Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

NUTRIENT MANAGEMENT

CODE 590

(ac)

DEFINITION

Managing the amount (rate), source, placement (method of application), and timing of plant nutrients and soil amendments.

PURPOSE

This practice is used to accomplish one or more of the following purposes–

- To budget, supply, and conserve nutrients for plant production
- To minimize agricultural nonpoint source pollution of surface and ground water resources
- To properly utilize manure or organic by- products as a plant nutrient source
- To protect air quality by reducing odors, nitrogen emissions (ammonia, oxides of nitrogen), and the formation of atmospheric particulates
- To maintain or improve the physical, chemical and biological condition of soil

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all lands where plant nutrients and soil amendments are applied. This standard does not apply to one-time nutrient applications to establish perennial crops.

CRITERIA

General Criteria Applicable to All Purposes

Plans for nutrient management must comply with all applicable Federal, state, and local laws, rules, and regulations. See the Reference Section for the specific laws.

Plans for nutrient management must be developed in accordance with requirements of the Natural Resources Conservation Service (NRCS) General Manual Title 190, Part 402, Nutrient Management; technical requirements of the NRCS Field Office Technical Guide (FOTG); procedures contained in the National Planning Procedures Handbook (NPPH), and the NRCS National Agronomy Manual (NAM) Section 503.

Impact to cultural resources, wetlands, and Federal and State protected species needs to be determined prior to implementation of this practice. Any impacts need to be avoided or minimized to the extent practical during planning, design and implementation of this conservation practice in accordance with established National and Florida NRCS policy, General Manual (GM) Title 420-Part 401, Title 450-Part 401, and Title 190-Parts 410.22 and 410.26; National Planning Procedures Handbook (NPPH) FL Supplements to Parts 600.1 and 600.6; National Cultural Resources Procedures Handbook (NCRPH); and The National Environmental Compliance Handbook (NECH).

A nutrient budget for nitrogen, phosphorus, and potassium must be developed that considers all potential sources of nutrients including, but not limited to, green manures, legumes, crop residues, compost, animal manure, organic by-products, biosolids, waste water, organic matter, soil biological activity, commercial fertilizer, and irrigation water.

Plans for nutrient management shall specify the source, amount, timing and method of application of nutrients on each field or area planned and is compatible with realistic production goals and specify mitigation practices or efforts to minimize losses of nutrients and other potential contaminants to surface and/or ground waters.

Enhanced efficiency fertilizers, used in Florida must comply with the definition by the Association of American Plant Food Control Officials (AAPFCO) and be accepted for use by Florida Department of Agriculture and Consumer Services' (FDACS) Division of Agricultural Environmental Services Bureau of Compliance Monitoring has responsibility for verification of product guarantees, ingredients (by AAPFCO definition) and label claims.

For nutrient risk assessment policy and procedures see Title 190, General Manual (GM), Part 402, Nutrient Management, and Title 190, National Instruction (NI), Part 302, Nutrient Management Policy Implementation.

The NRCS-approved nutrient risk assessment for nitrogen must be completed on all sites unless Florida NRCS, with the concurrence of Florida Department of Environmental Protection (DEP) has determined specific conditions where nitrogen leaching is not a risk to water quality, including drinking water.

The NRCS-approved nutrient risk assessment for phosphorus (Florida P-Index) must be completed when:

- Phosphorus application rate exceeds UF/IFAS fertility rate guidelines for the planned crop(s), or
- The planned area is within a phosphorus- impaired watershed (contributes to 303d- listed water bodies), or
- The Florida NRCS and Florida DEP have not determined specific conditions where the risk of phosphorus loss is low.

A phosphorus risk assessment will not be required when Florida NRCS, with concurrence of Florida DEP has determined specific conditions where the risk of phosphorus loss is low. These fields must have a documented agronomic need for phosphorus; based on soil test phosphorus (STP) and UF/IFAS nutrient recommendations.

