

**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD**

NUTRIENT MANAGEMENT

(Acre)

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 non-point 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.

Plans for nutrient 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 504, Amendment NE16.

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

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, organic matter, 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 form, source, amount, timing and method of application of nutrients on each field to achieve realistic production goals, while minimizing N and/or P movement to surface and/or ground waters.

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

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the Natural Resource Conservation Service.

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Soil Sampling and Laboratory Analysis (Testing)

Nutrient planning shall be based on current soil test results developed in accordance with University of Nebraska recommendations. Current soil tests are those that are no older than one year for N and no more than three years for other nutrients.

Soil samples shall be collected and prepared according to University of Nebraska NebGuide G91-1000 "Guidelines for Soil Sampling". Laboratories that meet University of Nebraska guidelines shall perform soil test analyses. 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. buffer pH, pH, electrical conductivity (EC), soil organic matter, N, P, and K. Refer to Appendix A "Annual Nutrient Budget Jobsheet" for more information.

Special Soil and Plant Tissue Testing

Tissue sampling and testing, chlorophyll meters, late spring nitrate tests where used, shall be done in accordance with University of Nebraska recommendations.

Nutrient/Lime Application Rates

Lime 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 University of Nebraska recommendations (and/or industry practice when recognized by the university) that considers 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 N application rates shall match University of Nebraska recommendations. Refer to Appendix B for a list of NebGuides and other references providing these recommendations and to Appendix A "Annual Nutrient Budget Jobsheet" for additional instructions. When manure or other organic by-products are a source of nutrients, see "Additional Criteria" below.

- ◆ **Phosphorus Application** - Planned P application rates shall match the recommended rates of the University of Nebraska or industry standards with soil tests less than; Bray P-1/Mehlich III of 30 ppm, or Olsen (Sodium bicarbonate) of 20 ppm. Commercial P fertilizer may be applied at rates equal or less than the estimated crop removal of P in harvested plant biomass on sites with soil tests greater than Bray P-1/Mehlich III of 30 ppm, or Olsen (Sodium bicarbonate) of 20 ppm. Agricultural Waste Management Field Handbook, Chapter 6 will be used to determine crop removal when using commercial amendments. When manure or other organic by-products are a source of nutrients, see "Additional Criteria" below
- ◆ **Potassium Application** - Excess K shall not be applied in situations in which it causes unacceptable nutrient imbalances in crops or forages. When forage quality is an issue associated with excess K 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 University of Nebraska guidance or industry practice if recognized by the University of Nebraska.
- ◆ **Starter Fertilizers** - Starter fertilizers containing N, P and K may be applied in accordance with University of Nebraska recommendations, or industry practice if recognized by the University of Nebraska. 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.

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 when possible. Acceptable "book values" may be used when no other alternative is available. Book values are found in the Agricultural Waste Management Field Handbook, Chapter 4 - Agricultural Waste Characteristics.

Odor Management

Manure/organic by-products will be applied according to local/state rules and regulations for odor control. When odor management plans are required, key components include; application method, timing, location and manure source.

Nutrient Application Rates

The application rate (in/hr) for liquid manure applied through irrigation shall not exceed the soil intake/infiltration rate. The total application shall not exceed the field capacity of the soil.

When manure or other organic by-products are used, the planned rates of N and P application recorded in the plan shall be determined based on the following guidance:

- ◆ **Nitrogen Application** – When the plan is being implemented on the agronomic rate for N, University of Nebraska recommendations will be followed. Nitrogen based manure/organic by-product applications will consider the "Crop Available Nitrogen". Refer to Appendix B for a list of NebGuides and other references providing these recommendations and to Appendix A "Annual Nutrient Budget Jobsheet" for additional instructions.

Manure or other organic by-products may be applied on legume crops at rates equal to the estimated removal of N in harvested plant biomass.

When the plan is being implemented on a phosphorus standard, manure or other organic by-products shall be applied at rates

consistent with the P application guidelines below. In such situations, an additional N application, from non-organic sources, may be applied according to University of Nebraska recommendations.

