NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

NUTRIENT MANAGEMENT

(Ac.)

CODE 590

DEFINITION

Managing the amount, source, placement, form and timing of the application of plant nutrients and soil amendments.

PURPOSE

- To budget and supply nutrients for plant production.
- To properly utilize manure or organic by-products as a plant nutrient source.
- To minimize agricultural nonpoint source pollution of surface and ground water resources.
- To protect air quality by reducing nitrogen emissions (ammonia (NH_3) and nitrogen oxides "NO_x", compounds) 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.

CRITERIA

General Criteria Applicable to All Purposes

Plans for nutrient management shall comply with all applicable federal, state, and local laws and regulations as stated in the National Engineering Manual, Part MS521.05, "State Laws and Regulations Governing Poultry and Livestock Waste Management Systems".

Plans for nutrient management shall be

developed in accordance with policy requirements of the NRCS General Manual Title 450, Part 401.03 (Technical Guides, Policy and Responsibilities) and Title 190, Part 402 (Ecological Sciences, Nutrient Management, Policy); 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.

A nutrient management plan, which is part of a more comprehensive conservation plan, such as resource management systems, must be compatible with other requirements such as erosion control, pest or residue management, etc.

Persons who review or approve plans for nutrient management shall be certified through any certification program acceptable to NRCS within the state.

A nutrient budget for nitrogen, phosphorus, and potassium shall be developed that considers all potential sources of nutrients including, but not limited to animal manure and organic by-products, waste water, commercial fertilizer, crop residues, legume credits, and irrigation water.

Realistic yield goals shall be established based on soil productivity information, historical yield data, climatic conditions, level of management and/or local research on similar soil, cropping systems, and soil and manure/organic by-products tests.

For new crops or varieties, industry yield recommendations may be used until documented yield information is available.

Plans for nutrient management shall specify the source, amount, timing and method of application of nutrients on each field to achieve realistic production goals, while minimizing movement of nutrients and other potential contaminants to surface and/or ground waters.

Areas contained within established minimum application setbacks (e.g., sinkholes, wells, gullies, ditches, surface inlets or rapidly permeable soil areas) shall not receive direct application of nutrients.

For the application of inorganic fertilizers, soil erosion must be controlled to the level stated in the conservation plan. Conservation plans may be a resource management system, progressive plan, basic conservation system or alternative conservation system.

For the application of organic fertilizer such as animal manure, organic by-products, or treated wastewater, soil erosion must be controlled to the soil loss tolerance.

Runoff and water management controls will be installed, as determined by the conservation planner, on fields that receive nutrients.

The amount of nutrients lost to erosion, runoff, irrigation and drainage, shall be addressed, as needed.

Soil and Tissue Sampling and Laboratory Analyses (Testing). Nutrient planning shall be based on current soil or tissue (where used as a supplement) test results developed in accordance with Land Grant University guidance. Current soil tests are those that are no older than three years.

Soil and tissue samples shall be collected and prepared according to the Land Grant University guidance or standard industry practice. Soil and tissue test analyses shall be performed by laboratories that are accepted in one or more of the following:

- Laboratories successfully meeting the requirements and performance standards of the North American Proficiency Testing Program (NAPT) under the auspices of the Soil Science Society of America, or
- State recognized program that considers laboratory performance and proficiency to assure accuracy of soil test results.

Soil and tissue testing shall include analyses for any nutrients for which specific information is needed to develop the nutrient plan. Request analyses are pertinent to monitoring or amending the annual nutrient budget, e.g. pH, electrical conductivity (EC), soil organic matter, phosphorus and potassium.

Nutrient Application Rates. Soil amendments shall be applied, as needed, to adjust soil pH to an adequate level for crop nutrient availability and utilization.

Recommended nutrient application rates shall be based on Land Grant University recommendations (and/or industry practice when recognized by the university) that consider current soil test results, realistic yield goals and management capabilities. If the Land Grant University does not provide specific recommendations, application shall be based on realistic yield goals and associated plant nutrient uptake rates.

