United States Department of Agriculture
Natural Resources Conservation Service

Water Quality Enhancement Activity – Nutrient Management

Nutrient Management

Nutrient management is managing the amount, source, placement, form, and timing of the application of plant nutrients and soil amendments. Nutrient management effectively utilizes available nutrient resources to supply crops with nutrients required to efficiently produce food, forage, fiber, and cover while minimizing environmental degradation. Nutrient management is applicable to all lands where plant nutrients and soil amendments are applied.

Nutrient management may be a component of a conservation management system and is most effective when used in conjunction with crop rotation, residue management, pest management, conservation buffer practices, and/or other practices needed on a site-specific basis to address natural resource concerns and the landowner's objectives. The major objective of nutrient management is to minimize nutrient losses from fields, thus helping protect surface and ground water supplies.

Nutrient management may be used to plan for the safe and effective application of farm available organic resources such as manures and organic by-products. When manure is produced, stored and utilized on farm a Comprehensive Nutrient Management Plan (CNMP) is encouraged. A CNMP is a conservation system that is unique to animal feeding operations. It includes conservation practices and management activities which, when implemented as part of a conservation system, will help to ensure that animal production and natural resource protection goals are achieved

Benefits

Increased management of nutrients will protect and enhance water quality and the biotic communities that depend upon clean lakes and rivers. Water quality, water quantity, and air quality are current issues important to urban and rural communities alike. Proper nutrient management ensures nutrients are less likely to enter ground and surface waters. This is especially important when humans utilize the water as a drinking water source. Nutrient management also addresses impacts on aquatic life, wildlife, recreation activities, and overall aesthetics. When not properly managed, nutrients can volatilize to form other air pollutants, including ozone precursors and fine particulate matter.

Nutrient Management enhancement activities help agricultural producers and the environment:

- Cleaner ground and surface water
- Better air quality
- Reduced costs
- Maintain or improve soil health
- Increased crop yields

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Criteria for Nutrient Management Enhancement Activity
Acceptance of this enhancement **requires a participant to** have developed a Nutrient Management Plan or a Comprehensive Nutrient Management Plan. Additionally the producer must employ two or more of the following Nutrient Management Activities.

- ☐ 1. Nutrient Testing of Plant Tissue
- ☐ 2. Nitrogen Application Management
- ☐ 3. Phosphorus Fertilizer Incorporation Or Injection
- ☐ 4. Adding Legumes To the System As A Source Of Nitrogen
- ☐ 5. Using Cover crops To Scavenge And Recycle Residual Nitrogen
- ☐ 6. Precision Agriculture Operations

Reference:
Follett, R.F. 2001. Nitrogen Transformation and Transport Processes. pp. 17-44, In R.F. Follett and J. Hatfield. (eds.). 2001. Nitrogen in the Environment; Sources, Problems, and Solutions. Elsevier Science Publishers. The Netherlands. 520 pp.

Sims, J.T. (ed.) 2005. Phosphorus: Agriculture and the Environment. Agron. Monogr. 46. ASA, CSSA, and SSSA, Madison, WI.

Stevenson, F.J. (ed.) 1982. Nitrogen in Agricultural Soils. Agron. Series 22. ASA, CSSA, and SSSA, Madison, WI.

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1. Nutrient Testing of Plant Tissue

Activity: Modify nitrogen application based on annual plant tissue testing.

Minimum Criteria: Use one or both of the following plant tissue tests each year to help more accurately determine nitrogen utilization by crop plants:

1. Chlorophyll Meter – Chlorophyll meter readings can be used to determine the nitrogen status of corn late in the vegetative growth period. This involves planting "reference strips" where 10-25% more nitrogen is applied than recommended. Then a chlorophyll meter is used to compare the reference strips with the rest of the field to determine if nitrogen is deficient. Additional late season nitrogen is applied if needed. For additional information, follow your Land Grant University guidelines for using and interpreting the results of a chlorophyll meter test.
2. Stalk Testing – The nitrogen status of the corn crop can be determined by measuring the nitrate concentrations in the lower portions of cornstalks at the end of the growing season. This involves taking an 8" sample of the cornstalk after black layer development in corn. The stalk is analyzed for nitrate to determine if the corn received insufficient, sufficient, or excessive levels of nitrogen. Since this test is conducted after the current corn crop is mature, the results are used to "fine-tune" nitrogen recommendations in the next corn crop. Follow your Land Grant University guidelines for the use of this type of test.

