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

It is intended that nutrient management plans developed from this standard be used to help producers improve or maintain their level of management and expertise as it relates to the application of nutrients on the lands they own and/or control.

- To budget and supply nutrients for plant production.
- To minimize the potential for environmental damage including agricultural non-point source pollution of surface and ground water resources.
- To maintain or improve the physical, chemical and biological condition of soil.
- To properly utilize all sources of organic material including animal waste as a plant nutrient source.
- To prevent or reduce excess nutrient concentrations in the 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.
- All nutrient management plans that address land application of animal waste shall comply with the State of Idaho Waste Management Guidelines for Confined Feeding Operations.
- Plans for nutrient management shall be developed in accordance with policy requirements of the NRCS General Manual Title 450, Part 401.03 (Technical Guides, Policy and Responsibilities) and Title 190, Part 402 (Ecological Sciences, Nutrient Management, Policy); technical requirements of the NRCS Field Office Technical Guide (FOTG); procedures contained in the National Planning Procedures Handbook (NPPH), and the NRCS National Agronomy Manual (NAM) Section 503.
- Persons who approve plans for nutrient management shall be certified through the joint Idaho Department of Agriculture, NRCS, and University of Idaho (U of I) certification program.
- A nutrient budget for nitrogen, phosphorus, and potassium shall be developed that considers all potential sources of nutrients including, but not limited to, animal waste and

organic by-products, waste water, commercial fertilizer, crop residues, legume credits, and irrigation water.

- Nutrient budgets shall use:
  1. U of I of Idaho Fertilizer Guides.
  2. Recommendations with an equivalent research database approved by a committee made-up of industry, university and agency representatives.
  3. Crop uptake values (Chapter 6, NRCS Agricultural Waste Management Field Handbook).
  4. Tables, values and guides generated from Idaho Animal Waste Management Program (IDAWM) or other state approved programs.
  5. Those contained in the NRCS Agricultural Waste Management Field Handbook, (AWMPH).
- If actual analysis data is available for applied waste, or if waste sources are unique, then use actual analysis values in lieu of standard values. If actual analysis data is not available, nutrient content of waste, organic by-products, septage, and cover crops shall be determined using standard values contained in NRCS Agricultural Waste Management Field Handbook (AWMFH) Chapter 4, ASAE D-384, or U of I of Idaho Fertilizer Guides.
- Yield goals for the crops included in the recommendation shall be based on proven yield by the producer, and achievable yield goals for the area including advancements in technology. Yield goals shall be established for every crop in the rotation.
- Nutrient management plans shall specify the form (liquid, gas or solid), source (dairy, feedlot, commercial fertilizer, etc.), amount, timing, and method of application of nutrients on each field or Conservation Treatment Unit (CTU) to achieve realistic production goals, while minimizing nitrogen and/or phosphorus movement to surface and/or ground water.
- The soil test phosphorus level above which there is no agronomic advantage for application of additional phosphorus is the Phosphorus Threshold (TH) for crops grown in Idaho. The TH is used in the nutrient budgeting process to determine application rates, and to determine trends in soil P concentrations over time. A soil test P concentration is a chemical evaluation of the capability of the soil, as represented by a soil sample, to supply plant available P during the growing season to achieve a desired yield response.
- If nutrient requirements are not available for new or specialty crops use local data from the producer or industry.
- Crop rotations shall be documented in the nutrient management plan.
- Irrigation Water Management as prescribed by the Irrigation Water Management Standard (Code 449), shall be a component of a nutrient management plan if nutrients are applied on irrigated cropland.
- Refer to the Nutrient Application Timing section of this standard for required runoff control practices.

Soil Sampling and Laboratory Analysis

- Soil samples shall be collected and prepared in a manner representative of the entire field (see U of I CES

NO. 704, Soil Sampling for an example).

- Soil test analysis will be performed using analytical methods prescribed by the North American (formerly the Western States) Laboratory Proficiency Testing Program. Soil test P will be determined using the Bray 1 method for soils with no free lime (pH<6.5) and the Olsen method ($NaHCO_3$) method for soils with free lime (pH>6.5).

Soil Testing - Development of the Initial Nutrient Management Plan

- A nutrient management plan for N budgeting shall be developed using current soil tests taken in the spring prior to seeding a spring crop, in the fall prior to seeding a fall crop, or in the spring following a fall seeded crop.
- A nutrient management plan for P budgeting can be developed using soil tests taken anytime during the year.
- Soil tests for P are taken for two main purposes: 1) to develop the P nutrient budget; and 2) for comparison to the appropriate P Threshold value. In some cases, one soil test will serve both purposes.
- Current soil tests for purposes of developing the nutrient budget shall be taken as described in Table 1.