The planned rates of nutrient application, as documented in the nutrient budget, shall be determined based on the following guidance:

- Nitrogen Application **-** Planned nitrogen application rates shall match the recommended rates as closely as possible, except when manure or organic by-products are a source of nutrients. When manure or organic by-products are a source of nutrients, see “Additional Criteria” below.
- Phosphorus Application **-** Planned phosphorus application rates shall match the recommended rates as closely as possible, except when manure or organic by-products are sources of nutrients. When manure or organic by-products are a source of nutrients, see “Additional Criteria” below.
- Potassium Application - Potassium shall not be applied in situations in which excess (greater than soil test potassium recommendation) causes unacceptable nutrient imbalances in crops or forages. When forage quality is an issue associated with excess potassium application, state standards shall be used to set forage quality guidelines.
- Other Plant Nutrients - The planned rates of application of other nutrients shall be consistent with Land Grant University guidance or industry practice if recognized by the Land Grant University in the state.
- Starter Fertilizers - When starter fertilizers are used, they shall be included in the overall nutrient budget, and applied in

accordance with Land Grant University recommendations, or industry practice if recognized by the Land Grant University within the state.

Nutrient Application Timing. Timing and method of nutrient application (particularly nitrogen) shall correspond as closely as possible with plant nutrient uptake characteristics, while considering cropping system limitations, weather and climatic conditions, risk assessment tools (e.g., leaching index, P index) and field accessibility.

(Organic Fertilizer). Organic fertilizers will not be applied more than 45 days prior to planting a crop when the organic nutrients are incorporated into the soil. Organic fertilizers will not be land applied more than 30 days before planting a crop when the organic nutrients are not incorporated into the soil. Organic fertilizers will not be applied more than 45 days prior to "green-up" of forages.

Nutrient Application Methods. Application methods to reduce the risk of nutrient transport to surface and ground water, or into the atmosphere shall be employed.

To minimize nutrient losses:

- Apply nutrient materials uniformly, or at variable rates to application area(s).
- Nutrients shall not be applied on saturated soil.
- Nutrients shall be applied considering the plant growth habits, irrigation practices, and other conditions so as to maximize availability to the plant and minimize the risk of runoff, leaching, and volatilization losses.
- Nutrient applications associated with irrigation systems shall be applied in a manner that prevents or minimizes resource impairment and in accordance with the requirements of irrigation water management (Code 449).
- Nutrient applications associated with phosphorus and/or potassium should be done to minimize soil erosion and loss of phosphorus.
- The method of manure application should be that which is most compatible with the operator's management ability.

Design of irrigation systems to apply liquid manures should be done by an equipment manufacturer, professional engineer, or other qualified personnel using soil intake rates, water holding capacity, volume to be applied, acres available, vegetation uptake rates, and pump head information provided by NRCS. The lowest possible pressure shall be used in order to control drift of droplets and volatilization of droplets. However, pressure should not be so low as to create a poor pattern. A variance which allows high-pressure application systems must be obtained from DEQ-OPC. Application rates should not exceed the soil intake rates or the nutrient uptake rates of the plant/crop covering the application area.

Dry manure being sold and utilized off-site should be documented within the producer’s log. The log shall consist of 1) date of transaction, 2) name of recipient, 3) address of recipient, 4) amount of manure transferred. Responsible application of manure should be encouraged by the producer by providing the buyer a copy of operation and maintenance guidelines and a nutrient sample analysis from that year.

Land application of manure shall be no closer than 50 feet to any intermittent stream or no closer than 150 feet to any perennial stream or well. Intermittent streams will be indicated by a broken black or blue line and perennial streams will be indicated by a solid black or blue line on the United States Department of the Interior Geological Survey Quadrangle Map. The establishment of a 50-foot vegetative strip around the spray fields and livestock operation barns is recommended. The vegetative strip should include a 25-foot strip of rapidly maturing trees, a 15-foot strip of tall shrubs, and a 10-foot strip of native grasses. Ventilation should not be adversely affected by the placement of vegetation strips.

Conservation Management Unit (CMU) Risk Assessment. In areas with identified or designated nutrient related water quality impairment, a CMU specific risk assessment of

the potential for nutrient transport from the area shall be completed.

