

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 and NOx 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

Nutrient management activities shall comply with all applicable federal, state, and local laws and regulations. Review and comply with the minimum set back requirements in the current South Dakota (SD) General Water Pollution Control Permit for Concentrated Animal Feeding Operations when dealing with permitted facilities. Nutrient management plans (NMP) shall be compatible with other components of a conservation plan and

include appropriate management techniques and conservation practices to reduce environmental risk.

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 identified in annual nutrient management plans will be established from multi-peril crop insurance; proven yields on a field-by-field or farm-by-farm basis for a continuous 5-year average yield plus 10 percent or the Natural Resources Conservation Service (NRCS) Crop Yield Tables (Productivity Indexes and SD Agricultural Statistics Service Information) plus 10 percent.

Yields identified in the initial NMP for a livestock facility will be determined from yields established for purchasing multi-peril crop insurance; proven yields on a field-by-field or farm-by-farm basis; SD Agricultural Statistics Service using the published continuous 5-year average yield plus 10 percent or the NRCS Crop Yield Tables (Productivity Indexes and SD Agricultural Statistics Service Information) plus 10 percent.

For new crops or varieties, university or 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.

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact your Natural Resources Conservation Service [State Office](#), or visit the [electronic Field Office Technical Guide](#).

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

Areas contained within established minimum application setbacks (e.g., sinkholes, wells, gullies, ditches, surface inlets) shall not receive direct application of 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 and tissue (where used as a supplement) test results developed in accordance with South Dakota State University (SDSU) guidance. Current soil tests for nitrogen recommendations will be those no older than one year old. Soil tests for immobile nutrients are those that are no older than two years.

Soil and tissue samples shall be collected and prepared according to SDSU guidance. Soil samples will be taken as per land grant university recommendations found on the back of the SDSU Soil Testing Laboratory soil sample information sheet or SDSU-FS935, "Recommended Soil Sampling Methods for South Dakota." Soil test analyses shall be performed according to the analytical procedures in the "Recommended Chemical Soil Test Procedures for the North Central Region (NCR-221), revised January 1998." Soil test analyses for phosphorus shall be limited to Bray and Kurtz P-1, Mehlich II, Mehlich III if Phosphorus (P) is determined colorimetrically, or Olsen (NaHCO₃) methods performed according to the analytical procedures in the "Recommended Chemical Soil Test Procedures for the North Central Region (NCR-221), revised January 1998."

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

Nutrient Application Rates

Recommended nutrient application rates shall be based on the most recent SDSU EC750 "Fertilizer Recommendations Guide" using current soil test results, realistic yield goals, and management capabilities.

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

In SD, soil amendments are considered to be those materials which are applied to improve the physical, chemical, or other characteristics of the soil or improve crop production excluding unmanipulated animal and vegetable manure, pesticides, commercial fertilizer, lime, or lime sludge, produced by a municipality, treated sewage sludge, or compost (SDCL 38-19A-1(14) unless such materials are certified by the SD Department of Agriculture (SDDA) as a registered soil amendment. Soil amendment products must be applied according to the manufacturer's product label instructions or guidelines established by SDSU. State law requires registration of soil amendment products with the SDDA prior to distribution in the state. Soil amendment products not currently registered shall not be included as part of a NMP developed within the guidelines of this practice. A current list of soil amendment products register, in SD, can be obtained from the SDDA Web site at: <http://www.state.sd.us/doa/das/hp-fert.htm>.

If significant levels of plant available nitrogen or phosphorus are delivered to a field from the use of a soil amendment according to label instructions, those nutrients must be considered in the NMP.

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 SDSU guidance.

Starter Fertilizers - When starter fertilizers are used, they shall be included in the overall nutrient budget, and applied in accordance with SDSU recommendations.

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.

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 to application areas (i.e., management zone or field);

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.

Nutrients shall not be applied to frozen, snow-covered, or saturated soil if the potential risk for runoff exists.

- Liquid manure applications to frozen or snow-covered (winter) soil will not be allowed. In situations where a catastrophic system failure is imminent; manure may be applied to soils with slopes less than 4 percent provided that a 300 feet setback is maintained to a lake, river, stream, noncropped wetland, or conveyance to these waters.