Table 1	
Depth	**Nutrient Analyzed**
0 - 12 inches	NO_3 - N, NH_4 - N, P, & K
12 - 24 inches	NO_3 - N, NH_4 - N

A complete lab analysis should be made of samples taken from the first foot for all nutrient management plans.

Fields that are part of a long term sod, pasture, or alfalfa in rotation, may not require annual soil tests. Soil tests are to be taken when nutrients will be applied as part of an on-going management program.

Non-inversion cropping systems (i.e., no till) or areas where resource problems dictate closer management may require soil samples in zones less than 0 - 12".

- Soil tests taken for comparison to the P threshold will be taken at one of two depths, as described in Table 2, dependent upon on-site surface or ground water resource concerns.

  Surface water runoff concerns exist when runoff leaves the contiguous operating unit from normal storm events, rain on snow or frozen ground, or irrigation.

  Ground water concerns exists when a high water table, fractured bedrock, cobbles, gravel, or course-textured soils are conducive for the downward movement of water and associated nutrients.

Table 2	
Primary Resource Concern	**P Threshold Soil Sample Depth**
Surface Water Runoff	0 – 12"
Ground Water, fractured bedrock, cobbles or gravel	18 – 24"

When considering soil P levels, a surface water resource concern is the priority concern. If both concerns exist, a surface water concern takes priority. If neither concern exists, then the nutrient management plan is developed based on the TH for the ground water concern to prevent concentrations of nutrients above the agronomic requirement of the crop, and to maintain soil quality and long term sustainability of the cropland resource.

- To meet local nutrient requirements, as identified in the fertilizer guide or approved industry recommendations, the 0 – 12" soil test can be used to determine other diagnostic needs.
- Fields that are part of a nonirrigated cropland rotation that includes summer fallow do not have to be soil tested the year the field(s) are in summer fallow.
- In situations where specialty crops are raised, or environmental considerations have been identified (high water tables, leaching vulnerability, tile drains, fractured bedrock, deep or shallow soils), sampling greater than or less than the prescribed depths may be appropriate. The NRCS soil survey data is sufficient to make this determination unless site specific conditions vary substantially from the survey. The production system and environmental considerations will determine soil-sampling depth. Soil samples will represent the field or CTU being planned.
- Phosphorus Threshold (TH) concentrations by resource concern are described in Table 3. Use the primary resource concern identified and site characteristics to determine the TH of the site.

Table 3

Primary Resource Concern	P Threshold Concentration	
	Olsen	Bray 1
Surface Water Runoff	40 ppm	60 ppm
Ground Water, fractured bedrock, cobbles or gravel		
< 5 feet	20 ppm	25 ppm
> 5 feet	30 ppm	45 ppm

Soil Testing - Maintenance of the Nutrient Management Plan

- For purposes of developing annual nutrient budgets, soil samples will be taken and analyzed as described in Table 1.
- For purposes of tracking P trends, soil samples will taken and analyzed as described in Table 2 and as follows:

  Surface water resource concern: Use the soil P concentration determined from the 0-12 inch sample taken for development of nutrient budgets.

  Ground water resource concern: The TH soil test for P at the 18-24 inch zone is required to track P trends. If results of the initial soil test for P are less than 75% of the TH, then soil samples for comparison to the TH can be taken once every 5 years to monitor trends of P in the profile and to make adjustments in the plan as necessary.

Plant Tissue Testing

- Tissue sampling and testing is recommended during the growing season to monitor crop nutrient concentrations.

- Tissue sampling shall be done in accordance with U of I of Idaho guidelines or the guidelines of the laboratory performing the tissue analysis.

Nutrient Application Rates

- Acceptable nitrogen, phosphorus and potassium application rates shall be established according to the U of I of Idaho Fertilizer Guide or recommendations from an approved equivalent research database, and will be based on soil tests as identified in the previous section under Soil Testing.
- Nitrogen application rates will be determined for each crop in the rotation.
- Phosphorus application rates will be determined for a single crop or for the crop rotation. Table 4 includes P application rates based on soil test P concentrations as compared to the site TH.

Table 4

Soil Test P	P Application Rate
Surface Water	
< TH (ppm)	Recommended rates or Crop P uptake
> TH (ppm)[1]	Crop P uptake
Ground Water	
< TH (ppm)	Recommended P rate or Nitrogen based
> TH (ppm)[1]	Crop P uptake

[1] **Note: When soil test P concentrations are above the TH, the planner, in cooperation with the producer, will design a nutrient management plan that will reduce soil test P concentrations below the TH and minimize potential off-site transport. This may require adjustments in crop rotation, irrigation method and scheduling, form, timing or placement of P applied, and changes in P application rates less than crop P uptake.**

- If soil test P concentrations are above the TH, then crop uptake values will be used in development of the nutrient budget regardless of the nutrient source.
- Potassium application shall not exceed the recommended rate except when concentrations in the soil are determined not to cause unacceptable nutrient imbalance in crops and forage quality, and do not become limiting to crop growth and sustainability.
- Starter fertilizers are considered a part of the nutrient budget.
- Nutrient applications are recommended when plant tissue tests indicate a need for nutrient application to correct or prevent a deficiency.
- Calibrate waste and fertilizer application equipment to ensure recommended rates are applied.