States that utilize a threshold (Phosphorus Index P-I) prescreening procedure to trigger CMU risk assessment shall follow approved procedures as recommended by the respective state or Land Grant University.

In areas with a known nutrient impairment from agricultural non-point source, the phosphorus index assessment will be completed for the application of inorganic fertilizer as well as for organic fertilizers. The results of this assessment and recommendations will be discussed with the producer and included in the plan.

Use an appropriate nutrient risk assessment tool for the nutrient in question (e.g., leaching index, phosphorus index) or other state recognized assessment tool.

Plans developed to minimize agricultural nonpoint source pollution of surface or groundwater resources will include practices and/or management activities that will reduce the risk of nitrogen or phosphorus movement from the field.

Additional Criteria Applicable to Manure and Organic By-Products or Biosolids Applied as a Plant Nutrient Source

Producers will maintain a minimum forage height of 4 inches on fields where organic nutrients are land applied during the winter months.

Increase the buffer widths for intermittent streams and surface water bodies from 50 feet to 100 feet during the winter months.

When animal manures or organic by-products are applied, a risk assessment of the potential for nutrient transport from the CMU shall be completed to adjust the amount, placement, form and timing of application of nutrient sources, as recommended by the respective state or Land Grant University.

Nutrient values of manure and organic by-products (excluding sewage sludge or biosolids) shall be determined prior to land application. Samples will be taken and analyzed with each hauling/emptying cycle for a storage/treatment facility. Manure sampling frequency may vary based on the operation's manure handling strategy and spreading schedule. If there is no prior sampling history, the manure shall be analyzed at least annually for a minimum of three consecutive years. A cumulative record shall be developed and maintained until a consistent (maintaining a certain nutrient concentration with minimal variation) level of nutrient values is realized. The average of results contained in the operation's cumulative manure analyses history shall be used as a basis for nutrient allocation to fields. Samples shall be collected and prepared according to Land Grant University guidance or industry practice.

In planning for new operations, acceptable "book values" recognized by the NRCS and/or the Land Grant University may be used if they accurately estimate nutrient output from the proposed operation (e.g., NRCS Agricultural Waste Management Field Handbook, MS State University Extension Service Crop Recommendations Guide).

Biosolids (sewage sludge) shall be applied in accordance with USEPA regulations. (40 CFR Parts 403 (Pretreatment) and 503 (Biosolids) and other state and/or local regulations regarding the use of biosolids as a nutrient source.

Manure and Organic By-Product Nutrient Application Rates. Manure and organic by-product nutrient application rates shall be based on nutrient analyses procedures recommended by the respective state or Land Grant University. As indicated above, "book values" may be used in planning for new operations. At a minimum, manure analyses shall identify nutrient and specific ion concentrations, percent moisture, and percent organic matter. Salt concentration shall be monitored so that manure applications do not cause plant damage or negatively impact soil quality.

The application rate (in/hr) of liquid materials applied shall not exceed the soil intake/infiltration rate and shall be adjusted to minimize ponding and to avoid runoff. The total application shall not exceed the field capacity

of the soil and shall be adjusted, as needed, to minimize loss to subsurface tile drains.

The planned rates of nitrogen and phosphorus application recorded in the plan shall be determined based on the following guidance:

Nitrogen Application Rates

When manure or organic by-products are used, the nitrogen availability of the planned application rates shall match plant uptake characteristics as closely as possible, taking into consideration the timing of nutrient application(s) in order to minimize leaching and atmospheric losses.

Management activities and technologies shall be used that effectively utilize mineralized nitrogen and that minimize nitrogen losses through denitrification and ammonia volatilization.

Manure or organic by-products may be applied on legumes at rates equal to the estimated removal of nitrogen in harvested plant biomass.

When the nutrient management plan component is being implemented on a phosphorus basis, manure or organic by-products shall be applied 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.

Phosphorus Application Rates

When manure or organic by-products are used, the planned rates of phosphorus application shall be consistent with any one of the following options:

Phosphorus Index (PI) Rating. Nitrogen-based manure application on Low or Medium Risk Sites; phosphorus-based or no manure application on High and Very High Risk Sites.

