riparian buffers, field borders, filter strips, and grassed waterways, and are particularly effective in providing water quality treatment near sensitive discharge areas. Field borders are strips of either natural or planted permanent vegetation at the edge or perimeter of fields. Field borders help reduce erosion from wind and water, protect soil structure and water quality, and provide wildlife habitat. Filter strips and grassed waterways are areas of permanent vegetation between production areas that drain to natural waterbodies, decreasing runoff velocity and removing sediments and their associated nutrients before they reach surface waters.

Riparian buffers can consist of deep-rooted trees, shrubs, or forested area (Zone 1); herbaceous vegetation (Zone 2); and grass filter strips (Zone 3). While three separate zones are preferable, riparian buffers should consist of at least Zones 1 and 2. Refer to NRCS CPS Riparian Forest Buffer (Code 391) for details.

Stream and River Protection 3.1.3.	Revegetate bare areas in the above riparian buffers, field borders, filter strips, or non-fertilized vegetated filter strips if the bare areas reduce the function of the buffer.
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Guidance: Riparian buffers are highly effective, although regular maintenance is required for them to remain so. Producers must inspect riparian buffers frequently and repair rills or channels that may develop following heavy rain. Revegetate bare areas to ensure the effectiveness of buffers.

3.2 Springs and Sinkholes

Springs and Sinkholes 3.2.1.	Buffer springs and spring runs with a minimum of 100 feet of non-fertilized vegetation.
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3.2.2.	Buffer sinkholes and other visible karst features with a minimum of 50 feet of non-fertilized vegetation.
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Guidance: Spring water directly reflects the quality of groundwater in an area. FDEP works with the WMDs and local stakeholders to define the major groundwater contributing areas for springs (i.e., springsheds), and to identify measures to help restore springs water quality in relevant BMAPs. Nursery producers can protect spring water quality by preventing N from leaching into groundwater. Implementing the 4R principles and recommended irrigation management strategies will help nursery producers comply with groundwater and springs regulations.

Springs and Sinkholes 3.2.3.	Never dispose of any materials into sinkholes.
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Guidance: Sinkholes provide direct access to the groundwater that supplies drinking and irrigation water; therefore, never use sinkholes to dispose of trash, clippings, or other material. Vegetated buffers around sinkholes and visible karst features may be required in some cases to prevent runoff into groundwater.

Springs and Sinkholes 3.2.4.	In Outstanding Florida Springs BMAPs adopted by FDEP, do not exceed appropriate fertilizer rates for N, based on crop nutrient requirements as described in practice 1.2.4 above.
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Guidance: Part VIII, Chapter 373, F.S., includes more stringent springs protection requirements within an Outstanding Florida Springs (OFS) BMAP. Nursery operations in BMAP areas are required to implement BMPs and to consider adopting new, emerging technologies to help protect springs and other water resources. Within OFS BMAPs, do not exceed appropriate agronomic rates for N, which is the limiting nutrient for springs and groundwater.

3.3 Wetlands and Lakes

Wetlands and Lakes 3.3.1.	Buffer wetlands with a minimum of 25 feet of non-fertilized vegetation or consistent with ERP buffers when they are established by permit.
3.3.2.	Buffer impaired waterbodies located within adopted BMAP areas with a minimum of 50 feet of non-fertilized vegetation or consistent with ERP buffers when they are established by permit.

Guidance: 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. Use an NRCS county soil survey map to help identify the locations of wetlands, hydric soils, or frequently flooded areas. If you do not have an ERP,

(which requires a wetlands delineation map) seek technical assistance from the applicable WMD to determine if there are wetlands on the nursery operation. Rule Chapter 62-340, F.A.C., provides the methodology that state and local governments in Florida use to determine the boundaries between wetlands and uplands and other surface waters.

