

**NATURAL RESOURCES CONSERVATION SERVICE  
CONSERVATION PRACTICE STANDARD**

**NUTRIENT MANAGEMENT**

(Acre)

**CODE 590**

**DEFINITION**

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

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

**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.

Persons who review and approve plans for nutrient management shall be certified in accordance with NRCS, General Manual, Title 190, Ecological Sciences, Part 402, Nutrient Management; OR402.01, Policy and OR402.03, Certification.

Plans for nutrient management that are elements of a Resource Management System (RMS) Plan or Comprehensive Nutrient Management Plan (CNMP) for livestock operations, shall recognize other requirements of the RMS or CNMP and be compatible with those requirements.

**CONDITIONS WHERE PRACTICE APPLIES**

This practice applies to all lands where plant nutrients and soil amendments are applied.

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

**CRITERIA**

**General Criteria Applicable to All Purposes**

Plans for nutrient management shall comply with all applicable Federal, Tribal, state, and local laws and regulations.

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 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

Plans for nutrient management shall specify the form, source, amount, timing and method of application of

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nutrients on each field to achieve realistic production goals, while minimizing nitrogen and/or phosphorus movement to surface and/or ground waters.

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

### **Soil Sampling and Laboratory Analysis (Testing)**

Nutrient planning shall be based on current soil test results developed in accordance with Pacific Northwest Land Grant University (PNLGU) guidance or industry practice if recognized by the PNLGU. Current soil tests for nitrogen, phosphorus and potassium are those that are less than five-years old.

Site specific conditions and management levels may require more frequent soil sampling and analysis. In such cases the frequency shall be determined by the planner and client and documented in the nutrient management plan.

Current soil tests and analyses are required during the inventory and evaluation phase of the nutrient management planning process on critical fields. The number of critical fields to be sampled will be determined by the planner and decision-maker.

Critical fields in the planning unit are identified as those that meet one of the following criteria:

- ◆ Where manure or organic-by-products are or will be applied.
- ◆ Located within areas with designated nutrient related water quality concerns.
- ◆ Located over an unconfined aquifer.
- ◆ Contain soil map units subject to frequent or very frequent flooding.
- ◆ Contain soils with high or very high runoff classes.
- ◆ Contain soils with high leaching potential.
- ◆ Within 200 feet of perennial surface waters.

- ◆ Receiving N or P applications in excess of plant uptake for any crop in the crop rotation.

The nutrient management component of the conservation plan will include a schedule for sampling and analysis for all fields in the planning unit

On fields where manure and other organic-by-products are applied at end of season, soil nitrate-nitrogen sample and analysis will be taken, in addition to the current soil test requirement to evaluate nitrogen management. The test will be taken a minimum of once during the planned soil test cycle identified in the plan.

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

- ◆ State Certified Programs,
- ◆ The North American Proficiency Testing Program (Soil Science Society of America), or
- ◆ Laboratories whose tests are accepted by the PNLGU.

Soil testing shall include analysis for any nutrients for which specific information is needed to develop the nutrient plan. Analyses shall be requested to monitor or amend the annual nutrient budget for pH, electrical conductivity (EC), soil organic matter, nitrogen, phosphorus, and potassium.

### **Plant Tissue Testing**

Tissue sampling and testing, where used, shall be done in accordance with PNLGU 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 PNLGU nutrient management guidelines and expertise (and/or industry practice when recognized by PNLGU) which consider current soil test results, realistic yield goals and management capabilities. If PNLGU does not provide specific nutrient management guidelines, application shall be based on realistic yield goals, and associated plant nutrient uptake rates.

Plant uptake rates recognized by NRCS may be found in the Agricultural Waste Management Field Handbook, Chapter 6 – Role of Plants in Waste Management, Table 6-6. When plant uptake rates are not available the NRCS State agronomist shall be contacted for assistance in developing a nutrient management guideline based on the general criteria in this standard.

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. When forage quality is an issue associated with excess potassium application, state standards shall be used to set forage quality guidelines. High concentrations of potassium and nitrogen

in manure applied on forages may cause grass tetany, a serious disorder in lactating ruminants. When soil test K levels exceed 800 ppm, the potential animal health concerns will be discussed with the producer and noted in the nutrient management plan.