In such cases, plans shall include:

- A record of the phosphorus index rating for each field and
- Information about conservation practices and management activities that can reduce the potential for phosphorus movement from the site.

When such assessments are done, the results of the assessment and recommendations shall be discussed with the producer during the development of the plan.

When the phosphorus index (PI) rating is low or medium, nitrogen-based plans will be developed such that manure application rates of nitrogen do not exceed the values shown in the Appendix VI; Table 15 of the Specification Sheets, "Realistic Yield Potential and Nitrogen Recommendations for a Specific Crop Yield".

When the phosphorus index (PI) rating is high, phosphorus-based plans will be developed such that manure application rates of phosphorus do not exceed the values shown in Appendix VI; Table 16 of the Specification Sheets,, "Nutrients Removed by Selected Crops".

When the phosphorus index (PI) rating is very high, phosphorus-based plans will be developed such that manure application rates of phosphorus do not exceed 50% of the values shown in Appendix VI; Table 16 of the Specification Sheets,, "Nutrients Removed by Selected Crops".

In hay harvesting operations which reach the anticipated crop yields, P_2O_5 and K_2O values listed in Appendix VI; Table 16 of the Specification Sheets,, " Nutrients Removed by Selected Crops". should be used. In grazing operations, the P_2O_5 and K_2O values listed in Appendix VI; Table 16 of the Specification Sheets, “Nutrients Removed by Selected Crops” must be reduced by dividing the values by 4.0. Normally a combination of both operations exists and the values listed should be pro-rated based on the different degrees of the grazing and haying. Conservation planners must allow for annual adjustments to the farming operation regarding haying and grazing.

Hay and grazing values listed in Appendix VI; Table 16 of the Specification Sheets, “Nutrients Removed by Selected Crops” should be reduced by 25% during years when both operations occur. Conservation planners must allow for annual adjustments to the farming operation regarding haying and grazing operations.

When the phosphorus-based plan is being implemented, manure or other organic byproducts shall be applied at rates consistent with the utilization of phosphorus. In such situations, additional nitrogen from non-organic sources maybe required to supply the recommended amounts of nitrogen and obtain anticipated crop yields.

Periodic evaluations using the phosphorus index rating shall be made to identify any nutrient build up and promote better application rates of phosphorus. A current soil test must be submitted before the evaluation is performed.

** Acceptable phosphorus-based manure application rates shall be determined as a function of soil test recommendation or estimated phosphorus removal in harvested plant biomass. Guidance for developing these acceptable rates is found in the NRCS General Manual, Title 190, Part 402 (Ecological Sciences, Nutrient Management, Policy), and the National Agronomy Manual, Section 503 (to be developed).

The application of phosphorus applied as manure may be made 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. When such applications are made, the application rate shall:

- Not exceed the recommended nitrogen application rate during the year of application, or
- Not exceed the estimated nitrogen removal in harvested plant biomass during the year of application when there is no recommended nitrogen application.
- Not be made on sites considered vulnerable to off-site phosphorus transport unless appropriate conservation practices, best management practices or management activities are used to reduce the vulnerability.

Potassium Application - Potassium shall not be applied in situations in which excess (greater than soil test potassium recommendation) causes unacceptable nutrient imbalances in crops or forages. When forage quality is an issue associated with excess potassium application, state standards shall be used to set forage quality guidelines.

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 shall be monitored in accordance with the USEPA regulations. (40 CFR Parts 403 (Pretreatment) and 503 (Biosolids), and/or any applicable state and local laws or regulations (www.epa.gov; www.deq.state.ms.us)

Manure Generation

Manure production data are available in Chapter 4 of the NRCS "Agricultural Waste Management Field Handbook" (AWMFH). On-farm site-specific data should be used in lieu of text book data. Frequently used values for total confinement are listed in Appendix II; Table 2 for quick reference.