Soil, Manure, and Tissure Sampling and Laboratory Analysis (Testing)
Nutrient planning should be based on current soil, manure, and tissue (where used as a supplement) test results developed in accordance with University of Florida, Institute of Food and Agricultural Sciences (UF/IFAS) guidance or industry practice recognized by UF/IFAS.

Current soil tests are those that are no older than 3 years, but may be taken on an interval recommended by UF/IFAS or as required by Florida code (i.e., Biosolids, Chapter 62-640 (F.A.C.). The area represented by a soil test must be that acreage recommended by UF/IFAS Soil Testing Procedure.

Where a conservation management unit (CMU) is used as the basis for a sampling unit, all acreage in the CMU must have similar soil type, cropping history, and management practice treatment.

Soil test analyses must be performed by laboratories successfully meeting the requirements and performance standards of the North American Proficiency Testing Program-Performance Assessment Program (NAPT-PAP) under the auspices of the Soil Science Society of America (SSSA) and NRCS, or other NRCS-approved programs that consider laboratory performance and proficiency to assure accuracy of soil test results. Alternate proficiency testing programs must have stakeholder (e.g., FL DEP, NRCS State Staff, growers, and others) support and be regional in scope.

The soil and tissue tests must include analyses pertinent to monitoring or amending the annual nutrient budget, e.g., pH, electrical conductivity (EC) and sodicity where salts are a concern, soil organic matter, phosphorus, potassium, or other nutrients and test for nitrogen where applicable. Follow UF/IFAS guidelines regarding required analyses.

Nutrient values of manure, organic by-products, and biosolids must be determined prior to land application.

Manure analyses must include, at minimum, total nitrogen (N), ammonium N, total phosphorus (P), or P_2O_5, total potassium (K) or K_2O, and percent solids, or follow UF/IFAS guidance regarding required analyses.

Manure, organic by-products, and biosolids samples must be collected and analyzed at least annually, or more frequently if needed to account for operational changes (feed management, animal type, manure handling strategy, etc.) impacting manure nutrient concentrations.

Samples must be collected, prepared, stored, and shipped, following UF/IFAS guidance (See the Livestock Waste Testing Laboratory web-site for sampling instructions: http://soilslab.ifas.ufl.edu/LWTL%20Home.asp or industry practice.

When planning for new or modified livestock operations, acceptable “book values” recognized by the NRCS (e.g., NRCS Agricultural Waste Management Field Handbook) and the UF/IFAS, or analyses from similar operations in the geographical area, may be used if they accurately estimate nutrient output from the proposed operation.

Manure testing analyses must be performed by laboratories successfully meeting the requirements and performance standards of the Manure Testing Laboratory Certification program (MTLCP) under the auspices of the Minnesota Department of Agriculture, or other NRCS-approved program that considers laboratory performance and proficiency to assure accurate manure test results.

Nutrient Application, Rates
Planned nutrient application rates for nitrogen, phosphorus, and potassium must not exceed UF/IFAS guidelines (SL-129) or industry practice when recognized by UF/IFAS

Determination of nutrient rates must be based on crop/cropping sequence, current soil test results, realistic yield goals, and NRCS-approved nutrient risk assessments.

If UF/IFAS does not provide specific guidance that meet these criteria, application rates must be based on plans that consider realistic yield goals and associated plant nutrient uptake rates.

Realistic yield goals must be based on historical yield data, soil productivity information, climatic conditions, nutrient test results, level of management, and local research results considering comparable production conditions.

Estimates of yield response must consider factors such as soil quality, drainage, pH, salinity, etc., prior to assuming that nitrogen and/or phosphorus are deficient.

For new crops or varieties, industry demonstrated yield, and nutrient utilization information may be used until UF/IFAS information is available.

Lower-than-recommended nutrient application rates are permissible if the grower’s objectives are met.

Applications of biosolids, starter fertilizers, or pop- up fertilizers must be accounted for in the nutrient budget.