- ◆ **Phosphorus Application** - When manure or other organic by-products are used, the planned rates of P application shall be consistent with any one of the following options:
 - **Phosphorus Index (PI) Rating Option.** An N-based manure application may be used on Low or Medium risk sites. A P-based manure application (crop P removal basis) will be used for sites with a High Risk. Manure or other organic P sources will not be applied to any field with a Very High Risk. Refer to Nebraska Agronomy Technical Note 107 "Nebraska Phosphorus Index Background and Users Guide", or EC195 "The Nebraska Phosphorus Index (2005) Background and Users Guide" for guidance on the P-index.
 - **Soil Test Option.** Nitrogen-based manure applications (according to University of Nebraska guidelines) are acceptable on sites where soil test levels indicate phosphorus application is needed for optimum crop production. A P-based manure application (crop P removal basis) will be used where phosphorus application is not recommended for optimum crop production. All soil test levels used to determine the need for phosphorus applications and nitrogen recommendations are according to University of Nebraska guidelines..

Determining Phosphorus-Based Application Rate

A single application of manure may be made at a rate equal to the University of Nebraska recommended P application, or the estimated P removal in harvested plant biomass for the crop or multiple years in a crop sequence.

Agricultural Waste Management Field Handbook, Chapter 6 will be used to determine crop P uptake. When manure is applied to supply P for multiple years in a crop sequence, the application rate shall not exceed the

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University of Nebraska recommended N application rate during the year of application.

Field Risk Assessment

When animal manure or other organic by-products are applied, a field-specific assessment of the potential for P transport from the field shall be completed. This assessment may be done using the P-Index risk assessment tool. In such cases, plans shall include:

- ◆ a record of the P-Index risk assessment rating for each field or sub-field, and
- ◆ information about conservation practices and management activities that can reduce the potential for P 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.

Heavy Metals Monitoring

When sewage sludge is applied, the accumulation of potential pollutants (including arsenic, cadmium, chromium, copper, lead, mercury, molybdenum, nickel, selenium, and zinc) in 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

In areas with an identified or designated nutrient-related water quality impairment, an assessment shall be completed of the potential for N and/or P transport from the field. The Leaching Index (LI) and/or P Index (PI), or other recognized assessment tools, may be used to make these assessments. The results of these assessments and recommendations shall be discussed with the producer and included in the plan.

Plans developed to minimize agricultural non-point source pollution of surface or ground water resources shall include practices and/or management activities that can reduce the risk of N or P movement from the field.

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. Excess K shall not be applied in situations in which it causes unacceptable levels that adversely affect soil condition.

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

CONSIDERATIONS

Consider induced deficiencies of nutrients due to excessive levels of other nutrients or changes in pH.

Recognize and consider the importance of odor management planning, manure storage and handling with nutrient management plans involving manure.

Consider the need for timely manure sampling and the uniformity of nutrient content in manure.

Consider utilizing manure/organic by-products instead of commercial fertilizer to improve soil organic matter and other benefits.

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, tillage, diversity of soil organisms and to protect or improve water quality.

Consider winter annual cover crops whenever possible to tie-up and recycle residual N.

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 N to provide nutrients at the times of maximum crop utilization,

- ◆ avoiding winter nutrient application for spring seeded crops,
- ◆ band applications of P 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 manure or organic by-products, and
- ◆ delaying field application of animal manure 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.

When developing a comprehensive nutrient management plan for livestock systems an analysis of whole farm nutrient balance for the potential of nutrient concentration shall be completed. An inventory of manure nutrients (with appropriate adjustments for dietary nutrients) and crop needs shall also be completed.

Consider minimum application setback distances from environmentally sensitive areas, such as sinkholes, wells, gullies, ditches, surface inlets or rapidly permeable soil areas.

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

Consider N volatilization losses associated with the land application of animal manure. 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 manure 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 profile sampling for N, Pre-Sidedress Nitrogen Test

(PSNT), Pre-Plant Soil Nitrate Test (PPSN) or soil surface sampling for P 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 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 water quality impairment.

