NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

NUTRIENT MANAGEMENT
(Ac.)
No. 590

DEFINITION

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

PURPOSES

- To budget and supply nutrients for plant production.
- To properly utilize manure or organic by-products as a plant nutrient source.
- To minimize agricultural non-point source pollution of surface and ground water resources.
- To protect air quality by reducing nitrogen and/or particulate emissions to the atmosphere.
- To maintain or improve the physical, chemical and biological condition of soil.

CONDITIONS WHERE PRACTICE APPLIES

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

CRITERIA

General Criteria Applicable to All Purposes

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

Persons who review or approve plans for nutrient management shall be certified by the West Virginia Department of Agriculture's Nutrient Management Certification program.

Plans for nutrient management that are elements of a more comprehensive conservation plan shall recognize other requirements of the conservation plan and be compatible with its other requirements. Example (CNMP and CAFO Plans)

A nutrient budget for nitrogen, phosphorus, and potassium shall be developed that considers all potential sources of nutrients (animal manure, organic by-products, waste water, commercial fertilizer, crop residues and legume credits.)

Use the Nutrient Budget Worksheet WVAGR WS-A (590), WV- NUT MAN2.3, or other approved methods.

Realistic yield goals shall be established based on soil productivity information (soil survey), client's historical yield data, climatic conditions, level of management and/or local research on similar soil, cropping systems, and soil and manure/organic by-products. For new crops or varieties, industry yield recommendations may be used until documented yield information is available.

Plans for nutrient management shall specify the form, source, amount, timing and method of application of nutrients on each field to achieve realistic yield goals,

Conservation practice standards are reviewed periodically and updated if needed. To obtain the current version of this standard, contact your Natural Resources Conservation Service State Office or visit the Field Office Technical Guide (FOTG). ***Note: Bold italics is information added or changes made to the National Conservation Standard by WV.***

while minimizing nitrogen and/or phosphorus movement to surface and/or ground waters.

Erosion and runoff control practices shall be installed on fields that receive nutrients to reduce potential nutrient losses to acceptable levels. Soil loss will be reduced to (T).

For each crop where soil test results are obtained from other land grant universities or certified labs, recommendations will be determined by the nutrient management planner and correlated to the WVU recommendations.

All recommendations will be reviewed by the planner and adjusted accordingly (within the criteria) to ensure they meet landowner objectives.

Soil Sampling and Laboratory Analysis (Testing)

Nutrient planning shall be based on a current land grant university soil test ***including but not limited to West Virginia University (WVU), Virginia Tech, Penn State, or other soil tests from a certified lab. Current soil tests are those that are no older than three years.***

If a soil test is not available, the plan will be based upon crop requirements for the expected yield.

Use ***FOTG Reference, Penn State Agronomy Guide - Nitrogen Recommendations for Agronomic Crops) and/or Typical Crop Nutrient Removal for Phosphorus and Potassium). A soil test is required within one year of the initial plan date where book values are used.***

Soil samples shall be collected and prepared according to requirements of lab chosen. An example (WVU guidance) is provided. WVU Soil Sampling

Plant Tissue Analysis

Tissue sampling and analysis, where used, shall be done in accordance with Land Grant University recommendations and guidance.

Nutrient Application Timing

Timing of nutrient application shall correspond as closely as possible with the crop nutrient uptake characteristics. ***Use the Penn State Agronomy Guide to identify the timing of nutrient application for a specific crops establishment and/or maintenance.***

NUTRIENT APPLICATION METHODS

Nutrients shall not be applied to frozen, snow-covered, or saturated soil.

Nutrient applications associated with irrigation systems shall be applied in accordance with the requirements of Irrigation Water Management (Code 449).

Additional Criteria Applicable to Nutrient Application Rates for Inorganic Fertilizers

Recommended soil amendments and nutrient application rates shall be based on a current land grant university soil test including but not limited to West Virginia University (WVU), Virginia Tech, Penn State, or other soil tests from a certified lab for pH, P_2O_5 and K_2O. Nitrogen application will be based upon realistic yield goals.

Estimated yield values may be used to develop a preliminary plan that should be revised upon availability of actual yield data.

- ***Nitrogen Application – Planned nitrogen application rates shall account for the residual amount of nitrogen in the soil and crop residue***

use FOTG Reference, University of Maryland Mineralization Rates for Organic Nutrient Sources, April 2007

Previous crop	**% Stand**			
Alfalfa First year after alfalfa	>50% stand 25-49% stand <25% stand		110 70 40	
Red clover and trefoil First year after clover or trefoil	>50% stand 25-49% stand <25% stand		80 60 40	
Soybeans First year after soybeans harvested for grain.		---- 1 lb N/bu soybeans ----		

Use FOTG Reference, Penn State Agronomy Guide - Nitrogen Recommendations for Agronomic Crops and/or Fertilizer Recommendations to determine nitrogen recommendation based upon a realistic yield goal.

Potassium Application – On permanent pasture, avoid applying heavy rates of potash in early spring in order to minimize potential for grass tetany. Mg availability is reduced if the forage is high in potassium. Instead, make late spring, summer, or fall applications of potash.

