Nutrient Management

Conservation Practice Job Sheet ***AK*-590**

Natural Resources Conservation Service

Definition
Nutrient management is managing the source, rate, form, timing, and placement of plant nutrients.

Purpose
Nutrient management effectively and efficiently uses scarce nutrient resources to adequately supply soils and plants to produce food, forage, fiber, and cover while minimizing environmental degradation.

Where Used
Nutrient management is applicable to all lands where plant nutrients and soil amendments are applied.

Conservation Management Systems
Nutrient management may be a component of a conservation management system. It is 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 role of nutrient management is to minimize nutrient losses from fields, thus helping protect surface and ground water supplies.

Both nitrogen and phosphorus can be transported off site through leaching or surface runoff that may result in water quality impairment. Nitrogen is highly water soluble and therefore subject to leaching into shallow ground water. Nitrate contamination of wells has potential health impacts for humans and livestock. Young children and developing fetuses are especially susceptible to nitrate poisoning.

Phosphorus is less soluble than nitrogen but when phosphorus is repeatedly applied in excess of what the crop can use P builds up in the soil and can be leached or runoff as dissolved P. Phosphorus can also be transported off of fields with the soil when erosion occurs. Both nitrogen and phosphorus can cause increased plant growth in aquatic systems, reduced dissolved oxygen, fish kills, odors and reduction of water quality for drinking, recreation, and fish and wildlife.

Nutrient Management Planning
Nutrient management components of the conservation plan will include the following information:

- field map and soil map
- crop rotation or sequence
- results of soil, water, plant, and organic material samples analyses
- expected yield
- sources of nutrients to be applied
- nutrient budget, including credits of nutrients available

- recommended nutrient rates, form, timing, and method of application
- location of designated sensitive areas
- guidelines for operation and maintenance

Nutrient management is most effective when used with other agronomic practices, such as cover and green manure crops, residue management, conservation buffers, water management, pest management, and crop rotation.

General Nutrient Management Considerations

- Test soil, plants, water and organic material for nutrient content.
- Set realistic yield goals.
- Apply nutrients according to soil test recommendations.
- Account for nutrient credits from all sources.
- Consider effects of drought or excess moisture on quantities of available nutrients.
- Use a water budget to guide timing of nutrient applications.
- Use cover and green manure crops where possible to recover and retain residual nitrogen and other nutrients between cropping periods.
- Use split applications of nitrogen fertilizer for greater nutrient efficiency.

Guidelines for Operation and Maintenance

- Review nutrient management component of the conservation plan annually and make adjustments when needed.
- Calibrate application equipment to ensure uniform distribution and accurate application rates.
- Protect nutrient storage areas from weather to minimize runoff and leakage.
- Avoid unnecessary exposure to fertilizer and organic waste, and wear protective clothing when necessary.
- Observe setbacks required for nutrient applications adjacent to waterbodies, drainageways, and other sensitive areas.
- Maintain records of nutrient application as required by state and local regulations.
- Clean up residual material from equipment and dispose of properly.

Nutrient Management Assessment

Make a site-specific environmental assessment of the potential risk of nutrient management. The boundary of the nutrient management assessment is the agricultural management zone (AMZ), which is defined as the edge of field, bottom of root zone, and top of crop canopy. Environmental risk is difficult to assess beyond the AMZ.

Within an area designated as having impaired or protected natural resources (soil, water, air, plants, and animals), the nutrient management plan should include an assessment of the potential risk for nitrogen and phosphorus to contribute to water quality impairment.

The Leaching Index (LI), Nitrogen Leaching and Economic Analysis Package (NLEAP), the Phosphorus Index (PI), erosion prediction models, water quality monitoring, or any other acceptable assessment tools may be used to make risk assessments.

Evaluate other areas that might have high levels of nutrients, produced or applied, that may contribute to environmental degradation. For example, areas with high livestock concentrations or large areas of high-intensity cropping, such as continuous potatoes, corn, or specialty crops may be contributing heavy nutrient loads to surface or ground water.

