

USDA NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD
ARIZONA

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 optimum plant production.
- To properly utilize manure or organic by-products as a plant nutrient source.
- To minimize agricultural nonpoint source contamination 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

Nutrient management plans shall be prepared in accordance with this standard and comply with all applicable Federal, state, and local laws and regulations.

Arizona law (Title 49-The Environment) contains provisions for the regulation of both the application and management of nitrogen sources in agricultural production.

To comply with the State of Arizona Rule R18-9-202 regarding the application of nitrogen fertilizer the following goal oriented Best Management Practices (BMP) are to be used:

- Application of nitrogen fertilizer shall be limited to that amount necessary to meet projected crop plant needs.
- Application of nitrogen fertilizer shall be timed to coincide as closely as feasible to the periods of maximum crop plant uptake.
- Nitrogen fertilizer shall be applied by a method designed to deliver nitrogen to the area of maximum crop plant uptake.
- Application of irrigation water shall be timed to meet crop plant needs and be managed to minimize loss by leaching and runoff.
- The application of irrigation water shall be timed to minimize losses by leaching and runoff.
- The operator shall use tillage practices that maximize water and nitrogen uptake by crop plants.

Plus:

- Other methods to minimize nitrogen losses from leaching, runoff, or backflow into irrigation wells must be specified.

A complete description of these BMPs with their guidance practices can be found in "Nitrogen Fertilizer Management in Arizona" (Doerge, 1991).

A qualified person, as defined in the General Manual, shall review and/or approve all nutrient management plans. Those qualified (certified) to develop nutrient management plans are conservation planners with USDA-NRCS, agronomists certified by the American Society of Agronomy (ASA), Certified Crop Advisors certified by the ASA through its Certified Crop Advisor (CCA) program, or planners certified by the State of Arizona Nutrient Management Planning Certification Program.

Nutrient management plans that are elements of a more comprehensive conservation plan shall include all requirements of the conservation plan.

A nutrient balance table 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, sewage sludge, commercial fertilizer, soil, crop residues, legume credits, and irrigation water.

Realistic yield goals shall be established based on soil productivity information, historical yield data, climatic conditions, level of management and/or local research on similar soil, cropping systems, and soil and manure/organic by-products tests. A realistic yield goal is the crop yield that the producer expects to achieve 50% of the time. For new crops or varieties, industry yield recommendations may be used until sufficient yield information is available.

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

Fields having similar soil test results and crop recommendations may be grouped.

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. Current soil tests shall not be older than five years. Annually cropped fields will have a soil test taken the first year of a new plan or rotation, thereafter once in 5 years as a minimum. Hayland and pasture can be tested once in five years. If organic sources of fertilizers are used two or more consecutive years, annual soil testing is required.

Soil samples shall be collected, prepared, and tested according to the University of Arizona guidance or standard industry practice recognized by the University of Arizona. A partial list of testing laboratories using approved procedures can be found at the University of Arizona website (<http://www.ag.arizona.edu/pubs/garden/az1111>).

Soil testing shall include analysis for any nutrients for which specific information is needed to develop the nutrient management plan. Request analyses pertinent to monitoring or amending the annual nutrient budget: i.e., nitrogen, phosphorus, and potassium; additional

useful information would be: pH, cation exchange capacity (CEC), electrical conductivity (EC), and soil organic matter.

Plant Tissue Testing

Tissue sampling and testing shall be done in accordance with University of Arizona standards or recommendations.

Nutrient Application Rates

Soil amendments used to adjust soil pH or other soil conditions, should be applied for optimum availability and utilization of nutrients.

Nutrient application rates shall be based on University of Arizona recommendations or accepted industry practice. Current soil test results, management capabilities, and realistic yield goals shall be considered. If the University of Arizona recommended rates are not available, application rates shall be based on realistic yield goals and associated plant nutrient uptake rates.

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 meet the recommended rates, 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 meet the recommended rates, 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 to the extent that growth and quality in crops or forages are adversely affected. University of Arizona recommendations shall be followed.
- *Other Plant Nutrients* – The planned rates of application of other plant nutrients shall be consistent with University of Arizona guidance or industry practice recognized by the University of Arizona.

- *Starter Fertilizers* – Starter fertilizers containing nitrogen, phosphorus and potassium may be applied in accordance with University of Arizona recommendations or industry practice recognized by the University of Arizona. When starter fertilizers are used, they shall be included in the nutrient budget.

Nutrient Application Timing and Methods

Timing and method of nutrient application shall consider plant nutrient uptake characteristics, cropping system limitations, weather and climatic conditions, irrigation system, and field accessibility. Also, in addition to application of nutrients corresponding to crop uptake, consideration must be given to fertilizer efficiency (formulation or availability).

Preplant fertilizer and/or manure shall not be applied until after any deep irrigation for salt leaching has been completed.