Other Plant Nutrients – The planned rates of application for other nutrients shall be consistent with a land grant university or certified soil lab analysis results and recommendations.

Starter Fertilizers – Starter fertilizers containing nitrogen, phosphorus and potassium may be applied in accordance with the land grant university or certified lab recommendations. When starter fertilizers are used, they shall be included in the nutrient budget.

If litter, manure or other organic by-products are a source of nutrients, follow the section in the standard titled Nutrient Application Rate for Organic Fertilizer.

Criteria Applicable to Manure or Organic By-Products (Excluding Sewage Sludge/Bio-Solids) Applied as a Plant Nutrient Source

Nutrient values of manure and organic by-products (excluding sewage sludge/Bio-Solids) shall be determined prior to land application based on laboratory report provided by the landowner. Book values recognized by the NRCS and/or WVU, or historic records for the operation may be used to develop an initial plan. A manure analysis is required within 1 yr. of the initial plan where book values or historic records are utilized. A manure sample shall be submitted each year for analysis and the nutrient management plan modified to reflect changes in the nutrient content of manures.

Nutrient Application Rates for Organic Fertilizers

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

following:

All references to nutrient levels and related quantitative values are based on WVU soil test results.

Statewide Option 1 – Manure or litter may be applied at the nitrogen based application rate when soil test phosphorus levels are low to medium.

If the current soil test indicates the soil phosphorus level is high, a phosphorus based application rate of up to 1.5 times the crop removal rate will be used.

If the phosphorus level is very high, greater than 80lbs/ac, manure or litter will be applied at the crops estimated phosphorus removal rate or utilize the Phosphorus Field Risk Assessment. (Worksheet WVAGR WS-C (590) Phosphorus Index

If the phosphorus level does not exceed 120 lbs., a single application of phosphorus applied as manure may be made at a rate equal to the recommended phosphorus application or estimated phosphorus removal in harvested plant biomass for a maximum period of 3 years. When such application is made the nitrogen application rate will not exceed crop needs during the year of organic fertilizer application, or utilize the Phosphorus Field Risk Assessment.

If the phosphorus level exceeds 120 lbs., see section on Phosphorus Field Risk Assessment.

If excess litter, manure or organic by-products are generated on the farm the plan will identify the quantity, and the planned use of the excess. (See Manure Transfer 634)

Application equipment will be calibrated to insure accuracy and uniformity of manure or litter application and documented on Manure Spreader Calibration Worksheet WVAGR WS-B (590).

Statewide – Phosphorus Field Risk Assessment

When animal manures or other organic by-products are applied and the current soil test indicates soil phosphorus levels <u>greater than 80lbs/ac,</u> a field-specific assessment of the potential for phosphorus transport from the field may be completed. The assessment will be completed using the Phosphorus Index.

For fields with high or very high potential losses, appropriate conservation practices identified through the use of RUSLE2 and visual assessment should be considered to improve site index values and reduce the vulnerability to off-site phosphorus transport.

A record of the assessment rating for each field or sub-field, and information about conservation practices and management activities that can reduce the potential for phosphorus movement from the site, will be included in the plan.

When such assessments are done, the results of the assessment and recommendations shall be discussed with the producer during the development of the plan.

In situations where a phosphorus based plan is being implemented, an additional application of inorganic nitrogen may be required, N application will be based upon PSNT or estimated crop needs.

Nitrogen Field Risk Assessment

In areas where there are state and/or locally identified or designated nitrogen-related water quality impairments, (for example: karst and well-head protection areas), an assessment shall be completed of

the potential for nitrogen using the Leaching Index Values calculated within RUSLE2. 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 movement from the field.

Nutrient Application Rates for Sewage Sludge/Bio-Solids

Nutrient values for sewage sludge shall be determined by reviewing a laboratory analysis provided by the landowner. Where more than one analysis is available, an average value will be calculated.

If the current soil test indicates the soil phosphorus level is greater than 80lbs/ac, sludge may be applied at the estimated crop removal rate. When such application is made the nitrogen application rate will not exceed crop needs during the year of sludge application. Manure or litter may only be applied in lieu of the sludge.

Heavy Metals Monitoring

When sewage sludge is applied, the accumulation of potential pollutants (including but not limited to arsenic, cadmium, copper, lead, mercury, selenium, and zinc) in the soil shall be monitored by the owner/client in accordance with the US Code, Reference 40 CFR, Parts 403 and 503, and/or any applicable state and local laws or regulations.

Criteria for Application and Management to Manure or Organic of Nutrients Where Wildlife is a Primary Concern

Nutrients should be applied outside the primary nesting season (March 15 – July 15)

Since soil test recommendations are based on estimated yields for agricultural crops, caution should be used when recommending nutrient applications for areas to be established and/or maintained for wildlife (e.g. grassland communities). Nutrient application may result in vegetation too dense for many target and non-target species. Fertilizers should be carefully evaluated prior to making any recommendations. Under most circumstances, fertilizer applications should not be recommended.