Nutrient Sources
Nutrient sources utilized must be compatible with the application timing, tillage and planting system, soil properties, crop, crop rotation, soil organic content, and local climate to minimize risk to the environment.

Nutrient Application, Timing and Placement
Timing and placement of all nutrients must correspond as closely as practical with plant nutrient uptake (utilization by crops), and consider nutrient source, cropping system limitations, soil properties, weather conditions, drainage system, soil biology, and nutrient risk assessment results.

Nutrients must not be surface-applied if nutrient losses offsite are likely. This precludes spreading on:

- Soils when the top 2 inches of the soil are saturated from rainfall.

Exceptions for the above criteria can be made for surface-applied manure and other organic by- products when specified conditions are met and adequate conservation measures are installed to prevent the offsite delivery of nutrients. At a minimum, the following site and management factors must be considered:

- Slope,
- Organic residue and living covers,
- Amount and form of nutrients to be applied, and
- Adequate setback distances to protect local water quality.

Additional Criteria to Minimize Agricultural Non-point Source Pollution of Surface and Groundwater
Planners must use the current NRCS-approved nitrogen, phosphorus, and soil erosion risk assessment tools to assess the risk of nutrient and soil loss. Identified resource concerns must be addressed to meet current planning criteria (quality criteria). Technical criteria for risk assessments can be found in National Instruction (NI)-190-302 NRCS 190 Part 302

When there is a high risk of transport of nutrients, conservation practices must be coordinated to avoid, control, or trap manure and nutrients before they can leave the field by surface or subsurface drainage (e.g., tile). The number of applications and the application rates must also be adjusted to limit the transport of nutrients to tile.

Nutrients must be applied with the right placement, in the right amount, at the right time, and from the right source to minimize nutrient losses to surface and groundwater. The following nutrient use efficiency strategies or technologies must be considered:

- slow and controlled release fertilizers
- nitrification and urease inhibitors
- enhanced efficiency fertilizers
- incorporation or injection
- timing and number of applications
- soil nitrate and organic N testing
- coordinate nutrient applications with optimum crop nutrient uptake
- tissue testing, chlorophyll meters, and spectral analysis technologies
- other UF/IFAS recommended technologies that improve nutrient use efficiency and minimize surface or groundwater resource concerns.

Additional Criteria Applicable to Properly Utilize Manure or Organic By-Products as a Plant Nutrient Source
When manures and/or organic by-products are applied, and soil salinity is a concern, salt concentrations must be monitored to prevent potential crop damage and/or reduce soil quality.

The total single application of liquid manure:

- Must not exceed the soil's infiltration or water holding capacity
- Be based on crop rooting depth
- Must be adjusted to avoid runoff or loss to subsurface tile drains.

Do not apply waste/wastewater within 3 days of likely rainfall or during periods of frequent rainfall in a defined drainage way(s) that carries concentrated flow. Such material may be applied to newly constructed grass waterways if incorporated immediately.

Apply biosolids (sewage sludge) in accordance with USEPA regulations (40 CFR Parts 403 - General Pretreatment Regulations for Existing and New Sources of Pollution and 503 (Biosolids Rule) and Biosolids, Chapter 62-640 (F.A.C.), If the biosolids are septage from septic tanks, then follow Standards for Onsite Sewage Treatment and Disposal Systems, Chapter 64E-6, (F.A.C.)

Crop production activities and nutrient use efficiency technologies must be coordinated to take advantage of mineralized plant-available nitrogen to minimize the potential for nitrogen losses due to denitrification or ammonia volatilization.

Nitrogen and phosphorus application rates must be planned based on risk assessment results as determined by NRCS-approved nitrogen and phosphorus risk assessment tools.

When such assessments are completed, discuss the results of the assessment and recommendations with the producer during the development of the nutrient management plan.