Conservation practices and management techniques will be implemented with nutrient management to mitigate any unacceptable risks.

NUTRIENT MANAGEMENT DESIGN AND SPECIFICATIONS

Landuser: Field:
Assisted by: Date:

PURPOSE (check all that apply)	
☐ Budget and supply nutrients for plant production	☐ Utilize manure/organic materials as a nutrient source
☐ Minimize agricultural non-point source pollution	☐ Maintain or improve soil condition

Table 1. Field Conditions and Recommendations

CROP SEQUENCE/ROTATION (circle current crop)	EXPECTED YIELD

CURRENT SOIL TEST LEVELS (PPM or LB/ac)					
N	P	K	pH	O.M%	EC

RECOMMENDED NUTRIENTS/AMENDMENTS TO MEET EXPECTED YIELD					
Person or Company Making Recommendation:					
N	P_2O_5	K_2O	LIME	Other	Other

Table 2. Nutrient Sources

Credits		Pounds per acre					
		N		***P_2O_5***		***K_2O***	
1. Nitrogen credits from previous legume crop							
2. Residual from long-term manure application							
3. Irrigation water (if known)							
4. Other (e.g. organic matter decomposition)							
5. ***Total Credits***							
Plant-Available Nutrient Balance Worksheet		***N***		***P_2O_5***		***K_2O***	
(Circle column that is landuser's decision)		Trial A	Trial B	Trial A	Trial B	Trial A	Trial B
6. Credits (from row 5 above)							
7. Fertilizer	Starter						
	Other (e.g. split application)						
8. Manure/Organic Materials							
9. Subtotal (sum of lines 6, 7 and 8)							
10. Nutrients Recommended (from Table 1)							
11. Nutrient Status (subtract line 10 from line 9)							
If line 11 is a negative number, this is the amount of additional nutrients needed to meet the crops' recommendations.							
If line 11 is a positive number, this is the amount by which the available nutrients exceed the crop requirements.							

NUTRIENT MANAGEMENT SPECIFICATIONS			
Amount to be Applied (LB/ac)	***N:***	***P_2O_5:***	***K_2O***
Method, Form and Timing of Application:			

NUTRIENT MANAGEMENT SPECIFICATIONS – SUMMARY SHEET

Landuser: Date:
Assisted by:

Year:

Field No./Crop	***N***	***P_2O_5***	***K_2O***

Information on Form, Rate, Timing and Method of Application:

Year:

Field No./Crop	***N***	***P_2O_5***	***K_2O***

Information on Form, Rate, Timing and Method of Application:

Year:

Field No./Crop	***N***	***P_2O_5***	***K_2O***

Information on Form, Rate, Timing and Method of Application:

Nutrient Management – Job Sketch

Draw or sketch the field, showing any sensitive areas and required setback zones. Inside each sketched field, enter total field acres and net application acres. Other relevant information, such as complementary practices or adjacent field or tract conditions may be included.

Scale 1"= ft. (NA indicates sketch not to scale: grid size=1/2" by 1/2")

Perform the following operations and maintenance:
Review this nutrient management plan every years.
Maintain field records for 5 years.
Calibrate application equipment to apply within ± % of the recommended rate.
Handle all nutrient material with caution. Wear appropriate protective clothing.
Clean up residual material from equipment and dispose of properly.
Additional specifications and notes:

This plan was developed based on the requirements of the current NRCS standard and any applicable Federal, state, or local regulations or policies. Changes in any of these regulations may necessitate a revision of the plan.

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Supplement for Operations Where Manure or Other Organic Fertilizers are Applied

ORGANIC SOURCES OF NUTRIENTS

When manure, sewage sludge, or other organic sources of nutrients are land applied there is a potential for buildup of phosphorus, heavy metals or other elements in the soil. Some of these elements can reach environmentally harmful levels over time and may accumulate to concentrations that are toxic to plants.