Manure Composition

Very little specific data are available on nutrient content of various manures in lagoons, holding ponds or litter. Poultry compost is estimated to weigh 40 lbs/cf and contains 38 lbs. total nitrogen per ton, 55 lbs. P_2O_5 per ton, and 41 lbs. K_2O per ton.1 Broiler, breeder and pullet litter are estimated to weigh 31 lbs/cf.2, 45 lbs/cf and 28 lbs/cf, respectively. Mississippi State University Extension Research Report Vol. 23 No. 5 “Mississippi Broiler Litter: Fertilizer Value and Quantity Produced” states that an average sample of broiler litter in Mississippi has a nutrient value of 57 lbs./ton of N, 29 lbs./ton of P, and 59 lbs./ton of K on an “as is basis” with 19%

moisture. Nutrient value will vary depending on the type of birds, the age of the litter and its moisture content. Considerable variation occurs with manure handling, washwater/runoff dilution, bedding used, feeding ration, pasture grazing time, etc. It is highly recommended that laboratory analysis of manures be provided for the best utilization of this resource. In lieu of site-specific laboratory analysis, nutrient values in Appendix II; Tables 2 & 3 may be used in conjunction with the treatment, handling and application losses in Appendix III; Tables 4 - 6.

Soils

Nutrients applied to the land are held in the soil profile for plant uptake. Adequate cation exchange capacity, soil buffering, and plant utilization is needed to prevent excess nutrients from being transported to groundwater or surface water. Application of manures at multiple times of the year while plants are actively growing will promote better utilization of nutrients and reduce potential for runoff. Incorporation of manures will also reduce potential surface runoff and loss. Soil limiting factors to be considered in land application of manures are given in Appendix III; Table 7:

Additional Criteria to Protect Air Quality by Reducing Nitrogen and/or Particulate Emissions to the Atmosphere

In areas with an identified or designated nutrient management related air quality concern, any component(s) of nutrient management (i.e., amount, source, placement, form, timing of application) identified by risk assessment tools as a potential source of atmospheric pollutants shall be adjusted, as necessary, to minimize the loss(es).

When tillage can be performed, surface applications of manure and fertilizer nitrogen formulations that are subject to volatilization on the soil surface (e.g., urea) shall be incorporated into the soil within 24 hours after application.

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

When liquid forms of manure are applied with irrigation equipment, operators will select weather conditions during application that will minimize volatilization losses. See Appendix II; Table 4 for list of conditions.

Operators will handle and apply poultry litter or other dry types of animal manures when the potential for wind-driven loss is low and there is less potential for transport of particulates into the atmosphere.

Weather and climatic conditions during manure or organic by-product application(s) shall be recorded and maintained in accordance with the operation and maintenance section of this standard.

Additional Criteria to Improve the Physical, Chemical and Biological Condition of the Soil

Nutrients shall be applied and managed in a manner that maintains or improves the physical, chemical and biological condition of the soil.

Minimize the use of nutrient sources with high salt content unless provisions are made to leach salts below the crop root zone.

To the extent practicable nutrients shall not be applied when the potential for soil compaction and rutting is high.

CONSIDERATIONS

The use of management activities and technologies listed in this section may improve both the production and environmental performance of nutrient management systems.

The addition of these management activities, when applicable, increases the management intensity of the system and is recommended in a nutrient management system.

Action should be taken to protect National Register listed and other eligible cultural resources.

The nutrient budget should be reviewed annually to determine if any changes are needed for the next planned crop.

For sites on which there are special environmental concerns, other sampling techniques may be appropriate. These include

soil profile sampling for nitrogen, Pre-Sidedress Nitrogen Test (PSNT), Pre-Plant Soil Nitrate Test (PPSN) or soil surface sampling for phosphorus accumulation or pH changes.

Additional practices to enhance the producer's ability to manage manure effectively include modification of the animal's diet to reduce the manure nutrient content, or utilizing manure amendments that stabilize or tie-up nutrients.

Soil test information should be no older than one year when developing new plans, particularly if animal manures are to be used as a nutrient source.

Excessive levels of some nutrients can cause induced deficiencies of other nutrients.

If increases in soil phosphorus levels are expected, consider a more frequent (annual) soil testing interval.