Incidental winter application of solid manure, waste feed materials, snow, and ice will be allowed to facilitate the proper operation of open beef feedlots by allowing producers to clean along feed bunks, watering areas, and allow removal of snow and ice from the open lots. Winter applications are allowed only under the following conditions:

- Winter manure storage is designed into the facility and winter manure applications will be no more than 10 percent of the annual manure production.
- Winter manure applications will not exceed the rate per acre calculated in the nutrient budget for the application field based on fall soil test results.
- Set back distances from surface waters or water conveyances will be 300 feet and 1,000 feet from named lakes, rivers, and perennial streams.
- Winter manure applications are prohibited on floodplains with soils classified as frequently or occasionally flooded as list in National Cooperative Soil Survey.
- Applications will only be allowed on fields with slopes less than four percent slope and be prioritized using current soil loss calculations based on the water erosion prediction technology as listed in the South Dakota Technical Guide (SDTG). Fields with the lowest predicted soil loss will have the highest priority for winter applications.

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.

Field Risk Assessment (on all fields)

Plans for nutrient management will include a determination of the vulnerability of the application site to leach nitrates to an aquifer and the vulnerability for phosphorus loss to surface waters. Use the following guidance to make the vulnerability determinations:

Vulnerability for nitrate leaching to an aquifer.

Fields located over shallow aquifers as defined in SD Codified Law (CL) 34A-3A-24 will be considered highly vulnerable for nitrate leaching. The Web Soil Survey (WSS) will be used to identify the leaching risk for soil map units in each county in SD. Saturated Hydraulic Conductivity (Ksat) is a soil property (ease of soil pores to transmit water) that will be used to indicate leaching risk. Soils map units that have a Ksat value of 10 micrometers/sec ($\mu\text{m}/\text{sec}$) or greater, and are on slopes less than 6 percent, would be considered to have a "High Leaching Risk." The WSS is located at <http://websoilsurvey.nrcs.usda.gov/app/>.

For permitted facilities, in SD, contact the Department of Environment and Natural Resources (DENR) for identification of application fields located over shallow aquifers.

Vulnerability for phosphorus loss to surface waters.

For surface water protection, areas of fields within 100 feet of a lake, river, stream, noncropped wetland, or a conveyance to these waters should be considered highly vulnerable to potential surface water contamination. A conveyance may be defined as a ditch, tile inlet, intermittent stream, waterway, or un-vegetated channel. A lake is a pond, reservoir, or other body of water, created by either natural or artificial means. A cropped wetland is not included in this definition of a lake. A pond that is used for the treatment and

disposal of wastes and that is permitted for such uses is not a lake.

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

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.

Nutrient values of manure and organic by-products 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. Samples shall be collected and prepared according to SDSU guidance. Also refer to SD-NRCS-FS-36, "Sampling Manure for Nutrient Management" for sampling procedures.

In planning for new operations, acceptable "book values" recognized by the NRCS and/or SDSU may be used if they accurately estimate nutrient output from the proposed operation (e.g., NRCS Agricultural Waste Management Field Handbook).

Biosolids (treated sewage sludge) and domestic septage shall be applied in accordance with all applicable state and federal regulations listed in 40 CFR 503 which is adopted in SDCL 74:52:09:01 by reference.

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 SDSU. As indicated above, "book values" may be used in planning for new operations; however, manure applications will only be made based on manure nutrient sampling results. An exception to use "book values" will be made for first year liquid containment systems. At a minimum, manure analyses shall identify nutrient and specific ion concentrations, and percent moisture. 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 based on soil test phosphorus, potential sheet/rill erosion, and the presence of perennial vegetation consistent with Table 1. In situations where manure applications will be based on phosphorus crop removal, an additional nitrogen application, from non-organic sources, may be required to supply the recommended amounts of nitrogen.