Micronutrient levels tend to be higher in organic nutrient sources than in commercial fertilizers. Micronutrients are essential for plant growth in small amounts but can become toxic to plants at higher levels. Soil tests should include micronutrients when organic fertilizers are applied over a long time.

Phosphorus can be transported off of fields through erosion and runoff. At very high levels of soil phosphorus, leaching can move P into groundwater. When phosphorus is transported in runoff it can lead to eutrophication of the receiving waters. Since phosphorus is an essential element for plant and animal growth it can cause excess growth when it accumulates in surface water. This growth causes changes in the aquatic plant community, increased growth of algae and depletion of the oxygen in the water from decomposition of the excess plant growth. The end result can be fish kills, loss of recreation opportunities and contamination of drinking water.

Growing and harvesting crops and providing vegetative filters may be all that is needed to reduce the phosphorus level of the soil and prevent P transport into surface water.

When growing "fresh edible crops for produce market, such as vegetables, root, or tuber crops" and using sewage sludge, animal manure or other organic materials as sources of plant nutrients, applications should be in accordance with applicable Federal, State, and/or local laws or policies.

MANURE

Use the Alaska Phosphorus Index to assess the risk for phosphorus pollution from a field or management unit. If the risk is low or medium manure can be applied based on nitrogen needs of the crop, however, applying manure based on nitrogen will usually result in an accumulation of soil phosphorus over a period of several years. It is common for the fields closest to the manure storage to have the highest levels of accumulated phosphorus because it is easy and quick to apply manure to these fields.

As phosphorus builds up in the soil it will show up in soil tests. Long term record keeping and monitoring of trends will indicate if phosphorus is reaching an environmentally harmful level. Periodic use of the Phosphorus Index will indicate when land applications of manure should switch to a phosphorus based instead of a nitrogen based rate.

When manure is applied to agricultural crops based on phosphorus content, the amount of nitrogen supplied by the manure is less than that required by the crop. Supplemental applications of inorganic nitrogen (N) fertilizer may be required for optimum crop yield. The worksheet on page 3 can be used to calculate the amount of additional nitrogen fertilizer needed by the crop.

The farm manager may choose to reduce the amount of manure applied annually to fields *before* a critical level of soil phosphorus is reached. Soil test records can be used to determine if a buildup is occurring or if practices are maintaining a steady level of soil phosphorus. Maintaining a level of soil phosphorus below an environmentally critical threshold will give the operator more options for handling an unanticipated need to apply manure at a high rate in an emergency.

Other option for managing phosphorus include feeding low phosphorus feeds and applying amendments to stored manure to reduce volatilization of nitrogen. These practices maintain a better balance between nitrogen and phosphorus in the manure.

SEWAGE SLUDGE

When sewage sludge is applied to land, the accumulation of potential pollutants (including: arsenic, cadmium, copper, lead, mercury, selenium, and zinc) in the soil is monitored in accordance with the U.S. Code Reference 40 CFR parts 403 and 503, state laws, and/or local ordinances. In Alaska, contact the Department of Environmental Conservation for information regarding regulation of land application of sewage sludge.

Sewage sludge must be analyzed prior to application to determine its nutrient value, heavy metals, and salt content. Generally speaking, heavy metal content of sewage sludge is low in Alaska because of lower levels of industrialization. Nitrogen or phosphorus may be the critical elements in calculating land application rates. Heavy metals are frequently restricted to a "life time" maximum application rate. Keeping good records of when, where, and how much material was applied is essential when working with sludge and other organic industrial waste.

INSTRUCTIONS (***Discard the instructions. Do not include in the nutrient mgmt. plan.***)
A nutrient budget worksheet (page 3) is not required (but may be desirable) for each field. At least one budget worksheet will be included in each plan. The planner must complete a nutrient budget for each field but the recommendations may be recorded on the summary sheet (page 4).

Step 1. **GENERAL**. Enter the cooperator's name, field(s), who assisted with the planning, and the date.

Step 2. **PURPOSE.** Check all purposes for which the practice will be applied.