Under certain conditions, enhancement or restoration of wetlands may be a BMP-eligible cost share practice or project to control N and P. For example, nutrient retention in wetland soils and in biomass can be an effective BMP to prevent loss of N and P offsite. If considering this approach, your local FDACS, NRCS, or WMD representatives can provide assistance and possible financial support. Do not dredge or fill in wetlands unless you are issued a permit or are determined to be exempt. It is important to consult with FDACS, the local WMD, and the NRCS prior to conducting activities in or near wetlands to ensure compliance with any permitting requirements or NRCS program eligibility requirements. Wetlands and lakes benefit from non-fertilized vegetated buffers.

3.4 Ditch and Canal Maintenance and Water Management

Ditch and Canal Maintenance and Water Management 3.4.1.	Maintain perennial herbaceous vegetation on all ditch and canal banks to protect them from erosion or provide an alternative means for preventing sediment from moving off site.
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Guidance: Some nursery operations use ditches to manage stormwater runoff from fields. Ditches can carry sediments, N, and P from fields into receiving waters. Ditches that are properly designed and maintained, however, provide treatment and minimize effects on water quality. In many cases, vegetation on ditch banks or in ditches will protect the ditches from erosion and trap sediments to prevent offsite transport downstream. When properly maintained, water control structures also help to slow the velocity of ditch water and prevent bank erosion. Retaining water in ditches promotes nutrient removal and sediment settling. Vegetated buffers along ditch and canal banks also help stabilize banks, and trap and reduce sediments, N, and P from entering these conveyances. Use care to minimize the buildup of vegetated debris in waterways and irrigation ditches, and never dump debris in wetlands.

Ditch and Canal Maintenance and Water Management 3.4.2.	When sediments are observed in runoff moving off site, work with FDACS to evaluate the feasibility of implementing appropriate settling measures.
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Guidance: Where water resource concerns are identified, producers must implement appropriate practice(s) which may include installation or management of existing water control structures to hold water onsite. Doing this will improve the existing hydrologic conditions and reduce the runoff. Before installing new (non-replacement) water control structures, contact FDACS for technical assistance and cost share availability, and work with the representative to determine appropriate settling measures.

Ditch and Canal Maintenance and Water Management 3.4.3.	Operate and maintain water control structures to minimize the movement of N, P, and sediments off site.
3.4.4	Operate and maintain water control structures to minimize the admission of aquatic vegetation into downstream public waterways.

Guidance: Routinely remove any accumulated aquatic weeds at the riser board control structure(s) to maintain proper drainage.

Ditch and Canal Maintenance and Water Management 3.4.5.	Do not remove sediments below the ditch's original invert elevation unless installation or maintenance of sumps or sediment traps is required. Original invert elevations can be determined by engineering drawings or changes in soil characteristics and color.
3.4.6.	Ensure that pump intakes are sufficiently elevated from the bottom of water conveyances, or consistent with an ERP to reduce sediment and debris in offsite discharges.

Guidance: Pumps are often used to move water within a nursery operation, depending on the situation or need. Axial flow pumps are typically chosen when there is a need to move surface water from one body of water to another (e.g., ditch to ditch, pond to ditch) because they can quickly move large amounts of water using less energy consumption compared to other pumps. It is important for producers to minimize offsite discharges and comply with permit requirements for pumped discharges. Placing the pump intake above the ditch invert is necessary to minimize the disturbance of the bottom of the ditch when the pump is operational. Automation can allow the pump to shut off when the water level in the ditch drops to a point below the intake where further drainage could cause the pump to intake air and malfunction.

3.5 Erosion Control

Site characteristics such as clay soils, sandy soils, or sloped terrain can significantly increase the risk of erosion and offsite sediment transport. Removal of natural vegetation and topsoil further increases the potential for soil erosion. The most effective method of erosion control uses vegetation to hold soil in place and decrease the velocity of runoff water.

