

**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 help producers improve or maintain their level of management and expertise related to the application of nutrients on the lands they manage.

- 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.
- 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 (Refer to the reference section at the end of this standard).

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.

Nutrient management plans that address land application of animal manure shall be developed using guidance from the USDA-NRCS Agricultural Waste Management Field Handbook (AWMFH) and Utah State University (USU) Extension publications.

Plans may be developed by anyone but must be reviewed and approved by an individual(s) who has been granted approval authority from the State Conservationist. Approval authority can be obtained by:

- attending NRCS/USU developed training programs,
- and submission, review, and approval of two nutrient management plans by the NRCS state and area agronomist.

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.

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

**NRCS, UT
October, 2000**

Plant nutrient utilization values may be obtained from the Utah Fertilizer Guide, Ortho Agronomy Handbook, or Western Fertilizer Handbook. Values based on USU Extension research may be used if available.

Realistic yield goals shall be established based on soil productivity information, historical yield data, climatic conditions, level of management or University research on similar soil and cropping systems. 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 or Conservation Treatment Unit (CTU) to achieve realistic production goals, while minimizing nitrogen and/or phosphorus movement to surface and/or ground waters.

Irrigation Water Management (449) shall be a component of a nutrient management plan when nutrients are applied on irrigated land.

Erosion, runoff, and water management controls shall be installed, where needed, as determined by NRCS assessment tools such as the Utah Manure Application Risk Index (UMARI) or the Revised Universal Soil Loss Equation, on all fields that receive nutrients.

Soil Sampling and Laboratory Analysis (Testing)

Nutrient planning shall be based on current soil test results. Current soil tests are those that are taken at least once every three years where nutrients are applied on the basis of phosphorus (P) or yearly where nutrients are applied on the basis of nitrogen (N).

Soil samples shall be collected and prepared according to the Utah Fertilizer Guide or USU fact sheets.

Soil test analyses shall be performed by a laboratory that is a member of the North American Proficiency Testing Program (See Appendix A). Soil testing shall include analysis for all nutrients and/or soil conditions for which specific information is needed to develop the nutrient plan (e.g. pH, electrical

conductivity (EC), soil organic matter, nitrogen, phosphorus, potassium, and micronutrients).

Plant Tissue Testing

Tissue sampling and testing, where used, shall be done in accordance with the Utah Fertilizer Guide.

Nutrient Application Rates

Recommended nutrient application rates shall be based on current soil test results, realistic yield goals, management capabilities, or plant nutrient utilization values found in the Utah Fertilizer Guide, Western Fertilizer Handbook or Ortho Agronomy Handbook.

The planned rates of nutrient application, as documented in the nutrient budget, shall be determined based on the following guidance:

- **Nitrogen, Phosphorus, or Potassium Application** - Planned applications shall not exceed the plant nutrient utilization values for the controlling nutrient. When manure or other organic by-products are a source of nutrients see "Additional Criteria" below.
- Excess potassium shall not be applied in situations in which it causes unacceptable nutrient imbalances in crops or forages
- **Other Plant Nutrients** - The planned rates of application of other nutrients shall be consistent with The Utah Fertilizer Guide.
- **Starter Fertilizers** - Starter fertilizers shall be applied in accordance with the Utah Fertilizer Guide. When starter fertilizers are used, they shall be included in the nutrient budget.

Nutrient Application Timing

Nutrient applications shall be timed to correspond with plant nutrient uptake characteristics, while considering cropping system limitations, weather and climatic conditions, and field accessibility.

Application of nutrients on frozen and/or snow-covered ground will not be allowed unless **all** of the following criteria are met:

- The risk for pollution as determined by UMARI is very low or low,
- Nutrient application rates do not exceed nutrient utilization values nor threshold values as defined in the section labeled "Manure or Other Organic By-Product Application Rates",
- Tank applications of liquid manure do not exceed nutrient utilization values nor 20% of the available water holding capacity of the soil,
- Appropriate setbacks from waters of the state, runoff containment, and/or other practices as determined by the risk index are applied.