Contact the State Agronomist or State Biologist for recommendations.

Additional Criteria to Protect Air Quality by Reducing Nitrogen and/or Particulate Emissions to the Atmosphere

Handle and apply poultry litter or other dry types of animal manures when weather conditions are calm and there is less potential for blowing and emission of particulates into the atmosphere. A spreading pattern will be followed that minimizes applicator exposure to airborne particulates.

SPECIAL CONSIDERATIONS

Consider application methods and timing that further 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,***
- ***on cropland, incorporate surface***

applications of solid forms of manure or some commercial fertilizer nitrogen formulations (i.e. Urea) into the soil within 24 hours of application.

- ***avoiding fall or winter nutrient application for spring seeded crops,***
- ***band applications of phosphorus near the seed row,***
- ***applying nutrient materials uniformly to application areas,***
- ***rotate livestock feeding areas to minimize build up of manure and nutrients,***
- ***delayed field application of animal manures if precipitation capable of producing runoff and erosion is forecast within 24 hours of the time of the planned application.***

Consider annual reviews to determine if changes in the nutrient management plan are desirable (or needed) for the next planned crop.

Consider removing animals from fields receiving poultry litter applications for a period of at least two weeks.

GENERAL CONSIDERATIONS

- Consider micronutrient deficiencies of nutrients due to excessive levels of other nutrients. (e.g. zinc, manganese, and boron)
- Consider additional practices to improve soil nutrient and water storage, infiltration, aeration, tilth, diversity of soil organisms and to protect or improve water quality.
- Consider cover crops and their harvest whenever possible to utilize and reduce residual nitrogen.
- Priority areas for land application of manure should be on slopes less than 15% and located a minimum of 50 feet from waterways, sinkholes and other waterbodies. It is preferable to apply manure on pastures and hayland soon after cutting or grazing before re-growth has occurred.
- Consider the potential problems from odors associated with the land application of animal manures, especially when applied near or upwind of residences.
- Consider avoiding, when possible, the land application of animal manures during weekends and holidays.
- Consider nitrogen volatilization losses associated with the land application of animal manures. 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 and manure or litter analysis information no older than one year when developing new plans, particularly if animal manures are to be a nutrient source.
- On sites on which there are special environmental concerns, consider other sampling techniques to monitor soil fertility. (For example: Pre-Sidedress Nitrogen Test (PSNT), or soil surface sampling for phosphorus accumulation or pH changes.)
- ***Consider utilizing crops with higher phosphorus uptake in correlation with no application of phosphorus on fields where soil test P is greater***

than 120 lbs. (See FOTG reference)
<u>Crop Nutrient Uptake and Removal</u>

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 sample analyses.
- Realistic yield goals for the crops in the rotation.
- Quantification of nutrient sources for N, P and K.
- Recommended nutrient rates, timing, form, and method of application and incorporation.
- Location of designated sensitive areas or resources and the associated nutrient management restriction.
- Guidance for implementation, operation, maintenance, and recordkeeping.
- Complete nutrient budget for nitrogen, phosphorus, and potassium for the rotation or crop sequence.
- Manure or litter spreader rate calibrations and the desired application rate.
- 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.
- ***Signature of a West Virginia Certified Nutrient Management Planner and certificate number.***

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 (3 years maximum) plan review to determine if adjustments or modifications to the plan are needed.***
- Protection of fertilizer storage facilities from weather and accidental leakage or spillage.
- ***Calibration of all fertilizer application equipment to ensure uniform distribution of material at planned rates according to Worksheet WVAGR WS-B (590).***
- Maintaining records to document plan implementation.
- Records include:
- soil test results and recommendations for nutrient application,
- quantities, analyses and sources of nutrients applied,
- dates and method of nutrient applications,
- crops planted, planting and harvest dates, yields, and crop residues removed,
- application rate of nutrients,

- results of water and plant heavy metal analyses (if applicable),
- Dates of review and person performing the review, and recommendations that resulted from the review.

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

WORKER PROTECTION AND BIO-SECURITY

Workers should be protected from and avoid unnecessary contact with chemical fertilizers, manures or poultry litter. Protection should include the use of protective clothing. 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 of nutrient application equipment should be conducted so as not to contaminate surface or groundwater. 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/or leaching.

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

The operator should follow bio-security measures published by the West Virginia Department of Agriculture to minimize the risk of introduction or spreading of disease. (See FOTG Technical Reference – Conservation Planning)

WVDA Routine Bio-Security Measures for On-Site Farm Visits or Other Livestock Concentration Points

REFERENCES

WVDA Routine Bio-Security Measures for On-Site Farm Visits or Other Livestock Concentration Points

Penn State Nutrient Fact Sheet 13-Managing Phosphorus for Crop Production

Penn State Agronomy Guide 2009

University of Maryland Mineralization Rates for Organic Nutrient Sources, April 2007

West Virginia University Extension Service

Sampling Soils, Willem A. vanEck, Clifford W. Collier, Jr., September, 1995