For fields receiving manure and/or organic by- products, where phosphorus risk assessment results equate to LOW risk, additional phosphorus and potassium can be applied at rates greater than crop requirement not to exceed the nitrogen requirement for the succeeding crop. For fields receiving manure and/or organic by-products, where phosphorus risk assessment results equate to MODERATE risk, additional phosphorus and potassium may be applied at a phosphorus crop requirement rate for the planned crops in the rotation. When phosphorus risk assessment results equate to HIGH risk, additional phosphorus and potassium may be applied at phosphorus crop removal rates if the following requirements are met:

- a soil phosphorus drawdown strategy has been implemented, and
- a site assessment for nutrients and soil loss has been conducted to determine if mitigation practices are required to protect water quality.
- Any deviation from these high risk requirements must have the approval of the Chief of the NRCS.

Nitrogen Application Rates

- When manure and/or organic by-products are used, match the nitrogen availability of the planned application rates to plant uptake characteristics as closely as possible, taking into consideration the timing of nutrient application(s) in order to minimize leaching and atmospheric losses. There are several sources of crop uptake data that can be used (e.g., Agricultural Waste Management Field Handbook (AWMFH), Chapter 6 and UF/IFAS research publications - Bahiagrass Fertilization).
- Manure or organic by-products may be applied on legumes at rates equal to the estimated removal of nitrogen in harvested plant biomass not to exceed UF/IFAS recommendations.
- When the nutrient management plan component is being implemented on a phosphorus basis, apply manure or organic by- products at rates consistent with a phosphorus- limited application rate. In such situations, an additional nitrogen application, from non- organic sources, may be required to supply, but not exceed, the recommended amounts of nitrogen in any given year.

Manure may be applied at a rate equal to the recommended phosphorus application, or estimated phosphorus removal in harvested plant biomass for the crop rotation, or multiple years in the crop sequence at one time. When such applications are made, the application rate must not exceed the

acceptable phosphorus risk assessment criteria, must not exceed the recommended nitrogen application rate during the year of application or harvest cycle, and no additional phosphorus must be applied in the current year and any additional years for which the single application of phosphorus is supplying nutrients.

Regardless of nitrogen application rate used, do not apply manures on sites considered vulnerable to off-site phosphorus transport unless appropriate conservation practices, best management practices, or other management activities are used to reduce the vulnerability to an acceptable level.

Heavy Metal Monitoring
When sewage sludge (biosolids) is applied, the accumulation of potential pollutants (including arsenic, cadmium, copper, lead, mercury, selenium, and zinc) in the soil will be monitored in accordance with the US Code, Reference 40 CFR, Parts 403 and 503, and Biosolids, Chapter 62-640 F.A.C. will be followed.

Additional Criteria to Protect Air Quality by Reducing Odors, Nitrogen Emissions and the Formation of Atmospheric Particulates

To address air quality concerns caused by odor, nitrogen, sulfur, and/or particulate emissions; the source, timing, amount, and placement of nutrients must be adjusted to minimize the negative impact of these emissions on the environment and human health. One or more of the following may be used:

- slow or controlled release fertilizers
- nitrification inhibitors
- urease inhibitors
- nutrient enhancement technologies
- incorporation
- injection
- stabilized nitrogen fertilizers
- residue and tillage management
- no-till or strip-till
- other technologies that minimize the impact of these emissions

Do not apply poultry litter, manure, or organic by- products of similar dryness/density when there is a high probability that wind will blow the material offsite.

When manure or organic by-products are applied to grassland, hayland, pasture or minimum-till areas, manage the rate, form, and timing of application(s) to minimize volatilization losses.

When liquid forms of manure are applied with irrigation equipment, operators need to select weather conditions during application that will minimize volatilization losses.

Additional Criteria to Improve or Maintain the Physical, Chemical, and Biological Condition of the Soil to Enhance Soil Quality for Crop Production and Environmental Protection

Time the application of nutrients to avoid periods when field activities will result in soil compaction. In areas where salinity is a concern, select nutrient sources that minimize the buildup of soil salts.

CONSIDERATIONS

Soil test phosphorus levels should not exceed Florida approved soil test thresholds established to protect the environment. See UF/IFAS publication SL-129 for the soil test thresholds.