Erosion Control 3.5.1.	Construct and maintain above-grade access roads so that they minimize the impeding or diversion of surface water flow.
3.5.2.	Maintain vegetative cover or alternative means for stabilizing road banks to prevent sediments from moving offsite. Describe the alternative means in the Comments section [of the BMP Checklist].
3.5.3.	Locate and size permanent crossing areas over surface waters to minimize adverse effects to water resources.
3.5.4.	Stabilize all crossings over streams and creeks using rocks, culverts, bridges, or other methods to prevent erosion.

Guidance: Properly constructed access roads help prevent water quality effects by eliminating the formation of gullies. If improperly constructed, access roads are a potential source of long-term erosion and sedimentation problems. Access roads constructed entirely in uplands, at or near grade, usually result in little to no effects to water resources. Above-grade access roads with appropriately-sized culvert crossings to maintain surface water flows also pose little to no water resource threats when properly designed, constructed, and maintained. Refer to NRCS CPS Code 560 and Code 578 for guidance on designing and constructing access roads and crossings to prevent impacts to water quality.

Check with the appropriate WMD when constructing access roads through wetland areas or over navigable waterways to determine how to remain in compliance with district regulations.

Erosion Control 3.5.5.	Utilize cover crops on fields not in production for preventing soil erosion in field grown nursery operations.
3.5.6.	Ensure that plant row orientation is compatible with topographic features of the site.
3.5.7.	Maintain vegetation between rows to prevent soil erosion.

Guidance: Fields that are not in production should be planted with non-invasive species that will stabilize the soil and produce biomass that can be incorporated into the soil to enhance structure and improve nutrition for future crops. Leguminous cover crops should be considered for their capacity to increase soil N fertility. If your operation includes field-grown nursery stock, utilize cover crops to prevent soil erosion on fields that are not in production. Cover crops protect the soil surface from erosive forces such as wind and rain, while their roots stabilize the soil structure and enhance water infiltration. Implementing cover crops is not only beneficial for soil conservation but also for maintaining soil fertility and water quality.

Topographic features of the land such as slope, water conveyance and surface water storage areas, protected areas, and vegetative buffers may affect the location, orientation, number of rows planted, and number of plants per acre. The number of plants per acre is determined by plant spacing, which reflects market plant size, access to fields and plants, and equipment used for transporting or producing plants. Transportation needs, farm equipment size, and turning radii can dictate the width of field borders, the space between rows, or distance between plants within a row. Efficient use of space while accommodating production operations that have minimal impact on native soils, natural features of the site, and surrounding areas is key to site development and layout. In some cases, regulations and codes govern site development and layout and must become a part of the operation's prospectus regardless of efficiency.

Vegetation maintained between rows, in field borders, in grassed waterways, road banks, and other open areas stabilizes soil and minimizes erosion from wind and storm events. Perennial non-invasive plants are best for these areas. These plants should be easily maintained and form a dense mat when mowed. As water moves across this vegetation, velocity is slowed, enhancing the settling of particulates and associated contaminants. Aside from planted vegetated areas, swales, surface water detention and collection areas, natural riparian areas, and/or onsite wetlands may be used for additional water quality treatment before water is discharged from the property.

Organic mulches may be used in place of vegetation between plant rows. Mulch will stabilize the soil and minimize erosion, particularly if used for travel lanes. Mulch placed within rows also helps conserve soil moisture and can suppress weed growth and the need for mowing or herbicide applications. Fields that are not in production should be planted with non-invasive species that will stabilize the soil and produce biomass that can be incorporated into the soil to enhance structure and improve nutrition for future crops. Leguminous cover crops should be considered for their capacity to increase soil N fertility.

3.6. Wellhead Protection

Wellhead Protection 3.6.1.	Inspect wellheads and pads for significant leaks or cracks and make any necessary repairs.
3.6.2.	Prevent contamination by using backflow prevention devices at wellheads if injecting fertilizer or chemicals, or if shared with a potable use source.
3.6.3.	Cap or valve any existing flowing wells.

Guidance: With most of Florida's water supply originating from groundwater, it is important for agricultural operations to protect wellheads from contamination. Contact your WMD before installing a new well to determine if a construction permit and/or Consumptive Use Permit is required.