Nutrient applications through irrigation systems shall be applied in accordance with the requirements of Irrigation Water Management (Code 449). The application rate shall not exceed the soil intake/infiltration rate as defined by NRCS's Utah Irrigation Guide. Individual applications shall not exceed the field capacity of the soil.

Liquid manure applications through irrigation systems may be made outside the active growing season where a water budget shows that deep percolation or runoff will not occur.

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

Nutrient values of manure and organic by-products shall be determined prior to land application based on laboratory analysis.

Where actual analysis data is not available, standard "book values" found in the NRCS AWMFH may be used. In subsequent years, actual values shall be obtained through yearly testing. Tests should be taken yearly for at least five years in order to develop average nutrient values for the given management system. Once established, average values may be used for determining application rates as long as the management system remains the same (except as required by a UPDES permit).

Samples for testing shall be collected and prepared according to USU guidelines. Tests are to be taken separately for different types and consistencies of material.

Manure or Other Organic By-Product Application Rates

The rates of application shall be based on Soil Test Phosphorus (STP) (Olsen Method) according to the following threshold values:

<u>STP (ppm)</u>	<u>Apply Based On:</u>
< 50	Crop nitrogen utilization
50-100	Crop phosphorus utilization
>100	No application of manure

Agronomic Rate Determination

Acceptable manure application rates may be based on either soil test recommendations or crop nutrient utilization values.

Additional Nitrogen Application

When applications are made based on phosphorus needs, additional nitrogen from commercial fertilizer may be required to supply the nitrogen needs.

Phosphorus Limits

Manure or other organic by-products will be applied on the basis of crop phosphorus utilization on areas with the following soil limitations:

- Where available water holding capacity is less than 3.0 inches in the top 5-foot.
- Where depth to bedrock or cemented pan is less than or equal to 2 feet from the surface.
- Where depth to the seasonal water table is less than or equal to 2 feet from the surface.
- Where flooding frequently occurs, as defined in the soil survey.
- Where rock fragments 3 - 10 inches in diameter exceed 25% by volume; stones and

boulders greater than 10 inches in diameter exceed 10% by volume in the top 5 foot.

- f. Where permeability is greater than 2.0 in/hr.

Applications for Multiple Year Crop Phosphorus Needs

Applications of manure may be made for crop phosphorus needs for multiple years in the crop sequence. When such applications are made, daily air temperatures must exceed 50 degrees F for a minimum of 7 days prior to incorporation, and the application rate shall:

- not exceed the recommended phosphorus needs for the crop rotation,
- not exceed the 50 ppm Olsen STP level after application,
- not be made on frozen/snow covered ground,
- not exceed 1½ times the recommended nitrogen application rate during the year of application,
- not be made on sites considered high or medium risk to runoff or leaching unless appropriate conservation practices, best management practices, or management activities are used to reduce the risk to low or very low

Field Risk Assessment

When animal manure or other organic by-products are applied, a field-specific assessment of the potential for nutrient runoff and leaching shall be completed. This assessment shall be made using UMARI. In such cases, the assessment shall include:

- a record of the limiting factors and risk index for each field,
- plan maps that show the location of sensitive areas,
- information about conservation practices and management activities that can

reduce the potential for nutrient movement from the site.

The results of the assessment and recommendations shall be discussed with the producer during development of the plan.

Additional Criteria Applicable to Biosolids Applied as a Plant Nutrient Source

Nutrient Application Timing

Biosolids (sewage sludge) cannot be applied on frozen/snow covered ground on slopes greater than 6% unless there is 80% vegetative ground cover or a runoff containment plan in place.

Biosolids cannot be applied within 30 feet of wells, rivers, streams, ditches, or other waterbodies at any time.

Nutrient Application Rates

Applications that exceed agronomic rates for nitrogen require that a permit be obtained from the Utah Department of Environmental Quality.

Biosolids cannot be applied to the land if it is likely to adversely affect a threatened or endangered species.

Application records which track field operations, application rates, management practices, and site restrictions must be kept.