Use variable-rate nitrogen application based on expected crop yields, soil variability, soil nitrate or organic N supply levels, or chlorophyll concentration.

Use variable-rate nitrogen, phosphorus, and potassium application rates based on site-specific variability in crop yield, soil characteristics, soil test values, and other soil productivity factors.

Develop site-specific yield maps using a yield monitoring system. Use the data to further diagnose low- and high- yield areas, or zones, and make the necessary management changes. See Title 190, Agronomy Technical Note (TN) 190.AGR.3, Precision Nutrient Management Planning (TN-190-AGR-3)

Soil test information should be no older than 1 year when developing new plans.

Use soil tests, plant tissue analyses, and field observations to check for secondary plant nutrient deficiencies or toxicity that may impact plant growth or availability of the primary nutrients.

Use the adaptive nutrient management learning process to improve nutrient use efficiency on farms as outlined in the NRCS' National Nutrient Policy in GM 190, Part 402, Nutrient Management.

PLANS AND SPECIFICATIONS

The following components shall be included in the nutrient management plan:

1. aerial site photograph(s)/imagery or site map(s) and a soil survey map of the site;
2. soil information including: soil type surface texture, pH, drainage class, permeability, available water capacity, depth to water table, restrictive features, and flooding and/or ponding frequency;
3. current and/or planned plant production sequence or crop rotation;
4. soil, water, compost, manure, organic by- product, and plant tissue sample analyses applicable to the plan;
5. realistic yield goals for the crop(s);
6. listing and quantification of all nutrient sources and form;
7. in accordance with the nitrogen and phosphorus risk assessment tool(s), specify the recommended nutrient application source, timing, amount (except for precision/variable rate applications specify method used to determine rate), and placement of plant nutrients for each field or management unit;
8. location of designated sensitive areas or resources and the associated nutrient application restrictions and setbacks;
9. guidance for implementation, operation, maintenance, recordkeeping; and
10. complete nutrient budget for nitrogen, phosphorus, and potassium for the plant production sequence or crop rotation;
11. for manure applications, location of nearby residences, or other locations where humans may be present on a regular basis, and any identified meteorological (e.g., prevailing winds at different times of the year), or topographical influences that may affect the transport of odors to those locations;
12. results of approved risk assessment tools for nitrogen, phosphorus, and erosion losses;
13. documentation establishing that the application site presents low risk for phosphorus transport to local water when phosphorus is applied in excess of crop requirement;
14. when soil phosphorus levels are increasing, include a discussion of the risk associated with phosphorus accumulation and a proposed phosphorus draw-down strategy;
15. List all enhanced efficiency fertilizer products that are planned for.

In addition, the following components must be included in a precision/variable rate nutrient management plan:

- Document the geo-referenced field boundary and data collected that was processed and analyzed as a GIS layer or layers to generate nutrient or soil amendment recommendations.
- Document the nutrient recommendation guidance and recommendation equations used to convert the GIS base data layer or layers to a nutrient source material recommendation GIS layer or layers.
- Document if a variable rate nutrient or soil amendment application was made.

- Provide application records per management zone or as applied map within individual field boundaries (or electronic records) documenting source, timing, method, and rate of all applications that resulted from use of the precision agriculture process for nutrient or soil amendment applications.
- Maintain the electronic records of the GIS data layers and nutrient applications for at least 5 years.

If increases in soil phosphorus levels are expected (i.e., when N-based rates are used), the nutrient management plan must document:

- the soil phosphorus levels at which it is desirable to convert to phosphorus based planning,
- the potential for soil test phosphorus drawdown from the production and harvesting of crops, and
- management activities or techniques used to reduce the potential for phosphorus transport and loss,
- for Animal Feeding Operations (AFO's), a quantification of manure produced in excess of crop nutrient requirements, and
- a long-term strategy and proposed implementation timeline for reducing soil P to levels that protect water quality.