Locate new wells away from possible pollutant sources, such as petroleum storage tanks, septic tanks and drainfields, chemical mixing areas, or fertilizer storage facilities. Regularly inspect wellheads and pads for leaks or cracks, and repair structures to prevent possible groundwater contamination. For existing wells, backflow prevention devices are required if injecting any fertilizers or chemicals or if connected to any potable water use.

3.7. Non-Fertilizer Material Storage and Handling

Non-Fertilizer Material Storage and Handling 3.7.1.	Store pesticides, separate from fertilizers, in an enclosed, roofed structure with an impervious floor and lockable door, at least 100 feet away from wells, surface waters, or sinkholes.
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Guidance: Proper storage, handling, and disposal of pesticides, solvents, and other chemicals can help avoid adverse environmental effects, protect the water supply, and reduce exposure of the owner to legal liability for contamination and cleanup. Store these materials under a roof, and ideally on an impervious surface that does not have floor drains. Some pesticides include active ingredients that are toxic or poisonous to humans and should be stored in a more secure manner than fertilizers.

Non-Fertilizer Material Storage and Handling 3.7.2.	Mix and load pesticides on an impermeable surface, use portable mix/load stations, or conduct any field mix/load activities at random locations in the field.
3.7.3.	Recycle or properly dispose of used oil, solvent bath waste, and antifreeze in accordance with state and federal laws.

Guidance: Load pesticides into application equipment away from wells and surface waterbodies. A concrete or asphalt pad with rainfall protection is an ideal mix/load site, as this permits easy recovery of spilled material. If this is not feasible, loading at random locations in the field is acceptable and will prevent a buildup of pesticide residues in one location. Clean up spilled material immediately.

3.8 Additional Water Resource Protection BMPs for Nursery Operations

Additional Water Resource Protection Practices for Nursery Operations 3.8.1	Compost vegetation debris, or properly dispose of the material.
3.8.2	If composting, establish a nursery composting area that is at least 100 feet away from wetlands, delineated floodplains, and other water bodies.

Guidance: Debris management involves minimizing the generation of wastes and properly managing discarded plant material and potting substrate to protect water resources.

It is important to dispose of discarded plant material and other wastes properly. Careless or illegal dumping or disposal may spread non-native nursery plants to natural areas. Depending on the situation and local ordinances, several options are available to dispose of plant material. Materials can be burned, composted, and/or staged in disposal areas pending shipment offsite.

Natural nursery waste products, or debris, which can include old potting substrate and/or discarded plants, can be a source of pollution that is not readily recognized by nursery personnel. On-site composting is a practical way to deal with this product to minimize the generation of routine nursery wastes that might otherwise be destined for a permitted landfill. Composting also helps prevent unintended water quality impacts from unmanaged debris areas. Using compost material at a volume in excess of 25%, however, may result in plant toxicity issues.

By following the basic steps outlined below, nurseries can create a beneficial product that can be reused onsite, or possibly sold to others in the trade:

- Separate woody and herbaceous plant material before composting. Chip woody wastes, if needed.
- Use a compost storage/processing area that is not prone to leaching (i.e., impermeable, or concrete base).
- Redirect surface runoff to prevent it from entering the composting site.

- Place larger-sized debris underneath smaller debris when composting dead nursery plants.

The finished compost product can be used onsite. It can be used to fill in holes after digging trees, for landscape use, or to augment potting substrate. Before using compost-amended product, test for electrical conductivity.

4.0 Reference Materials

The reference material listed below is intended for informational purposes and is not intended to be incorporated by reference pursuant to Rule 1-1.013, F.A.C.

Nutrient Management References

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Water Resource Protection References

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The following NRCS Field Office Technical Guide documents were referenced in the compilation of this manual and used to support FDEP initial verification.