- ◆ **Other Plant Nutrients** - The planned rates of application of other nutrients shall be consistent with PNLGU guidance or industry practice if recognized by PNLGU.
- ◆ **Starter Fertilizers** - Starter fertilizers containing nitrogen, phosphorus and potassium may be applied in accordance with PNLGU recommendations or industry practice, if recognized by PNLGU. When starter fertilizers are used, they shall be included in the nutrient budget.

#### **Nutrient Application Timing**

The timing of nutrient application shall correspond with PNLGU guidelines and expertise. In the absence of guidelines, timing and 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

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determined prior to land application based on laboratory analysis, or acceptable “book values” recognized by the NRCS and PNLGU. Historic records for the operation may be used, if they accurately estimate the nutrient content of the material. Book values recognized by NRCS and PNLGU may be found in the Agricultural Waste Management Field Handbook, Chapter 4 - Agricultural Waste Characteristics.

### **Nutrient Application Rates**

The application rate (in/hr) for material applied through irrigation shall not exceed the soil intake/infiltration rate. The field capacity of the soil shall not be exceeded at any time.

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

◆ **Nitrogen Application** - When the plan is being implemented on a phosphorus standard, manure or other organic by-products shall be applied at rates consistent with the phosphorus standard. In such situations, an additional nitrogen application, from non-organic sources, may be required to supply the recommended amounts of nitrogen.

On sites allowing nitrogen based nutrient application, manure and other organic by-products shall be applied according to the PNLGU nutrient recommendation for nitrogen. On legume only forage and seed stands, where there is no PNLGU recommendation, application may be 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 phosphorus application shall be consistent with:

### **Phosphorus Index (PI) Site Rating.**

Nitrogen based manure application is allowed on Low and Medium Risk Sites. Phosphorus based manure

application is required on High Risk Sites.\* No manure application is allowed on Very High Risk Sites unless the nutrient management plan includes conservation practice and management alternatives that will reduce PI transport and source factors.\*\*

\* Acceptable phosphorus based manure application rates shall be determined as a function of soil test recommendation or estimated phosphorus removal in harvested plant biomass.

\*\* Conservation practice and management alternatives that will reduce the PI site rating from Very High to High or lower site risk will be scheduled as components of a RMS or CNMP and be identified as criteria in the nutrient management practice specification. Phosphorus based manure application may continue during implementation of the required conservation practices and/or management alternatives.

A current phosphorus soil test shall be used in determining the PI rating. In western Oregon a Bray P1 test shall be used. In eastern Oregon the Olsen test is required.

Phosphorus removal in harvested plant biomass may be found in the Agricultural Waste Management Field Handbook, Chapter 6 – Role of Plants in Waste Management, Table 6-6.

### **Field Risk Assessment**

When animal manures or other organic by-products are applied, a field-specific assessment of the potential for phosphorus transport from the field shall be completed. This assessment shall be completed using the Phosphorus Index(PI). In such cases, plans shall include:

- ◆ a record of the PI site rating for each field or sub-field, and

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- ◆ information about conservation practices and management activities that can reduce the potential for phosphorus movement from the site.

When PI ratings are completed the results and recommendations shall be discussed with the producer during the development of the plan.

### **Heavy Metals Monitoring**

When biosolids are 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 US Code, Reference 40 CFR, Parts 403 and 503, and/or any applicable state and local laws or regulations.

Plans for nutrient management that include biosolids shall be developed in accordance with NRCS, General Manual, Title 190, Ecological Sciences, Part 402 Nutrient Management; OR40207(e)(1) Land application of sewage sludge and OR402.07(e)(3) and OR402.07(4)(b)(1).

### **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 nitrogen and/or phosphorus transport from the field.

These areas will be determined using the following references:

Current Oregon Department of Environmental Quality (DEQ) documents:

- ◆ Water Quality Limited Streams 303(d) List
- ◆ Total Maximum Daily Load (TMDL) and Water Quality Management Plan (WQMP).
- ◆ DEQ designated groundwater areas.

Oregon NRCS County Shallow Aquifer Maps, 1997, Section I, Field Office Technical Guide.

