

**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD
*SOUTH DAKOTA SUPPLEMENTS ITALICIZED***

NUTRIENT MANAGEMENT

(ac.)
CODE 590

DEFINITION

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

PURPOSES

- ◆ 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 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. *Review and comply with the minimum set back requirements in the current South Dakota Swine and General Livestock Permits when dealing with permitted facilities.*

Plans for nutrient management shall be developed in accordance with policy requirements of the *Natural Resources Conservation Service (NRCS) General Manual (GM), 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 *South Dakota Technical Guide (SDTG);*

procedures contained in the National Planning Procedures Handbook (NPPH), and the NRCS National Agronomy Manual (NAM), Section 503.

Persons who review or approve plans for nutrient management shall be certified *in South Dakota according to the state supplement to the GM, Title 190, Part 402.03(a).*

Plans for nutrient management that are elements of a more comprehensive conservation plan shall recognize other requirements of the conservation plan and be compatible with its other requirements.

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. *Yield goals should be no greater than the yield determined by adding five years of yield data, subtracting the highest and lowest yields, averaging the remaining three years and multiplying by 1.1. If long-term data for an individual field is not available, use yield data from similar soil, cropping, and management conditions elsewhere on the farm or local area.* For new crops, industry yield recommendations may be used until documented yield information is available.

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

Field Risk Assessment

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.

Use table “Nitrate Leaching Matrix” located in Section II of the SDTG. In addition, other necessary reference materials are the “Soil Leaching Potential” tables located in Section II of the SDTG and a reference list of the local United States Geological Survey/South Dakota Geological Survey Water Resource Reports or additional compiled aquifer information located in Section I of the SDTG.

- Vulnerability for phosphorus loss to surface waters.

For surface water protection, areas of fields within 200 feet of a lake, river, stream, or a conveyance to these waters should be considered highly vulnerable to potential surface water contamination. A conveyance may be defined as a drainage ditch, tile inlet, intermittent stream, waterway, or unvegetated channel. A lake is a pond, reservoir, or other body of water, created by either natural or artificial means, but is not a wetland or a pond or appurtenance that is used for the treatment and disposal of wastes and that is permitted for such uses.

Erosion, runoff, and water management controls shall be installed, as needed, on fields that receive nutrients.

Additional Criteria to Budget and Supply Nutrients for Plant Production

Soil Sampling and Laboratory Analysis (Testing)

Nutrient planning shall be based on current soil test results developed in accordance with *South Dakota State University (SDSU)* guidance. Current soil tests are those that are no older than three years.

Soil 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. 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).”

Soil testing shall include analysis 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.

Manure or Organic By-Product Testing

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.

Plant Tissue Testing

Tissue sampling and testing, where used, shall be done in accordance with *SDSU* standards or recommendations.

Nutrient Application Rates

Soil amendments shall be applied, as needed, to adjust soil pH to the specific range of the crop for optimum availability and utilization of nutrients.

Recommended nutrient application rates shall be based on *SDSU EC750 “Fertilizer Recommendations Guide”* using current soil test results, realistic yield goals and management capabilities.

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 other organic by-products are a source of nutrients. When manure or other 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 other organic by-

products are a source of nutrients. When manure or other organic by-products are a source of nutrients, see “Additional Criteria” below.

- ◆ **Potassium Application** - Excess potassium shall not be applied in situations in which it causes unacceptable nutrient imbalances in crops or forages *fed to livestock*.
- ◆ **Other Plant Nutrients** - The planned rates of application of other nutrients shall be consistent with *SDSU* guidance.
- ◆ **Starter Fertilizers** - Starter fertilizers containing nitrogen, phosphorus, and potassium may be applied in accordance with *SDSU* recommendations. When starter fertilizers are used, they shall be included in the nutrient budget.

Nutrient Application Timing

Timing and method of nutrient application shall correspond as closely as possible with plant nutrient uptake characteristics, while considering cropping system limitations, weather and climatic conditions, and field accessibility.