To manage the conversion of nitrogen in manure or fertilizer, use products or materials (e.g. nitrification inhibitors, urease inhibitors and slow or controlled release fertilizers) that more closely match nutrient release and availability for plant uptake. These materials may improve the nitrogen use efficiency (NUE) of the nutrient management system by reducing losses of nitrogen into water and/or air.

Crops or forages should not be planted until 15 days after heavy manure application. Salt accumulation near the soil surface and/or temporary excess of ammonia resulting from breakdown of organic nitrogen lower germination and reduce seeding growth.

When animal manure is land applied, copper and zinc should be monitored in the soil. Heavy metals can accumulate in the soil where excessive land application of animal manures is allowed for extended periods of time.

Manure and Organic By-Products (excluding sewage sludge or biosolids) shall not be land applied when predicted night time temperatures are less than 25 degrees F and day time temps are less than 40 degrees F for 4 of the next seven day forecast.

Consider practices that will reduce nitrogen and phosphorus movement from the field. Such practices include Grassed Waterways (412), Contour Buffer Strips (332), Filter Strips (393), Irrigation Water Management (449), Riparian Forest Buffer (391A), Conservation Crop Rotation (328), Cover and Green Manure (340), Contour Strip Cropping (585) and Residue Management (329A, 329B or 329C and 344).

These practices will improve soil nutrient andwater storage, infiltration, aeration, tilth,diversity of soil organisms and protect or improve water quality.

Considerations to Minimize Agricultural Nonpoint Source Pollution of Surface and Ground Water.

Erosion control and runoff reduction practices can improve soil nutrient and water storage, infiltration, aeration, tilth, diversity of soil organisms and protect or improve water and air quality (Consider installation of one or more NRCS FOTG, Section IV – Conservation Practice Standards).

Cover crops can effectively utilize and/or recycle residual nitrogen.

Apply nutrient materials uniformly to the application area. Application methods and timing that reduce the risk of nutrients being transported to ground and surface waters, or into the atmosphere include:

- Split applications of nitrogen to provide nutrients at the times of maximum crop utilization,
- Use plant tissue-test to minimize risk of over applying nitrogen in excess of crop needs.
- Avoid winter nitrogen application for spring seeded crops,
- Band applications of phosphorus near the seed row,
- Incorporate surface applied manures or organic by-products as soon as possible

after application to minimize nutrient losses,

- Delay field application of animal manures or organic by-products if precipitation capable of producing runoff and erosion is forecast within 24 hours of the time of the planned application.

Considerations to Protect Air Quality by Reducing Nitrogen and/or Particulate Emissions to the Atmosphere.

Odors associated with the land application of manures and organic by-products can be offensive to the occupants of nearby homes. Avoid applying these materials upwind of occupied structures when residents are likely to be home (evenings, weekends and holidays).

When applying manure with irrigation equipment, modifying the equipment can reduce the potential for volatilization of nitrogen from the time the manure leaves the application equipment until it reaches the surface of the soil (e.g., reduced pressure, drop down tubes for center pivots). N volatilization from manure in a surface irrigation system will be reduced when applied under a crop canopy.

When planning nutrient applications and tillage operations, encourage soil carbon buildup while discouraging greenhouse gas emissions (e.g., nitrous oxide N_2O, carbon dioxide CO_2).

Nutrient applications associated with irrigation systems should be applied in accordance with the requirements of Irrigation Water Management (Code 449).

CAFO operations seeking permits under USEPA regulations (40 CFR Parts 122 and 412) should consult with their respective state permitting authority for additional criteria.

PLANS AND SPECIFICATIONS

Plans and specifications for nutrient management shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose(s), using nutrients to achieve production goals and to prevent or minimize resource impairment.

Nutrient management plans shall include a statement that the plan was developed based on requirements of the current standard and any applicable Federal, state, or local regulations, policies, or programs, which may include the implementation of other practices and/or management activities. Changes in any of these requirements may necessitate a revision of the plan.