TABLE 1

Nitrogen need/Phosphorus Crop Removal Manure Application Determination						
Soil Test Phosphorus (ppm)		Predicted Soil Loss - Sheet and Rill Erosion (tons per acre per year)				
		Less than 4		4 to 6		Greater than 6
		100 Foot Vegetated Buffer		100 Foot Vegetated Buffer		
Olsen	Bray-1	Yes	No	Yes	No	
0-25	0-35	Nitrogen Need	Nitrogen Need	Nitrogen Need	Nitrogen Need	No application
26-50	36-75	Nitrogen Need	Nitrogen Need	Nitrogen Need	Phosphorus crop removal ¹	No application
51-75	76-110	Nitrogen Need	Phosphorus crop removal	Phosphorus crop removal	Phosphorus crop removal	No application
76-100	111-150	Phosphorus crop removal	Phosphorus crop removal	Phosphorus crop removal	Phosphorus crop removal	No application
Greater than 100	Greater than 150	No application	No application	No application	No application	No application

¹ Phosphorus crop removal is the amount of phosphorus a crop removes in one crop year.

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 offsite phosphorus

transport unless appropriate conservation practices, best management practices or management activities are used to reduce the vulnerability.

Heavy Metal Monitoring. When sewage sludge (biosolids) are applied, the applicable metal loading limits for arsenic, cadmium, copper, lead, mercury, molybdenum, nickel, selenium, and zinc shall be followed per 40 CFR 503 adopted by reference in SDCL 74:52:09:01.

Additional Criteria to Minimize Agricultural Non-point Source Pollution of Surface and Ground Water Resources

Plans developed to minimize agricultural non-point source pollution of surface or ground

water resources shall include the following practices and/or management activities that can reduce the risk of nitrogen or phosphorus movement from the field.

If a field is determined highly vulnerable for nitrate leaching to an aquifer, all of the following management activities will be implemented.

Prior to the application of nitrogen above starter application rates, a nitrate nitrogen test (zero to two foot and two to four foot sample) will be taken and analyzed. Soil samples (zero to six inches) should also be included and analyzed for P and K. Soil samples will be taken as per land grant university recommendations found on the back of the SDSU Soil Testing Laboratory Soil Sample Information Sheet, or SDSU-FS935, "Recommended Soil Sampling Methods for South Dakota."

An acceptable alternative to the zero to four feet sampling method would be to take a zero to two foot sample every year within four weeks after crop harvest prior to nitrogen applications above starter rates as recommended by SDSU.

If animal manure is to be applied, test the manure for total N, inorganic N, total P, and total K. Use sample procedures as described in SD-NRCS-FS-36, "Sampling Manure for Nutrient Management."

Use a soil fertility analysis and manure analysis as the primary tools in deciding what nutrients will be applied and the rate of application. Apply nitrogen at rates recommended by the SDSU EC750 "Fertilizer Recommendations Guide" and based upon a realistic yield goal.

Annually, sample and obtain a laboratory analysis to determine the concentration of nitrate nitrogen (NO₃-N) in irrigation water. Credit that amount of nitrogen delivered to the crop with the irrigation water.

Apply nutrients as close to the time of plant utilization as is possible. Apply no nitrogen in the fall, with the exception of incidental N in commercial phosphorus applications or organic wastes.

If areas of the field are determined to be highly vulnerable for phosphorus loss to surface waters, the following management activities and/or conservation practices will be implemented on the field.

Soil samples will be taken and analyzed for phosphorus at least every two years at a depth of zero to six inches. Take soil samples as per SDSU recommendations found on the back of the SDSU Soil Testing Laboratory Soil Sampling Information Sheet, SDSU-FS935, "Recommended Soil Sampling Methods for South Dakota."

If animal manure is to be applied, test the manure for total N, inorganic N, total P, and total K. Use sample procedures described in SD-NRCS-FS-36, Sampling Manure for Nutrient Management."

Use a soil fertility analysis and manure analysis as the primary tools in deciding what nutrients will be applied and the rate of application.

Manure or organic by-products applications will be planned according to Table 1 shown under "Additional Criteria Applicable to Manure or Organic By-Products Applied as a Plant Nutrient Source."

In no case shall commercial fertilizer and/or manure application rates exceed the rates of nitrogen recommended by EC 750 with the exception of organic wastes applied to legumes which may be applied at rates equal to crop removal minus soil test NO₃-N.

Commercial fertilizer phosphorus sources should be placed below the soil surface. However, surface application of commercial fertilizer is permitted on no-till cropland, pastureland, or hayland within 100 feet of a surface water or conveyance. In all other cropland tillage systems, commercial fertilizer phosphorus sources will be placed below the soil surface within 100 feet of a surface water or conveyance.