Nutrients shall not be applied to soils if the potential for runoff exists.

Commercial fertilizer may be applied as broadcast, knifed into the soil, banding with the planter, or surface banded. Any one method may have advantages under a given set of circumstances.

Nutrient applications associated with irrigation systems shall be applied in accordance with the requirements of Irrigation Water Management (Code 449). The application rate (in/hr) and application amounts for material applied through sprinkler irrigation systems shall not be at rates that result in runoff. Nutrients applied through surface irrigation systems shall have tailwater ponds and/or delivery systems to capture and reuse all runoff. Consult the Soil Survey or the Arizona Irrigation Guide for available water holding capacity and infiltration/permeability rates for the soil(s) receiving the application. Limit application to the volume of liquid that can be stored in the root zone.

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

Nutrient Management Plan Reviews

NMPs should be reviewed and updated by the owner/operator or their designate at least once each year.

For required NMPs, a whole farm budget for nitrogen and phosphorus shall be developed that includes the amount of manure produced on the farm and the amount of nutrients needed for the crops grown on the farm. The budget shall be in enough detail to determine if more nutrients will need to be brought onto the farm to grow crops or if excess manure is being generated and will need to be exported.

Nutrient values of manure and organic by-products shall be determined prior to land application based on laboratory analysis. Manure and on-farm generated waste shall be analyzed for nutrient content by laboratories that meet University of Arizona approved testing methods. Manure analyses will be conducted once a year for each manure source until a reliable trend of nutrient contents has been established for that source. Manure testing will be at least once every 5 years after that or whenever a significant management change will affect manure nutrient values (for example, major changes in the feed program).

Manure must, at a minimum, be analyzed for nitrogen, phosphorus, potassium, and moisture content. In those cases where manure analysis cannot be readily obtained, acceptable NRCS and/or University of Arizona “book values” may be used for planning purposes. Acceptable values may be found in the Agricultural Waste Management Field Handbook (AWMFH), Chapter 4 – Agricultural Waste Characteristics.

Nutrient Application Rates

All NMPs will require that the N and P application rates be determined. The “P” assessment tool will be used to determine if the critical element is either nitrogen or phosphorous. If the assessment tool indicates that phosphorous is critical, then the nutrient plan will be phosphorous based. All other plans will be nitrogen based.

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

Phosphorus Application – When manure or other organic by-products are used, the planned rates of phosphorus application for each field shall be determined using a current soil test.

If phosphorus is determined to be the limiting nutrient for determining nutrient application rates

(Phosphorous Assessment Tool), then the phosphorus application will be limited to phosphorus crop removal. Use P crop removal values recommended by the University of Arizona. If values are not available for a specific crop, use values given in AWMFH, Chapter 6.

Nitrogen Application - Planned nitrogen application rates for each field shall match the recommended rates. If phosphorus is determined to be the limiting nutrient for determining nutrient application rates, then an additional nitrogen application, from non-organic sources, may be required to supply the recommended amounts of nitrogen.

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

Animal manure and organic nutrients shall be injected or incorporated as soon as possible on annual crops or reseeded perennial crops to capture available N.

Manure may be applied without incorporating if surface runoff control measures such as a grass or legume crop, heavy crop residue cover, stripcropping, or diversions have been applied. However, losses of N by NH₃, N₂ and N₂O volatilization are likely, thereby reducing available N from manure.

Field-Specific Risk Assessment and Resources of Concern

When animal manure or other organic by-products are applied, a field-specific assessment of the potential for nitrogen and phosphorus transport from the field shall be completed.

This field specific assessment is done using the Phosphorous Assessment Tool, field landscape and soil properties, and locations of sensitive areas.

Identify sensitive areas adjacent to or near the fields to receive animal manure and locate them on plan maps:

- Wells and other potable water supplies
- Vegetated drainage ways or waterways
- Streams, rivers, lakes, and ponds
- Property lines.

Setbacks for spreading of manure shall be a minimum of 100 feet from drinking wells and non-community water supplies and a minimum of 300 feet from community water supplies. Greater site specific setbacks need to be considered where water supplies are located downslope from spreading sites.

Site specific setbacks or buffers will be identified and prescribed to protect sensitive areas other than drinking wells from potential pollution from animal manure applications. In lieu of using site specific setbacks or buffers to protect sensitive areas, the following are recommended setbacks:

- 25 feet from any waterway, drainage ditch, wash, arroyo, irrigation ditch, or property line.
- 100 feet from all surface waters including streams, canals, springs, ponds, and lakes.

The locations of sensitive areas and the setbacks or buffers to protect them shall be discussed with the producer during the development of the plan.