Nutrient Application Methods

Nutrients shall not be applied to frozen, snow-covered, or saturated soil if the potential risk for runoff exists. *In situations where a catastrophic system failure is imminent; animal waste may be applied to soils with slopes less than four percent provided that a 200 ft. buffer is maintained to a water conveyance.*

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

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

Nutrient values of manure and organic by-products (excluding sewage sludge) shall be determined prior to land application based on laboratory analysis *or, acceptable values agreed to by NRCS, SDSU, South Dakota Department of Environment and Natural Resources (DENR), and South Dakota Department of Agriculture (SDDA).*

Nutrient Application Rates

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

- ◆ **Nitrogen Application** - When the *application* is implemented on a *nitrogen* standard, manure or other organic by-products shall be applied at rates *based on SDSU recommendations or crop removal in the case of legumes*.

Manure or other organic by-products may be applied on legumes at rates equal to the estimated removal of nitrogen in harvested plant biomass.
- ◆ **Phosphorus Application** - *When manure or other organic by-products are used, the planned rates of application shall be based on soil test phosphorus and consistent with the following Table 1. In such situations, an additional nitrogen application, from non-organic sources, may be required to supply the recommended amounts of nitrogen.*

Table 1

<u>Soil Test Organic Phosphorus Level</u>	<u>Olsen (ppm)</u>	<u>Manure or by-product Application</u>
Low	<7	Nitrogen Based
Medium	8-11	Nitrogen Based
High	12-15	Phosphorus Based – not to exceed 1.5 times crop removal
Very High	16>	Phosphorus Based – not to exceed crop removal

A single 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 *highly vulnerable* to off-site phosphorus transport.

The application rate (in/hr) for material applied through irrigation shall not exceed the soil intake/infiltration rate. The total application shall not exceed *the water holding capacity of the root zone*.

Heavy Metals Monitoring

When *waste materials* are applied, with an accumulation of potential pollutants (including arsenic, cadmium, copper, lead, mercury, selenium, and zinc), the soil shall be monitored in accordance with the US Code, Reference 40 CFR, Parts 403 and 503, and/or any applicable state and local laws or regulations.

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

Plans developed to minimize agricultural nonpoint 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 the nutrient application site 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 (0 to 2-ft. and 2 to 4 ft. sample) will be taken and analyzed. Soil samples (0-6 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. Provide the requested information on the soil sample information sheet and send along with soil samples to the laboratory. Distribution copies are available at county Extension offices.

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 South Dakota-NRCS-Fact Sheet (FS)-36.

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. The sample shall be taken in the spring prior to irrigation water application. 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 starter fertilizer applications, incidental N in commercial phosphorus applications or organic wastes. Do not apply all of a row crop's nitrogen needs prior to planting unless an inhibitor is used, or the nitrogen needs are met through the application of organic waste.

If the nutrient application site is determined highly vulnerable for phosphorous loss to surface waters, the following management activities and/or conservation practices will be implemented.

Soil samples will be taken and analyzed for phosphorous at least every two years at a depth of 0-6 inches. Take soil samples as per SDSU recommendations found on the back of the SDSU Soil Testing Laboratory Soil Sampling Information Sheet. Please provide the requested information on the soil sample information sheet and send along with soil samples to the laboratory. Distribution copies are available at county Extension offices.

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.

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

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

- a) *Commercial fertilizer applications will not exceed twice the broadcast rate recommended in the EC-750 for soil test P levels which are medium or less. If the soil test P level is high or very high, P fertilization rates are limited to rates recommended in the EC 750 based on a realistic yield goal.*
- b) *Manure or organic by-products applications can be planned according to Table 1 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.

Place P below the soil surface, with the exception of no-till cropland or commercial fertilizer applications where surface application is permitted, except within 50 feet of a surface water or conveyance. In no case shall manure or organic by product applications be made within 50-feet of a surface water or conveyance; 200 feet if broadcast without incorporation..

A minimum of 50-foot wide filter strip of grass will be established or previously existing on the edges of fields that border a lake, river, or stream.

Conservation practices will be implemented that control erosion to the level acceptable in a resource management system.

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

Nutrients shall be applied in such a manner as not to degrade the soil's structure, chemical properties, or biological condition. Use of nutrient sources with high salt content will be minimized unless provisions are used to leach salts below the crop root zone.