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

- Aerial site photograph(s) or site map(s), and a soil survey map of the site,
- Location of designated sensitive areas or resources and the associated, nutrient management restriction,
- Current and/or planned plant production sequence or crop rotation,
- Results of soil, water, manure and/or organic by-product sample analyses,
- Results of plant tissue analyses, when used for nutrient management,
- Realistic yield goals for the crops,
- Complete nutrient budget for nitrogen, phosphorus, and potassium for the crop rotation or sequence,
- Listing and quantification of all nutrient sources,
- CMU specific recommended nutrient application rates, timing, form, and method of application and incorporation, and
- Guidance for implementation, operation, maintenance, and recordkeeping.

If increases in soil phosphorus levels are expected, the nutrient management plan shall document:

- Soil phosphorus levels at which it may be desirable to convert to phosphorus based planning,
- Results of appropriate risk assessment tools to document the relationship between soil phosphorus levels and potential for phosphorus transport from the field,
- Potential for soil phosphorus drawdown from the production and harvesting of crops, and

- Management activities or techniques used to reduce the potential for phosphorus loss.

OPERATION AND MAINTENANCE

Records should be maintained for five years; or for a period longer than five years if required by other Federal, state or local ordinances, or program or contract requirements. Periodic plan review to determine if adjustments or modifications to the plan are needed. As a minimum, plans will be reviewed and revised with each soil test cycle.

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

- Significant changes in animal numbers and/or feed management will necessitate additional manure sampling and analyses to establish a revised average nutrient content.
- Protection of fertilizer and organic by-product storage facilities from weather and accidental leakage or spillage.
- Calibration of application equipment to ensure uniform distribution of material at planned rates.
- Documentation of the actual rate at which nutrients were applied. When the actual rates used differ from the recommended and planned rates, records will indicate the reasons for the differences.

REFERENCES

Alabama Cooperative Extension Service Circular ANR-449. Nutrient Removal by Alabama Crops. Alabama Agricultural Experiment Station Agronomy and Soils Departmental Series No. 178. Soil Test Fertilizer Recommendations for Alabama Crops.

Bagley, C. Pat. and Evans, Richard R., "Broiler Litter as a Feed or Fertilizer in Livestock Operations", Mississippi State University, Cooperative Extension Service, 1998.

Maintaining records to document plan implementation. As applicable, records include:

- Soil, plant tissue, water, manure, and organic by-product analyses resulting in recommendations for nutrient application.
- Quantities, analyses and sources of nutrients applied.
- Dates and method(s) of nutrient applications.
- Weather conditions and soil moisture at the time of application; lapsed time to manure incorporation, rainfall or irrigation event.
- Crops planted, planting and harvest dates, yields, and crop residues removed,
- Dates of plan review, name of reviewer, and recommended changes resulting from the review.

Workers should be protected from and avoid unnecessary contact with plant nutrient sources. Extra caution must be taken when handling ammoniacal nutrient sources, or when dealing with organic wastes stored in unventilated enclosures.

Material generated from cleaning nutrient application equipment should be utilized in an environmentally safe manner. Excess material should be collected and stored or field applied in an appropriate manner.

Nutrient containers should be recycled in compliance with state and local guidelines or regulations.

Control of Pathogens and Vector Attraction in Sewage Sludge. EPA Environmental Regulations and Technology. EPA/625/R-92/013

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NRCS Conservation Practice Standard *Critical Area Planting* – Code 342*, Filter Strip* – Code 393, *Irrigation Water Management* – Code 449, and *Riparian Forest Buffer* – Code 391.

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Soil Management for Intensive Grazing, Vol. 18, No. 2, 1997, K. L. Wells and C. T. Dougherty, Department of Agronomy, University of Kentucky, p. 3.

Standards For The Use Or Disposal Of Sewage Sludge: Title 40 of the Code of Federal Regulations (40 CFR) Part 503.

United States Department of Agriculture - Natural Resources Conservation Service National Engineering Handbook. Agricultural Waste Management Field Handbook.

United States Department of Agriculture, Natural Resources Conservation Service. *National Soil Survey Handbook.*

Water Quality Functions of Riparian Forest Buffer Systems in the Chesapeake Bay Watershed. A Report of the Nutrient Subcommittee of the Chesapeake Bay Program. August 1995.

Varco, Jac J., Lagoon Analyses from PM-1 Plant & Science Dept., Mississippi State University, MS.