Heavy Metals

When sewage sludge is applied, the accumulation of potential pollutants (including arsenic, cadmium, copper, lead, mercury, selenium, and zinc) in the soil shall be monitored in accordance with US Code, Reference 40 CFR, Parts 403 and 503, and/or any applicable state or 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, assessments shall be completed of the potential for nitrogen and/or phosphorus transport from the field. The Phosphorous Assessment Tool may be used to help with 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 nonpoint 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 undesirable salt content will be minimized unless provisions are used to leach these salts below the crop root zone.

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

Cultural Resources.

If this practice involves soil disturbance, the area of potential effect for each undertaking must be investigated for cultural resources under section 106 of the National Historical Preservation Act of 1966, as amended, before soil disturbance occurs. See the NRCS Arizona Handbook of Cultural Resources Procedures - Applicability and Exceptions Section - for identification of practices that are exempt from, or that require cultural resources surveys.

Endangered Species

Determine if installation of this practice with any others proposed practice will affect any federal, tribal, or state listed Threatened or Endangered species or their habitat. NRCS's objective is to benefit these species or at least not have any adverse effect on a listed species. If the Environmental Evaluation indicates the action may adversely affect a listed species or result in adverse modification of habitat of listed species which has been determined to be critical habitat, NRCS will advise the land user of the requirements of the Endangered Species Act and recommend alternative conservation treatments that avoid the adverse effects.

Further assistance will be provided only if the landowner selects one of the alternative conservation treatments for installation; or at the request of the landowners, NRCS may initiate consultation with the U.S. Fish and Wildlife Service. If the Environmental Evaluation indicates the action will not affect a listed species or result in adverse modification of critical habitat, consultation generally will not apply and usually would not be initiated. Document any special

considerations for endangered species in the Practice Requirements Worksheet.

CONSIDERATIONS

Consider other practices such as: Waste Management System (312); Waste Storage Facility (313); and Waste Utilization (633) to properly handle, store, and utilize manure and other wastes to minimize pollution of surface and ground water resources.

Consider additional practices such as Conservation Cover (327), Filter Strips (393), Irrigation Water Management (449), 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 induced deficiencies of nutrients due to excessive levels of other nutrients.

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

Consider application methods and timing that reduce the risk of nutrients being transported to ground and surface

waters, or into the atmosphere. Suggestions include:

- split applications of nitrogen to provide nutrients at the times of maximum crop utilization,
- band applications of phosphorus near the seed row,
- applying nutrient materials uniformly to application areas or as prescribed by precision agricultural techniques,
- timely 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 other environmentally sensitive areas, such as bedrock outcrops, gullies, ditches, surface inlets, or rapidly permeable soil areas.

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

Consider the potential problems from vectors (insects, rats, etc.) in associated with manure storage and application.

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 manure is 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.)

Consider recommendations from animal nutritionists regarding modification of the animal's diet to reduce the manure nutrient content and to enhance the producer's ability to manage manure effectively.

Water Quantity

This practice is considered to have no effect on the amount of water.

Water Quality

This practice principally reduces the availability of nutrients that could pollute surface or ground water by limiting the amount applied to the soil to that needed to produce an optimum crop yield.

Major reductions are expected in the amount of nitrate Nitrogen that reaches ground water and a corresponding reduction in the contamination of private wells and domestic wells. Contamination of wells will be avoided in many areas.

Streams and lakes and other surface water bodies will receive less Phosphorus resulting in a decreased rate of eutrophication.

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, irrigation water, manure and organic by-product sample analyses, and wastewater as applicable,
- 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, or setbacks to protect them,
- guidance for implementation, operation, maintenance, and record keeping and,
- complete nutrient budget for nitrogen, phosphorous, and potassium for the rotation or crop sequence.

If increases in soil phosphorus levels are expected, 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, plans for nutrient management 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.

All NMPs shall be approved and bear the signature of a qualified person to certified that the plans have met this standard and all applicable Federal, state, and local regulations.

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, if necessary, 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. As applicable, records include:
 - a) soil test results and recommendations for nutrient application,
 - b) quantities, analyses, and sources of nutrients applied,
 - c) dates, duration, and method of nutrient applications,
 - d) volume of irrigation water applied,
 - e) crops planted, planting and harvest dates, yields, and crop residues removed, and
 - f) dates of review, person performing the review, and recommendations that resulted from the review.

Records should be maintained for five years; or for a period longer than five years if required by other Federal, state, or local ordinances, or program or contract requirements.

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, dispose of the wash water 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.

REFERENCES

Policy:

USDA, NRCS General Manual Title 450, Part 401.03 (Technical Guides, Policy and Responsibilities)

USDA, NRCS General Manual Title 190, Part 402 (Ecological Sciences, Nutrient Management, Policy)

Technical:

USDA, NRCS Field Office Technical Guide (FOTG)

Procedures:

USDA, NRCS, National Planning Procedures Handbook (NPPH)

USDA, NRCS National Agronomy Manual (NAM) Section 503