Step 3. **CROP SEQUENCE / ROTATION.** The crop sequence/rotation should describe the sequence of crops for at least five years. Start with last year's crop and project the crop rotation for the next four years. Circle the current crop.

Step 4. **YIELD.** Determine a realistic expected yield using historical records or the guidelines in the standard. It is important not to overestimate yields to minimize potential pollution sources and excess fertilizer costs.

Step 5. **CURRENT SOIL TESTS.** Enter the soil test values for N, P, and K and other test constituents as given on the report from the soil test laboratory. Indicate whether nutrient values are in parts per million (PPM) or lbs/ac.

Step 6. **RECOMMENDED NUTRIENTS / AMENDMENTS TO MEET YIELDS**. Using the soil test results and considering the yield, record the estimated amounts of nutrients and other soil amendments needed to produce the expected yield. Use the latest fertilizer guidelines from the Cooperative Extension or use the recommended nutrient values shown on the soil analysis if compatible with Extension and University recommendations.

Step 7. **NUTRIENT SOURCES – CREDITS.** Nitrogen is a very mobile nutrient and occurs in the soil and plants in many various forms. It can be stored in the soil's organic matter and released as microbial activity decomposes OM.

Line 1. N credits from previous crop or legume. Refer extension publication for the specific crop or legume for the most appropriate N credits (must be approved by NRCS State Agronomist). Enter zero if the information is not available from the University of Alaska or the Extension Service.

Line 2. Residual from long-term manure application. Not all nitrogen applied in previous applications is available to the crop the year of application. A percentage of last years' manure application and an even smaller percentage from the previous application will become plant available during this crop season. Phosphorus and potassium are considered to be nearly 100% available the year of application.

Line 3. Irrigation water. Irrigation water may contain an amount of nitrate nitrogen, which is available to plants. Refer to an individual water analysis for the operation. Enter "0"if a water analysis is not completed. Recommend a water analysis for future use if one has not been completed.

Line 4. Other. Enter the nitrogen contribution mineralized from organic matter and any other sources of nutrients not already identified. Enter "0"if values are not known

The nutrient value of other materials, like mulch or compost, can be determined by estimating the mass weight and per cent concentration of N in the material.

Step 8. **PLANT AVAILABLE NUTRIENTS APPLIED TO THE FIELD.** The producer can bring various sources of nutrients onto the field to supply the requirements of the crop. The nutrient budget is designed to allocate the sources of nutrients available and adjust the amounts based on the calculations to match the crops' needs. Use the trial A column to estimate the first budget trial. Use the trial B column to match available nutrients to needs.

Line 6. Credits. Total nutrient credits are summed in Line 5 and entered here.

Line 7. Fertilizer. Enter the amount of additional commercial fertilizer required (such as starter fertilizer). Make a note in the "Nutrient Management Specifications."

Line 8. Manure / organic materials. Manure application rates should be based on crop requirements, but can be applied in lessor amounts to distribute organic materials and micronutrients over a broader number of fields. Enter the nutrient amounts applied based on a manure test and planned application rates.

Step 9. **NUTRIENT STATUS.** The nutrient sources available for field application are subtotaled on Line 9. Next, the nutrient recommendations to meet expected yields are taken from TABLE 1, above. Subtract the nutrient requirements (line 10) from the nutrients available (line 9) to give a nutrient status (line 11).

Step 10. **NUTRIENT MANAGEMENT SPECIFICATIONS.** Record the amount of each nutrient, based on the selected producer decision, that will be applied (commercial fertilizer, others and manure), the planned method, form, and the time of application.

Step 11. **OPERATION AND MAINTENANCE.** On the second page of the design and specification, record the information requested. Nutrient management plans should be reviewed annually by the producer and a more thorough review once every five years unless there is a significant change in operations.

Step 12. Add Nitrogen to offset tie-up due to C/N.

Use the "Nutrient Management Specification - Summary Sheet" to record long-term recommendations and for operations that have large numbers of fields. Record the information here as specified in Step 10.

Make copies of page 3, for multiple fields rather than including several copies of the entire job sheet.