OPERATION AND MAINTENANCE

The owner/client is responsible for safe operation and maintenance of this practice including all equipment. Operation and maintenance addresses the following:

- Periodic plan review to determine if adjustments or modifications to the plan are needed. At a minimum, plans will be reviewed and revised with each soil test cycle, changes in manure volume or analysis, crops, or crop management.
- Fields receiving animal manures and/or biosolids must be monitored for the accumulation of heavy metals and phosphorus in accordance with UF/IFAS guidance and FL DEP guidelines.
- Significant changes in animal numbers, management, and feed management will necessitate additional manure analyses to establish a revised average nutrient content.
- Calibrate application equipment to ensure accurate distribution of material at planned rates.
- Document the nutrient application rate. When the applied rate differs from the planned rate, provide appropriate documentation for the change.
- Records must be maintained for at least 5 years to document plan implementation and maintenance. As applicable, records include:

  a. soil, plant tissue, water, manure, and organic by-product analyses resulting in recommendations for nutrient application;
  b. quantities, analyses and sources of nutrients applied;
  c. dates and method(s) of nutrient applications, source of nutrients, and rates of application;
  d. weather conditions and soil moisture at the time of application; lapsed time to manure incorporation, rainfall or irrigation event;
  e. crops planted, planting and harvest dates, yields, nutrient analyses of harvested biomass, and crop residues removed,
  f. dates of plan review, name of reviewer, and recommended changes resulting from the review, and
  g. all enhanced efficiency fertilizer products used.

Additional records for precision/variable rate sites must include:

- maps identifying the variable application source, timing, amount, and placement of all plant nutrients applied, and
- GPS-based yield maps for crops where yields can be digitally collected.

REFERENCES

Association of American Plant Food Control Officials (AAPFCO). 2011. AAPFCO Official Publication no. 64. AAPFCO Inc., Little Rock, AR.

U.S. Department of Agriculture, Natural Resources Conservation Service. 2010. Agronomy Technical Note, (TN) 190-AGR-3, Precision Nutrient Management Planning. Washington, DC.

U.S. Department of Agriculture, Natural Resources Conservation Service. 2011. Title 190, General Manual, (GM), Part 402, Nutrient Management. Washington, DC.

U.S. Department of Agriculture, Natural Resources Conservation Service. 2011. Title 190, National Instruction (NI), Part 302, Nutrient Management Policy Implementation. Washington, DC.

Biosolids, Chapter 62-640 Florida Administrative Code (F.A.C.),

http://www.dep.state.fl.us/legal/Rules/wastewater/62-640.pdf

Standards for Onsite Sewage Treatment and Disposal Systems, Chapter 64E-6,(F.A.C.)
http://www.doh.state.fl.us/environment/ostds/pdfiles/forms/64e620061126.pdf

Feedlot and Dairy Wastewater Treatment and Management Requirements, Chapter 62-670

(F.A.C.) http://www.dep.state.fl.us/legal/Rules/wastewater/62-670.pdf

USEPA CAFO Rules

EPA - Concentrated Animal Feeding Operations -Final Rule

USEPA 40 CFR Parts 403 and 503 (http://www.epa.gov/npdes/regulations/streamlining_part403.pdf) and (http://www.epa.gov/owm/mtb/biosolids/503pe/index.htm

Agricultural Fertilizers, Chapter 576, F.S.
http://www.leg.state.fl.us/Statutes/index.cfm?App_mode=Display_Statute&URL=0500-0599/0576/0576.html

Phosphorus Index, Exhibit 1, Chapter 9, Florida Agronomy Field Handbook

http://efotg.nrcs.usda.gov/references/public/FL/TheFloridaPhosphorusIndex080404Final.pdf

NRCS General Manual Title 450, Part 401.03 and Title 190, Part 402

NRCS National Planning Procedures Handbook (NPPH)

NRCS National Agronomy Manual (NAM) Section 503.

NRCS Agricultural Waste Management Field Handbook, Chapters 4, 6, and 11