Cumulative and annual pollutant soil loading rates on a dry weight basis cannot exceed specified limits if pollutant concentrations are greater than those described:

Pollutant Concentrations and Loading Rate

Pollutant	Pollutant Concentrations ppm	Cumulative Loading lbs/ac	Annual Loading lbs/ac
Arsenic	41	37	1.8
Cadmium	39	35	1.7
Copper	1500	1338	67.0
Lead	300	268	13.0
Mercury	17	15	0.8
Nickel	420	375	19.0
Selenium	100	89	4.5
Zinc	2800	2498	125.0

Additional Restrictions

Additional site restrictions for Class B biosolids must also be met (Class B biosolids are those that exceed EPA defined pathogen levels):

- Food crops, feed crops, and fiber crops shall not be harvested for 30 days after application.
- Food crops that touch the soil surface (i.e. melons, cucumbers, etc.) shall not be harvested for 14 months after application.
- Food crops that have harvested parts below the soil surface (i.e. potatoes, carrots, etc.) shall not be harvested for 20 months after application if the sludge is incorporated 4 months or more after application. They shall not be harvested for 38 months if incorporated before 4 months after application.
- Turf shall not be harvested for 1 year after sludge application.
- Animals shall not be grazed on a site for 30 days after application.

Public access to land with high potential for public exposure shall be restricted for 1 year after sludge application. Access to land with low potential for public exposure shall be restricted for 30 days after application.

Heavy Metals Monitoring

When biosolids that exceed EPA regulations for heavy metal levels (including arsenic, cadmium, copper, lead, mercury, selenium, and zinc) are applied, the soil shall be monitored in accordance with US Code, Reference 40 CFR, Parts 403 and 503.

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. Caution should be used when applying nutrient sources with high salt content. Provisions may need to

be made to leach salts below the crop root zone.

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 Strip (393), Riparian Forest Buffer (391A), Dike (356), Irrigation System Tailwater Recovery (447), 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 double cropping or crops that have high nutrient requirements whenever possible to utilize and recycle residual nitrogen and/or phosphorus.

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,
- immediate incorporation of land applied manure or organic by-products,
- delaying field application of animal manure or other organic by-products when heavy precipitation is forecast within 24 hours of the time of the planned application,
- avoiding application on wet soils to prevent compaction and rutting,
- reducing or eliminating application on soils that are prone to flooding and saturation.

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

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

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.

On sites where special environmental concerns exist, consider other sampling techniques. (For example: Soil profile sampling for nitrogen, where cultural resources exist, or 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 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 and/or organic by-product sample analyses,
- realistic yield goals for the crops in the rotation,
- recommended nutrient rates, timing, form, and method of application and incorporation,

- quantification of all nutrient sources,
- location of designated sensitive areas and the associated management restrictions,
- guidance for implementation, operation, maintenance, recordkeeping,
- nutrient budget for nitrogen, phosphorus, and potassium for the crop being grown and/or for the crop rotation.
- the soil phosphorus threshold values at which it is necessary to convert to phosphorus based application.

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

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 changes in any of these requirements may necessitate a revision of the plan.

In addition to the requirements described above, the conservation planner shall discuss with the producer:

- 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,
- how the plan is intended to prevent the nutrients (nitrogen and phosphorus) supplied for production purposes from contributing to water quality impairment.

OPERATION AND MAINTENANCE

The producer is responsible for safe operation and maintenance of this practice including all

equipment. Operation and maintenance addresses the following:

- plans will be reviewed and/or revised a minimum of once every five years or yearly for a UPDES permit, or when significant changes occur such as when the crop rotation changes, nutrient handling methods change, or animal numbers or types change,
- 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 the material and that applications are within 25% of the planned rate,
- documentation of the actual rate at which nutrients were applied,
- Maintaining records to document plan implementation. As applicable, records shall include:
 1. soil test results and recommendations for nutrient application,
 2. quantities, analyses and sources of nutrients applied,
 3. dates and method of nutrient applications,
 4. crops planted, planting and harvest dates, and yields, results of water, plant, and organic by-product analyses,
 5. dates of review and person performing the review, and recommendations that resulted from the review.

Records shall be maintained for a minimum of three years.

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.

When cleaning nutrient application equipment, excess material should be collected and stored or field applied in an appropriate manner. Application equipment should not be cleaned in areas where a high risk for runoff, leaching, or well contamination exists.