Nutrients shall not be applied to flooded or saturated soils when the potential for soil compaction and creation of ruts is high.

CONSIDERATIONS

Consider additional practices such as Conservation Cover (327), Grassed Waterway (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), and Residue Management (329A, 329B, or 329C, and 344) to improve soil nutrient and water storage, infiltration, aeration, tilth, diversity of soil organisms, and to protect or improve water quality.

Consider induced deficiencies of nutrients due to excessive levels of other nutrients.

Consider cover crops whenever possible to utilize and recycle residual nitrogen.

Consider application methods and timing that reduce the risk of nutrients being transported to ground and surface waters, or into the atmosphere. Suggestions include:

split applications of nitrogen to provide nutrients at the times of maximum crop utilization;

band applications of phosphorus near the seed row;

applying nutrient materials uniformly to application areas or as prescribed by precision agricultural techniques; and/or

immediate incorporation of land applied manures or organic by-products;

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

Consider the potential problems from odors associated with the land application of animal manures, especially when applied near or upwind of residences.

Consider nitrogen volatilization losses associated with the land application of animal manures. Volatilization losses can become significant if manure is not immediately incorporated into the soil after application.

Consider the potential to affect National Register listed or eligible cultural resources.

Consider using soil test information no older than one year when developing new plans, particularly if animal manures are to be a nutrient source.

Consider annual reviews to determine if changes in the nutrient budget are desirable (or needed) for the next planned crop.

On sites on which there are special environmental concerns, consider other sampling techniques. (For example: soil surface sampling for phosphorus accumulation or pH changes.)

Consider ways to modify the chemistry of animal manure, including modification of the animal's diet to reduce the manure nutrient content, to enhance the producer's ability to manage manure effectively.

PLANS AND SPECIFICATIONS

Plans and specifications will be prepared for specific field sites based on this standard. Plans and specifications include job sheets, narrative statements in conservation plans, and appropriate forms.

When applicable, plans shall include other practices or management activities as determined by specific regulation, program requirements, or producer goals.

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. As a minimum, plans will be reviewed and revised with each soil test cycle;

protection of fertilizer and organic by-product storage facilities from weather and accidental leakage or spillage. *If spillage, leakage, or release should occur the event is required by state regulations to be reported to the DENR or the SDDA;*

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 or exceed the recommended and planned rates, records will indicate the reasons for the differences;

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

field identification;

soil test results and recommendations for nutrient application;

quantities, analyses and sources of nutrients applied;

dates, *times* and method of nutrient applications;

crops planted, planting and harvest dates, yields, and crop residues removed;

results of water, plant, and organic by-product analyses; and dates of review, and person performing the review, and recommendations that resulted 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.

It is the responsibility of the crop producer, to maintain records that document the implementation of plans for nutrient management.

Workers should be protected from and avoid unnecessary contact with chemical fertilizers and organic by-products. Protection should include the use of protective clothing when working with plant nutrients. Extra caution must be taken when handling ammonia sources of nutrients, or when dealing with organic wastes stored in unventilated enclosures.

The disposal of material generated by the cleaning nutrient application equipment should be accomplished properly. Excess material should be collected and stored or field applied in an appropriate manner. Excess material should not be applied on areas of high potential risk for runoff and leaching.

The disposal or recycling of nutrient containers should be done according to state and local guidelines or regulations.

All chemigation is required by South Dakota law to have an effective check valve interlock, low pressure drain, and vacuum relief. See South Dakota Codified Law 34-2A-3, Administrative Rules of South Dakota, Chapter 74:02:09, Chemigation, for specific requirements. For questions concerning South

Dakota law, contact the DENR, Division of Water Management at 605-773-3352, or the SDDA at 605-773-3724.

REFERENCES:

SDSU-EC 750, "Fertilizer Recommendations Guide"

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

SDSU Soil Testing Laboratory: Soil Sampling Information Sheet

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

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

USGS/SDGS – Geology, Water Resources or Aquifer Reports

USDA – NRCS: Agricultural Waste Management Field Manual