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

- ◆ complete nutrient budget for N, P, and K and other appropriate nutrients for the crop budget according to instructions in Appendix A,
- ◆ aerial photograph or map and a soil map of the site,
- ◆ crop rotation,
- ◆ results and the recommended timing of soil, plant, water, manure or organic by-product sample analyses,
- ◆ realistic yield goals for the crops in the rotation,
- ◆ quantification of all nutrient sources,
- ◆ recommended nutrient rates, timing, form, and method of application and incorporation,
- ◆ location of designated sensitive areas or resources and the associated, nutrient management restriction,
- ◆ guidance for implementation, operation, maintenance, and
- ◆ guidance for recordkeeping (refer to Appendix A for specific requirements for annual nutrient budgets, refer to Title 130 Chapters 3, 10 and 11 for NDEQ requirements).

If increases in soil P levels are expected, plans shall document:

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- ◆ the soil P levels at which it may be desirable to convert to P based implementation,
- ◆ the relationship between soil P levels and potential for P transport from the field, and
- ◆ the potential for soil P drawdown from the production and harvesting of crops

In addition to the requirements described above, plans for nutrient management shall include:

- ◆ discussion about the relationship between N and P transport and water quality impairment. The discussion about N should include information about N leaching into shallow ground water and potential health impacts. The discussion about P should include information about P accumulation in the soil, the increased potential for P transport in soluble form, and the types of water quality impairment that could result from P movement into surface water bodies,
- ◆ discussion about how the plan is intended to prevent the nutrients (N and P) supplied for production purposes from contributing to water quality impairment,
- ◆ a statement that the plan was developed based on the requirements of the current standard and any applicable Federal, state, or local regulations or policies; and that changes in any of these requirements may necessitate a revision of the plan,
- ◆ Persons planning to apply commercial fertilizer, insecticides, or pesticides through an irrigation system must obtain a chemigation permit through the local Natural Resources District. All chemigation systems must be equipped with the appropriate safety equipment to prevent backflow of chemicals into the water source. Contact the local Natural Resources District for chemigation permit,
- ◆ Contact the Nebraska Department of Environmental (NDEQ) Quality for permits and other requirements related to applying livestock effluent or other liquid waste through irrigation systems and,
- ◆ When applicable, plans shall include other practices or management activities as determined by NRD management area requirements, state and local

zoning/regulation, program requirements, or producer goals.

In addition if nutrient management plans are developed as part of a NDEQ permit for a livestock waste control facility will address the following:

- ◆ Nutrient management plan requirements for NDEQ permits can be found in Title 130, Chapters 3, 10, and 11 (refer National Engineering Manual Part 501 Rules and Regulations),
- ◆ There may be additional requirements based on the actual construction, operation and maintenance of a particular livestock waste control facility,
- ◆ Major components of a nutrient management plan will be as follows: inventory of land application requirements for the facility; sampling, analysis; manure application plan; record-keeping; best management practices; reporting (P levels that require a report to NDEQ); setback requirements; and other considerations,
- ◆ In addition to the nutrient management plan, sludge management, odor management, equipment capacity, emergency response, operation and maintenance of livestock facilities and concerns related to the closure of livestock facilities will be addressed

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.
- ◆ 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 and nutrient trends. As applicable, records include:
 - soil test results and recommendations for nutrient application,
 - quantities, analyses and sources of nutrients applied,
 - dates 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,
 - dates of review and person performing the review, and recommendations that resulted from the review, and
 - other specific records as necessary to complete annual nutrient budgets (refer to Appendix A “Annual Nutrient Budget Jobsheet”).

Records should be maintained for five years; or longer than five years when beneficial to the producers long term nutrient management goals or if required by other Federal, state, or local ordinances, or program or contract requirements.

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.

Links to Other Guidance:

Nebraska Agronomy Technical Note 107 “Nebraska Phosphorus Index Background and Users Guide”, [Agronomy Tech Note Index](#)

EC195 “[The Nebraska Phosphorus Index \(2005\) Background and Users Guide](#)” for guidance on the P-index