NRCS Conservation Practice Codes

Nutrient Management

Code 590	Nutrient Management
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Irrigation Management

Code 441	Irrigation System – Microirrigation
Code 442	Irrigation Sprinkler System
Code 447	Irrigation Tailwater Recovery
Code 449	Irrigation Water Management
Code 554	Agricultural Drainage Management
Code 570	Irrigation Field Ditch
Code 607	Surface Drainage Field Ditch
Code 608	Surface Drainage Main or Lateral

Water Resource Protection

Code 309	Agrichemical Handling Facility
Code 327	Conservation Cover
Code 342	Critical Area Planting
Code 350	Sediment Basin
Code 351	Well Decommissioning
Code 378	Pond
Code 386	Field Border
Code 388	Irrigation Field Ditch
Code 390	Riparian Herbaceous Cover
Code 391	Riparian Forest Buffer
Code 393	Filter Strip
Code 410	Grade Stabilization
Code 412	Grassed Waterway
Code 527	Karst Sinkhole Treatment
Code 554	Drainage Water Management
Code 560	Access Road
Code 561	Heavy Use Protection Area
Code 570	Runoff Management System
Code 578	Stream Crossing
Code 580	Streambank and Shoreline Protection
Code 587	Structure for Water Control
Code 595	Pest Management
Code 603	Herbaceous Wind Barrier
Code 612	Tree/Shrub Establishment

Code 642
Code 755

Water Well
Well Plugging

5.0 Appendices

Appendix 1: Glossary

The definitions that follow only apply to *Florida Nursery Operations, 2024 Edition: Water Quality and Water Quantity Best Management Practices*.

Basin management action plan (BMAP) – (Section 403.067(7)(a), F.S.). The "blueprint" for restoring impaired waters by reducing pollutant loadings to meet the allowable loadings established in a total maximum daily load (TMDL). A BMAP represents a comprehensive set of strategies—permit limits on wastewater facilities, urban and agricultural BMPs, conservation programs, financial assistance, revenue generating activities, etc.—designed to implement the pollutant reductions established by the TMDL. BMAPs are broad-based plans developed with local stakeholders. BMAPs rely on local input and local commitment and are adopted by FDEP Secretarial order to be enforceable. Enrollment and proper implementation of BMPs, when verified by IV site visits and record retention, fulfills agricultural responsibilities under a BMAP.

Best management practice (BMP) – (section 373.4595(2)(a), F.S.). 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 discharges. BMPs for agricultural discharges shall reflect a balance between water quality improvements and agricultural productivity.

Biosolids – (rule 62-640.200, F.A.C.) means the solid, semisolid, or liquid residue generated during the treatment of domestic wastewater in a domestic wastewater treatment facility, formerly known as “domestic wastewater residuals” or “residuals.” Not included is the treated effluent or reclaimed water from a domestic wastewater treatment plant. Also not included are solids removed from pump stations and lift stations, screenings and grit removed from the preliminary treatment components of domestic wastewater treatment facilities, other solids as defined in subsection 62-640.200(30), F.A.C., and ash generated during the incineration of biosolids. Biosolids include products and treated material from biosolids treatment facilities and septage management facilities regulated by FDEP.

Note: Class AA biosolids, which are considered commercial fertilizer, are excluded from regulation under Rule Chapter 62-640, F.A.C.

Fertilizer – (section 576.011, F.S.) any substance which:

- (a) Contains one or more recognized plant nutrients and promotes plant growth; or
- (b) Controls soil acidity or alkalinity; or
- (c) Provides other soil enrichment; or
- (d) Provides other corrective measures to the soil.

The term “fertilizer” does not include unmanipulated animal or vegetable manures, peat, or compost which make no claims as described in paragraphs (a)-(d).

Karst – A type of topography formed by dissolution of bedrock in areas underlain by limestone, dolostone or, as in some western states, gypsum. Such terrain has underground drainage

systems that are reflected on the surface as sinkholes, springs, disappearing streams or even caves. (Florida Geological Survey, 2019).