The Leaching Index (LI) or Nitrogen Index (NI) and/or Phosphorus Index (PI) shall 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 nitrogen or phosphorus 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.

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

Manure and other organic-by-products applied to improve soil tilth shall be evaluated using the current approved Soil Condition Index procedure.

### **CONSIDERATIONS**

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

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

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of soil organisms and to protect or improve water quality.

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,
- ◆ avoiding winter nutrient application for spring seeded crops,
- ◆ 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 manure or organic by-products,
- ◆ 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.

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 and high use areas such as schools, shopping centers, industrial parks, etc.

Consider nitrogen 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 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 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.)

The PSNT is recommended for field corn plantings in western Oregon.

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:

- ◆ aerial photograph or map and a soil map of the site,
- ◆ current and/or planned plant production sequence or crop rotation,
- ◆ results of soil, plant, water, manure or organic by-product sample analyses,
- ◆ realistic yield goals for the crops in the rotation,

- ◆ quantification of all sources of N, P and K and other nutrient sources as needed.
- ◆ recommended nutrient rates from PNLGU nutrient guides, 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, recordkeeping, and
- ◆ Criteria and information that will assist the land-user to annually develop a complete nutrient budget for nitrogen, phosphorus, and potassium for each crop in the crop rotation.

If increases in soil phosphorus levels are expected where manure is applied based on the nitrogen standard, plans shall document:

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

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

In addition to the requirements described above, nutrient management plans that address nitrogen and/or phosphorus related water quality impairment shall also include:

- ◆ discussion about the relationship between nitrogen and phosphorus transport and water quality impairment. The discussion

about nitrogen should include information about nitrogen leaching into shallow ground water and potential health impacts. The discussion about phosphorus should include information about phosphorus accumulation in the soil, the increased potential for phosphorus transport in soluble form, and the types of water quality impairment that could result from phosphorus movement into surface water bodies.

- ◆ discussion about how the plan is intended to prevent the nutrients (nitrogen and phosphorus) 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.

#### **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. Refer to Waste Utilization 633, for guidance in calibrating application equipment.
- ◆ 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

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will indicate the reasons for the differences.

- ◆ Maintaining records to document plan implementation. As applicable, records include:
  - \* soil test results and recommendations for nutrient application,
  - \* quantities, analyses and sources of nutrients applied,
  - \* dates and methods 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, Tribal, state, or local ordinances, or program.

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.

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

## REFERENCES

USDA, NRCS, National Agronomy Manual, 190-V-NAM, June 2000.

USDA NRCS, Agricultural Waste Management Field Handbook, National Engineering Handbook, April 1992.

Oregon, NRCS Agronomy Technical Note No. 26, The Phosphorus Index, April 1994.

Oregon, NRCS Agronomy Technical Note No. 33, Soil Condition Index for Cropland Management Systems, May 2000.

Oregon, NRCS Agronomy Technical Note No. 38, Management of Residual Nitrogen in Cover Crops, August 1998.

Agricultural Phosphorus and Eutrophication, USDA, Agricultural Research Service, ARS-149, July 1999.

USDA, NRCS, Soil Quality Institute Technical Pamphlet No. 2, Phosphorus In Agriculture.

Oregon, NRCS Water Quality Technical Note No. 1, Water Quality Indicator Tools, October 2000.

Core 4 Conservation Practice Workbook, Part 2, Nutrient Management Chapters 1 to 6.

Oregon Department of Environmental Quality (DEQ) water quality documents available on DEQ web site at:  
(<http://waterquality.deq.state.or.us/wq/>)

- ◆ Water Quality Limited Streams 303(d) List
- ◆ Total Maximum Daily Load (TMDL) and Water Quality Management Plans (WQMP)
- ◆ 1998 303(d) Database (Decision Matrix)

Chapter 6. Fertility Management and Fertilizer Application, Pacific Northwest

Conservation Handbook, Pacific Northwest  
Extension Publication, Idaho, Oregon and  
Washington at:  
([http://pnwsteep.wsu.edu/Tillage\\_Handbook/  
contents.html](http://pnwsteep.wsu.edu/Tillage_Handbook/contents.html))

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