Nutrient Application Timing

- Application of solid wastes. Solid waste shall be incorporated unless applications are made on frozen ground, perennial crops or cropland under no-till; in those cases, emergency tillage (i.e. chiseling and disking cross slope), construction of berms or other containment practices will be applied to prevent surface runoff.
- Application of liquid wastes. Application of liquid waste shall not be made outside the active growing period of the crop, unless a water

budget for the site shows that deep percolation of wastewater or runoff will not occur prior to the next crop-growing season. Liquid waste shall be applied to crops at amounts not exceeding soil water holding capacity in the crop-rooting zone. Application of liquid wastes through surface or sprinkler irrigation systems will be timed to prevent deep percolation or runoff. The number of applications will be based on the volume of waste to be disposed of as well as related concerns with surface runoff and deep percolation.

- Application of commercial fertilizer. Timing of applications shall be sufficient to provide adequate plant establishment, growth and residue decomposition not to exceed U of I Crop Fertilizer Guides or an approved equivalent research database or crop uptake values and to avoid surface runoff and/or leaching.
- If most of the commercial N is applied in the fall for a subsequent spring crop, applications shall be made when soil temperatures are low enough to minimize nitrification (< 50 ° F), or with a nitrification inhibitor, or controlled release fertilizer.

Criteria Applicable to Utilizing Organic Waste Resources as a Plant Nutrient Source

- Organic biosolids, (i.e. waste from food processing facilities), shall be applied as prescribed by federal, state, or local regulations.

Criteria for Maintenance or Improvement of Physical, Chemical or Biological Condition of Soil

- Biosolids, other than animal waste, and sewage sludge shall be applied as prescribed by federal, state, or local regulations (40 CFR parts 403 and 503).
- Biosolids and by-products shall be applied to the soil as prescribed by federal, state and local regulations. Records of application and content of biosolids must be maintained as required by the state.

Additional Criteria to Protect Water Quality on Vulnerable Sites

- If the field or CTU lies within a hydrologic unit area that has been designated as having impaired water quality associated with nutrients, is within an area where nutrient contamination has been identified as a ground water quality concern, or is within a sole source water or wellhead protection area where nutrient contamination is of special concern due to high or very high vulnerability then, the nutrient management plan shall include an assessment of the potential risk for nitrogen and/or phosphorus to adversely impact water quality. The Nitrogen Leaching Index and/or the Phosphorus Index (PI), or other acceptable assessment tools may be used to make these assessments.
- Nutrient management plans shall include a record of site vulnerability ratings for each field or CTU and necessary conservation practices and management actions that will reduce the potential for nutrient movement from fields or CTUs with a high or very high vulnerability rating

- Utilize nutrient timing and placement to reduce Nitrogen and Phosphorus pollution of ground and surface waters. Special consideration will be given to application and placement of nutrients on sensitive areas (i.e., Highly Erodible Lands (HEL), within flood plains, near sensitive water bodies, in areas of ground water contamination from nutrient applications, within sole source water, wellhead protection areas, or within other areas of water quality concern).

  In areas of special consideration, methods will include:

  1. Apply nutrients to crop fields to avoid or reduce potential of transport to gullies, ditches, surface inlets, sinkhole areas, or wellhead area.
  2. Do not apply animal waste on sites where runoff is delivered directly to a conveyance channel or receiving water body unless runoff is treated with a conservation buffer or other mitigating practice prior to delivery.

  In areas of special consideration, recommended methods may include:

1. Split applications of Nitrogen to provide nutrients at the times of maximum crop uptake.
2. Band or place applications of phosphorus near the seed row.
3. Incorporate broadcast fertilizer on cultivated crops.
4. Farm on the contour or cross slope on all fields adjacent to wetlands if nutrient runoff appears to pose a more significant hazard than leaching.
5. Utilize fall cover crops whenever possible to immobilize residual nitrogen and retain for spring crops.
6. Utilize Conservation Cover, Residue Management, Conservation Crop Rotation, Grassed Waterway, Irrigation Water Management, Vegetative Buffer Strips and other conservation practices as needed to protect or improve water quality.