REFERENCES

- California Fertilizer Association, *“Western Fertilizer Handbook”*, 8th Edition, 1995
- “Definitions and General Requirements”*, R317-1, Utah Administrative Code, Utah Department of Environmental Quality (DEQ), Division of Water Quality (DWQ)
- “Drinking Water Source Protection for Groundwater Sources”*, R309-600, UAC, UDEQ, DWQ
- “Drinking Water Source Protection for Surfacewater Sources”*, R309-605, UAC, UDEQ, DWQ
- Goodrich, K.I., R.T. Koenig, S.D. Nelson, L.L. Young, N.P. Hansen, J.W. Hardman, *“Utah Manure Application Risk Index”*, October, 2000
- “Ground Water Quality Protection”*, R317-6, Utah Administrative Code, UDEQ, DWQ
- “Irrigation Guide for Utah”*, USDA-SCS, May, 1984
- James, D.W., and Topper, K.F., *“Utah Fertilizer Guide”*, EC 431, Utah State University, November, 1989
- Sharpley, A. 1995. *“RCA III, Fate and Transport of Nutrients, Phosphorus, Working paper No. 8”*, USDA-ARS National Ag. Water Quality Lab, Durant, OK.
- “Standards of Quality for Waters of the State”*, R317-2, Utah Administrative Code, UDEQ, DWQ
- Thorup, R.M., *“Ortho Agronomy Handbook”*, Chevron Chemical Company, 1989
- “Utah Pollutant Discharge Elimination System (UPDES)”*, R317-8, Utah Administrative Code, UDEQ, DWQ
- Utah State University Electronic Publications, <http://www.ext.usu.edu/publica/index.htm>

"Utah Water Quality Act", 19-5, Utah Code,
UDEQ, DWQ

APPENDIX A
NORTH AMERICAN PROFICIENCY TESTING LABORATORIES

Laboratory Consultants
 947 S. 48th St., Suite 127
 Tempe, AZ 85281
 Phone: 480-858-1841
 Fax: 480-858-0752

IAS Labs
 2515 E University Dr.
 Phoenix, AZ 85034
 Phone: 602-273-7248
 Fax: 602-275-3836

Soil, Water and Plant Testing Lab
 Colorado State University A319 NESB
 Fort Collins, CO 80523
 Phone: 970-491-5061
 Fax: 970-491-2930

Colorado Analytical Lab
 240 S Main St.
 Brighton, CO 80601
 Phone: 303-659-2313
 Fax: 303-659-2315

WELD Laboratories Inc.
 1527 1st Ave.
 Greeley, CO 80631
 Phone: 970-353-8118
 Fax: 970-353-1671

AGRI-Test Inc.
 2043 Kimberly Rd.
 Twin Falls, ID 83301
 Phone: 208-734-2303
 Fax: 208-734-2580

Stukenholtz Lab
 P.O. Box 353
 2924 Addison Ave., E
 Twin Falls, ID 83303-0353
 Phone: 208-734-3050
 Fax: 208-734-3919

Western Laboratories
 211 W. Hwy. 95
 P.O. Box 1020

Parma, ID 83660
 Phone: 208-722-6564
 Fax: 208-722-6550

NAPI-ATRL
 6 Miles South on Highway 371
 Farmington, NM 87401
 Phone: 505-326-2730
 Fax: 505-326-3152

SWAT Lab
 Gerald Thomas Hall Rm 269
 Las Cruces, NM 88003
 Phone: 505-646-4422
 Fax: 505-646-6041

ALBION Laboratories Inc.
 101 N. Main St.
 Clearfield, UT 84015
 Phone: 801-773-4631
 Fax: 801-773-4633

USU Analytical Laboratories
 Utah State University
 Ag. Science Rm. 166
 Logan, UT 84322-4830
 Phone: 801-797-2217
 Fax: 801-797-2117

University of Wyoming Soil Testing
 P.O. Box 3354
 16th and Gibbon
 Laramie, WY 82071
 Phone: 307-766-2135
 Fax: 307-766-5549

Energy Laboratories
 2393 Salt Creek Hwy.
 Casper, WY 82602
 Phone: 307-235-0515
 Fax: 307-234-1639