In no case shall manure or organic by-product applications (broadcast or incorporated) be made within 100 feet of a surface water or conveyance; 35 feet if a perennial grass filter strip is established and maintained. A

minimum of a 35-foot wide perennial grass filter strip is required in all cases on the edges of fields that border a lake, river, or intermittent/perennial stream.

In selected cases based on Table 1, depending on soil test phosphorus and estimated soil loss in a field, a perennial grass filter strip maybe required within 100 feet of a surface water or conveyance if manure is applied based on nitrogen needs of a crop and not crop removal of phosphorus (see Table 1).

At a minimum, conservation practices will be implemented to control erosion to the soil loss tolerance.

In situations where building soil test phosphorus levels is desirable for crop production:

Commercial fertilizer applications will be based on the rate recommended in the EC-750. For soil test P levels which are low or very low, broadcast commercial fertilizer applications can be made to build soil test phosphorus levels that will not exceed 20 pounds P₂O₅ for each ppm below a medium soil test. In addition, commercial fertilizer applications 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.

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 a nutrient management plan (i.e., amount, source, placement, form, timing of application) identified 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.

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.

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.

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 SDTG, Section IV – Conservation Practice Standards).

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

Apply nutrient materials uniformly to the application area (i.e., management zone or field). 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 stalk-test to minimize risk of over applying nitrogen in excess of crop needs.

Avoid winter nutrient 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 N₂O, carbon dioxide CO₂).

Nutrient applications associated with irrigation systems should be applied in accordance with

the requirements of Irrigation Water Management (449).

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;

The 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 NMP shall document:

The 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;

The 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

The owner/client or their agent 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. As a minimum, plans will be reviewed and revised with each soil test cycle;

Significant changes in animal numbers feed management and/or bedding 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.

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.

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.

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.

If spillage, leakage, discharge, or release should occur the event is required by state regulations to be reported to the SD DENR or the SDDA.

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.

All chemigation is required by SD law to have an effective check valve interlock, low pressure drain, and vacuum relief. See SDCL 34-2A-3, Administrative Rules of SD, Chapter 74:02:09, Chemigation, for specific requirements. For questions concerning SD law, contact the SD Department of Environment and Natural Resources, Division of Water Management, at (605) 773-3352, or the SDDA at (605) 773-3724.

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

REFERENCES

Follett, R.F. 2001. Nitrogen Transformation and Transport Processes. pp. 17-44, In R.F.

Follett and J. Hatfield. (eds.). 2001. Nitrogen in the Environment; Sources, Problems, and Solutions. Elsevier Science Publishers. The Netherlands. 520 pp.

Sims, J.T. (ed.) 2005. Phosphorus: Agriculture and the Environment. Agron. Monogr. 46. ASA, CSSA, and SSSA, Madison, WI.

Stevenson, F.J. (ed.) 1982. Nitrogen in Agricultural Soils. Agron. Series 22. ASA, CSSA, and SSSA, Madison, WI.

STATE SPECIFIC REFERENCES

SDSU-EC 750, "Fertilizer Recommendations Guide"

SDSU-Extra 8009, "Quantities of Nutrients Contained in Crops"

SDSU Soil Testing Laboratory: Soil Sampling Information Sheet

SDSU-FS935, "Recommended Soil Sampling Methods for South Dakota"

SD-NRCS-FS-36 "Sampling Manure for Nutrient Management"

SD-NRCS-FS-38 "Using Manure Analysis Results"

SD-NRCS-FS-43 "Calibrating Manure Spreader application Rates"

USGS/SDGS – Geology, Water Resources or Aquifer Reports,
<http://www.sdgs.usd.edu/digitalpubmaps/index.html>,

http://jurassic2.sdgs.usd.edu/cold_fusion/lithdb/search_lith.cfm

USDA – NRCS: Agricultural Waste Management Field Manual

South Dakota Codified Law - Shallow aquifers as defined in SDCL 34A-3A-24
<http://legis.state.sd.us/statutes/DisplayStatute.aspx?Type=Statute&Statute=34A-3A-24>

South Dakota Codified Law – Soil Amendments as defined in SDCL 38-19A-1(14)
<http://legis.state.sd.us/statutes/DisplayStatute.aspx?Type=Statute&Statute=38-19A-1>