2. Nitrogen Application Management

This activity contains four different options. Although more than one may be applied on the same farm, only one activity may be applied to the same acreage.

A: All the nitrogen for a crop is applied not earlier than 30 days before planting the crop.

Minimum Criteria: All nitrogen for a crop, regardless of form or application method, shall be applied no more than 30 days prior to the planned planting date of the crop.

B: All nitrogen for a crop is applied not earlier than 30 days before planting the crop, AND a controlled-release form of nitrogen fertilizer is used.

Minimum Criteria: All nitrogen for a crop shall be applied no more than 30 days prior to the planned planting date of the crop. The nitrogen fertilizer shall be a slow-release or controlled-release formulation.

C: Nitrogen is applied in two or more applications.

Minimum Criteria: The first application must be less than 50% of the total nitrogen required by the crop, and not applied earlier than 30 days before planting the crop. The second application must be more than 50% of the total nitrogen required by the crop, and must be made after crop emergence.

D: Split application based on a Pre-Sidedress Nitrogen Test (PSNT). Base nitrogen needs on the Pre-Sidedress Nitrate Test (PSNT) for fields to which manure has been regularly applied. The side-dress application rate of nitrogen will be derived from interpretation of the PSNT results.

Minimum Criteria: PSNT involves taking a soil test 12 inches deep during a crop growth stage recommended by the respective Land Grant University. The soil is analyzed for nitrate. The test method and rate of the sidedress nitrogen application is based on the guidance developed by your Land Grant University.

3. Phosphorus Fertilizer Incorporation or Injection

Activity: Apply all phosphorus fertilizer at least 3 inches deep and/or as 2x2 starter fertilizer to enhance availability to the crop at critical periods and minimize loss to the environment.

Minimum Criteria: Phosphorus fertilizer applied to the soil surface is vulnerable to loss in surface runoff, both in solution and attached to soil particles.

All phosphorus fertilizer will be injected at least three inches deep below the soil surface. Phosphorus applied as a starter fertilizer during the planting operation will be placed in a band 2 inches to the side and 2 inches below the corn seed. The method is commonly referred as "two by two" placement.

The amount of phosphorus fertilizer applied as a starter in the 2X2 placement shall not exceed the rate recommended by your Land Grant University. The total amount of phosphorus applied shall not exceed the rate recommended by the Land Grant University based on soil test recommendations.

4. Adding Legumes to the System as a Source of Nitrogen

Activity: Planting a leguminous crop as a part of the cropping system to replace part of the nitrogen required by the following crop.

Minimum Criteria: A leguminous (nitrogen-fixing) crop will be planted as part of the cropping system. This may be a leguminous cover crop that is planted between two primary crops in the system, or it may be a leguminous crop that replaces one of the primary crops in the system. This enhancement does not apply to legumes that are normally a part of the cropping system. Nitrogen credits from the leguminous crop will be calculated and applied according to the guidelines of the Land Grant University.

5. Using Cover Crops to Scavenge and Recycle Residual Nitrogen

Activity: Planting a cover crop that will scavenge nitrogen left in the soil after the harvest of a primary crop in the system.

Minimum Criteria: The cover crop selected shall have the growth rate and rooting depth to scavenge excess nitrogen from the root zone of the previous crop. It shall be seeded at a rate recommended by the NRCS Field Office Technical Guide. Any species that has the ability to scavenge excess nitrogen is acceptable. The nitrogen recommendation for the following crop shall be reduced by the amount of nitrogen assumed to have been scavenged and recycled by this cover crop.

This enhancement does not apply to the same acres on which the leguminous cover crop is applied.

6. Precision Agriculture Applications

Use variable rate technology (VRT), collection of yield data, mapping yields and analyzing results by field resulting in enhanced crop nutrition or reduced fertilizer cost.

Minimum Criteria: Precision nutrient application requires:

- Variable rate application technologies (VRT) - Computer-controlled equipment continually adjusts fertilizer applications based on soil maps or yield maps. Phosphorus and potassium fertilizer will be variably applied according to Land Grant University.
- Yield monitoring Systems - Yields in the field are measured using combine-mounted sensors or volume meters. A GPS receiver mounted on the combine supplies coordinates so that estimates of yields can be assigned to a field to create a yield map.