Manure – (rule 62-701.200, F.A.C.), means a solid waste composed of excreta of animals, and residual materials that have been used for bedding, sanitary or feeding purposes for such animals.

Nonpoint source pollution – Any source of water pollution that does not meet the legal definition of “point source” in section 502:(14) of the Clean Water Act. **“Point source”** means any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged. This term does not include agricultural storm water discharges and return flows from irrigated agriculture.

Outstanding Florida Springs (OFS) – (section 373.802(5), F.S.). Includes all historic first magnitude springs, including their associated spring runs, as determined by the FDEP using the most recent Florida Geological Survey springs bulletin, and the following additional springs, including their associated spring runs:

- (a) De Leon Springs;
- (b) Peacock Springs;
- (c) Poe Springs;
- (d) Rock Springs;
- (e) Wekiwa Springs; and
- (f) Gemini Springs.

The term does not include submarine springs or river rises.

Pesticide – (section 487.021, F.S.) means any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any insects, rodents, nematodes, fungi, weeds, or other forms of plant or animal life or viruses, except viruses, bacteria, or fungi on or in living humans or other animals, which the department by rule declares to be a pest, and any substance or mixture of substances intended for use as a plant regulator, defoliant, or desiccant; however, the term “pesticide” does not include any article that:

- (a) Is a “new animal drug” within the meaning of section 201(w) of the Federal Food, Drug, and Cosmetic Act;
- (b) Has been determined by the Secretary of the United States Department of Health and Human Services not to be a new animal drug by a regulation establishing conditions of use for the article; or
- (c) Is an animal feed within the meaning of section 201(x) of the Federal Food, Drug, and Cosmetic Act bearing or containing an article covered in this subsection.

Pollutant – A constituent that results in pollution, as defined in section 403.031(11), F.S.

Potable water well – (rule 62-521.200, F.A.C) means any water well which supplies water for human consumption to a community water system or to a non-transient non-community water system. For the purpose of this rule, any potable water well installed by an installation used to serve that installation’s operation is excluded from this definition.

Regional canal system – Water conveyances operated and controlled by local governments, special districts, Water Management Districts, or other governmental entities that typically serve larger geographic areas and multiple landowners and properties.

Riparian – Ecosystems along a waterbody, characterized by a high-water table and subject to periodic flooding and influence from the adjacent waterbody.

Sinkhole – A naturally occurring geological feature that has an open connection to groundwater. Areas that have topsoil and a root zone over the entire area or ponded areas that do not have an open connection to groundwater are not considered sinkholes for the purposes of this manual.

Spring – (Florida Geological Survey Bulletin 66, 2004). A point where underground water emerges to the earth's surface (including the bottom of the ocean). Springs flow naturally from underlying aquifers and are classified based on their magnitude, or amount of flow coming from the spring vent. First magnitude springs discharge 64.6 million gallons per day (MGD) or more; second magnitude springs discharge from 6.46 to 64.6 MGD.

Springshed – (section 373.802(7), F.S.). Areas within the groundwater and surface water basins which contribute, based upon all relevant facts, circumstances, and data, to the discharge of a spring as defined by potentiometric surface maps and surface watershed boundaries.

Stream – (section 373.019(20), F.S.). Any river, creek, slough, or natural watercourse in which water flows in a defined bed or channel.

Surface waters – (Rule 62-302.200, F.A.C.). Water upon the surface of the earth, whether contained in bounds created naturally or artificially or diffused. Water from natural springs is classified as surface water when it exits from the spring onto the earth's surface.

Total maximum daily load (TMDL) – (Section 303(d) of the Clean Water Act, 33 U.S.C. §1251 et seq. (1972)). The calculation of the maximum amount of a pollutant allowed to enter a waterbody so that the waterbody will meet and continue to meet water quality standards for that particular pollutant. A TMDL determines a pollutant reduction target and allocates load reductions necessary to the source(s) of the pollutant.