CONSIDERATIONS

- Individual conservation practices should be planned as part of a comprehensive conservation plan, which addresses all resource, concerns on the unit and reaches a Resource Management System level of treatment.
- Rotations included in a nutrient management plan should meet the criteria of the Conservation Crop Rotation standard (Code 328).
- When soil test P concentrations approach 75% of the TH, consider developing the nutrient management plan using crop P uptake for application rates. Recognize that at 75% of TH, concentrations of P are approaching the TH and management changes should be considered.
- Vary the amount of fertilizer in different parts of the field to account for differing fertilizer needs and the potential for leaching and runoff.
- Consider applying liquid wastes mixed with irrigation water during the last 1/4 to 1/3 of the irrigation set to minimize deep percolation and runoff.
- Consider split applications of nitrogen to provide nutrients at the times of maximum crop utilization, especially on fall seeded crops.

- Consider routine mineral and nitrate nitrogen status testing of forages produced from land with long term and/or heavy waste application rates. Excessive soil potassium can lead to high potassium levels in forages, especially legumes like alfalfa, produced for livestock. Excess potassium intake by cattle is associated with decreased magnesium absorption, decreased feed intake and milk production, increased intake of water, and increased urine output. High dietary levels of potassium are a major concern during the dry period. Plants with high levels of potassium and low levels of magnesium can cause grass tetany, a non-infectious metabolic disease in cattle.
- Consider limited application of organic materials with high heavy metal concentrations.
- Consider analyzing products from industrial processing used as fertilizer or soil amendments for heavy metals or other contaminants to prevent their buildup in the soil.
- Consider cover crops whenever possible to utilize and recycle residual nitrogen.
- Band applications of phosphorus near the seed row.
- Applying nutrient materials uniformly to application areas or as prescribed by precision agricultural techniques.
- Delaying field application of animal wastes 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 wastes, especially when applied near or upwind of residences.
- Consider nitrogen volatilization losses associated with the land application of animal wastes. Volatilization losses can become significant, if wastes is not immediately incorporated into the soil after application.

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:
  1. Aerial site photograph or map and a soil map.
  2. Current and/or planned plant production sequence or crop rotation.
  3. Results of soil, plant, water and organic sample analyses.
  4. Realistic yield goals for the crops in the rotation.
  5. Quantification of all nutrient sources.
  6. Recommended nutrient rates, timing, and method of application and incorporation.
  7. Location of designated sensitive areas or resources and the associated practices or methods planned to protect the area.
  8. Guidance for implementation, operation and maintenance of the nutrient management component of the conservation plan.

9. Complete nutrient budget for nitrogen, phosphorus, and potassium for the rotation or crop sequence.

- When nutrient management plans are expected to increase soil phosphorus concentrations, such that concentrations approach the TH, plans shall include:

10. A caution that phosphorus accumulation in the soil can occur and that the potential for such accumulation can contribute to water quality impairment, animal health, or crop production problems.
11. A discussion of the time interval after which it may be necessary to convert to phosphorus based waste or nutrient application rates for plan implementation.
12. The potential for soil phosphorous drawdown from the production and harvesting of crops.

OPERATION AND MAINTENANCE

Nutrient Management Plan Review and Revision

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

- Nutrient management plans shall be reviewed annually by the producer or their representative to determine if adjustments or modifications are needed. Annual reviewers, including the producer, need not be certified.
- The producer or their representative, shall revise the plan, as needed, to reflect significant changes in the operation that affect the overall nutrient management plan or upon change in landowner or tenant. Significant changes may include:

1. increase in livestock by 10%;
2. major changes to waste handling and storage system;
3. increase or decrease in application area by 10%;
4. change in crop or crop rotation;
5. change in irrigation system;
6. new designation as a sensitive area.

Safety

- Protect fertilizer and organic by-product storage facilities from weather and accidental leakage or spillage. Storage of manure, fertilizers and cleaning of application equipment should be done away from a wellhead.
- Calibration of application equipment to ensure uniform distribution of material at planned rates.
- Backflow protection devices shall be installed according to Idaho chemigation requirements when using irrigation systems for application or distribution of liquid waste or commercial fertilizer.
- 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 from cleaning nutrient application equipment should be stored and disposed of 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.

Field Records

- The producer will maintain field level records for a minimum of five years. As applicable, records include:

  1. Soil, plant tissue, organic, and water test results as collected and recommendations for nutrient application.
  2. Quantities, analyses and sources of nutrients applied.
  3. Approximate dates and methods nutrients were applied.
  4. Crops planted, planting and harvest dates, yields, and crop residues removed.
  5. Dates of annual review and person performing the review and recommendations that resulted from the review.
  6. Any additional information as required by this standard, (i.e. Site Vulnerability, Site Risk Assessment, Biosolid application records, and other appropriate cautions and discussions).
  7. Suggested Additional Records as applicable:

     * Irrigation Water Management evaluations.
     * Recommended conservation practices and management actions that can reduce the potential for nutrient movement.