Waters – (section 403.031, F.S.). Include, but are 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 section 403.0885, F.S., 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. (Additional text pertaining to waters of the state is provided in statute.).

Well – (section 373.303(7), F.S.) means any excavation that is drilled, cored, bored, washed, driven, dug, jetted, or otherwise constructed when the intended use of such excavation is for the location, acquisition, development, or artificial recharge of groundwater, but such term does not include any well for the purpose of obtaining or prospecting for oil, natural gas, minerals, or products of mining or quarrying; for inserting media to dispose of oil brines or to repressure oil-bearing or natural gas-bearing formation; for storing petroleum, natural gas, or other products; or

for temporary dewatering of subsurface formations for mining, quarrying, or construction purposes.

Wellhead – The structure directly over or adjacent to a well.

Wetlands – (section 373.019(27), F.S.) means those areas that are inundated or saturated by surface water or groundwater at a frequency and 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.

Appendix 2: Soil and Tissue Testing

Soil Testing

Basic soil testing involves four major steps: sample collection, sample analysis, interpreting results, and applying results on the operation. Consult with the soils laboratory or UF/IFAS County Extension agents for assistance with soil sampling to ensure reliable results, interpretation, and application.

The following list includes standard extraction methods used at the UF/IFAS Extension Soil Testing Laboratory and most private laboratories for different soil types in Florida.


1. Mehlich-3 extraction – Used on mineral or organic soils over most pH levels.
2. AB-DTPA extraction – Used on alkaline (calcareous) soils with a pH of 7.4 and above.
3. Water extraction – Used for extraction of P on organic soils.
4. Bray 1 or Bray 2 extraction – Used for extraction of P on organic and mineral soils.
5. Ammonium acetate extraction – Used for extraction of phosphorus, potassium, magnesium, calcium, and silicon on mineral soils.
6. Mehlich-1 extraction – Used for mineral soils with pH 6.5 or less.

More information regarding soil testing for plant-available nutrients can be found in the extension publication SL 408, at: <https://edis.ifas.ufl.edu/publication/SS621>.

Tissue Testing

Tissue analysis offers an estimate of a plant's nutritional status at the time of sampling. Nutrient deficiencies can be detected with tissue analysis before visual symptoms appear.

Appendix 3: Example Record Keeping Forms

Practices on the BMP Checklist preceded with a pencil icon () require records that must be kept for a minimum of five years to demonstrate compliance with the applicable BMPs for the subject parcel. All records are subject to collection and review pursuant to the requirements of section 403.067, F.S.

Producers are encouraged to maintain their records in electronic form for ease in completing the required implementation verification (IV) site visit. Examples of records are shown below. OAWP has developed an Excel spreadsheet, available upon request, that can assist producers with keeping nutrient records. Contact an FDACS representative for a copy of the spreadsheet, choose commercially available recordkeeping software suited to your operation, or develop your own record keeping system to assist with IV site visit requirements.

Soil Sample Records (Retain all Laboratory Results)

SAMPLE DATE	FIELD LOCATION	# of SAMPLES	NAME OF LABORATORY	RECORDS LOCATION

Fertilizer Records (Retain Receipts)

Field Name:				Production Acreage:		Year:		
Brand	Application method	Grade N-P ₂ O ₅ -K ₂ O	% CRN	% CRP ₂ O ₅	Amount of fertilizer applied (lbs./total production acreage)	Amount of fertilizer applied (lbs./acre)	Total N applied (lbs./acre) or (lbs./100 linear bed foot)	Total P ₂ O ₅ applied (lbs./acre)

Tissue Sample Records (Retain all Lab Results)

SAMPLE DATE	FIELD LOCATION	# of SAMPLES	NAME OF LABORATORY	RECORDS LOCATION

Rainfall (inches)

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

Ditch/Waterway Records

LOCATION	DESIGN CROSS SECTION	CURRENT CROSS SECTION	DATE OF LAST CROSS SECTION INSPECTION	RECORDS LOCATION