1. Scope
Manage the amount, source, placement, form, and timing of the application of nutrients and soil amendments. To supply nutrients for plant production, properly utilize manure or organic by-products as a plant nutrient source, minimize agricultural nonpoint source pollution of surface and ground water resources, improve air quality, and maintain or improve the physical, chemical, and biological conditions of soil.

2. Minimum Specifications
The following components shall be included in the nutrient management plan. Those items marked with an asterisk (*) will be recorded as minimum documentation requirements.

- Document resource concerns, problems, and practice objectives.*
- An aerial photograph or map.*
- A soil map of the site.
- Extent in acres.*
- Current and/or planned plant production sequence or crop rotation.*

The crop sequence (or rotation) should describe the sequence of crops for three (3) years. Start with last year’s crop and project the crop rotation for the next two (2) years. Circle the current crop.

- *Results of soil sample analyses.

Follow guidance on “#4 Guidelines for Soil Sampling” (near the end of this construction specifications) for soil sample collection. Enter the soil test values for nitrogen (N), phosphorus (P), potassium (K), and other constituents as given on the report from the soil test laboratory. Indicate whether the nutrient values are in parts per million (ppm) or pounds per acre (lbs/ac).

- *Results of manure or organic by-product sample analyses (required if land applied).

Follow guidance in the standard for additional criteria applicable to manure or organic by-products applied as a plant nutrient source.

- Results of plant or water analyses.

Follow guidance in the standard for plant tissue testing. For irrigation nutrient credits, follow the chart below:

<table>
<thead>
<tr>
<th>Water Application Rate (ACRE-FEET)</th>
<th>N IN WATER (PPM)</th>
<th>0.5</th>
<th>0.9</th>
<th>1.5</th>
<th>2.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>3</td>
<td>5</td>
<td>8</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>11</td>
<td>16</td>
<td>22</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>16</td>
<td>24</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>11</td>
<td>22</td>
<td>32</td>
<td>43</td>
<td></td>
</tr>
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<td>10</td>
<td>13</td>
<td>27</td>
<td>40</td>
<td>54</td>
<td></td>
</tr>
</tbody>
</table>

NRCS, KS
February 2020
• *Realistic yield goals for the crops in the rotation.

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

If historical data is not available, then the Soil Nutrient Assessment Program (SNAP) can be used. Be sure to enter all pertinent data in the program (such as State, county, crop, and yield goal from the producer) for documentation. Place a printout with the soil test results in the case file. The outcome will need to be within 50-100% to use as a realistic yield goal in place of actual data from the producer.

• *Quantification of all nutrient sources.

Record all sources of nutrients and the amounts to be applied to supply the requirements of the crop. This will include total nutrient credits, amounts of commercial fertilizer applied, and manure or organic by-products, if applied. If using Form KS-ECS-590, Nutrient Management, all nutrient sources will be recorded in the “Crop Nutrient Requirements and Fertilizer Applications” section of the form.

• *Recommended nutrient rates, timing, form, method of application, and incorporation.

When using Form KS-ECS-590, Nutrient Management, nitrate-nitrogen (NO₃-N) will be recorded in ppm. Profile NO₃-N will be analyzed using soil samples annually collected from the zero (0) to 24-inch soil depth. Consider application methods and timing that reduce the risk of nutrients (such as nitrogen [N] and phosphorus [P]) from being transported to ground and surface waters, or into the atmosphere. Suggestions include:

• If soil leaching potential is HIGH, it is recommended to do one (1) or more of the following:
  o Split-apply nitrogen (N)
  o Use a slow release nitrogen (N) source
  o Use a nitrification inhibitor
  o Apply nitrogen (N) as close as possible to crop nutrient utilization

• Avoiding winter and fall nutrient application for spring seeded crops.

• If phosphorus (P) runoff is a concern, it is recommended to do one (1) of the following:
  o Subsurface band applications of phosphorus (P) near the seed row
  o Preplant incorporate or injection of phosphorus (P) in the top two (2) inches of soil before the first runoff event

• Applying nutrient materials uniformly to application areas or as prescribed by precision agricultural techniques.

• 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.

• Applying nutrients as close as possible to time of use to reduce potential for surface and ground water contamination.

• Consider negative impacts when soil pH is not in balance for proper nutrient interactions in the availability of nutrients in the soil solution, as well as other plant growth needs.

• A profile nitrate test is required to determine the amount of unused nitrate in the soil prior to planting.
Manure Nitrogen (N) Application Rates

- When manure or organic by-products are used, the nitrogen (N) availability of the planned application rates shall match plant uptake characteristics as closely as possible, taking into consideration the timing of nutrient application(s) to minimize leaching and atmospheric losses.

- Management activities and technologies shall be used that effectively utilize mineralized nitrogen (N) and that minimize nitrogen (N) losses through denitrification, leaching, and ammonia volatilization.

- When the nutrient management plan component is being implemented on a phosphorus (P) basis, manure or organic by-products shall be applied at rates consistent with a phosphorus (P) limited application rate. In such situations, any additional nitrogen (N) application (from non-organic sources) may be required to supply, but not exceed, the recommended amounts of nitrogen (N) in any given year.

Manure Phosphorus (P) Application Rates

When manure or organic by-products are used, the planned rates of phosphorus (P) application shall be consistent with Table 1 below.

<table>
<thead>
<tr>
<th>TABLE 1: BASIS FOR NUTRIENT APPLICATION RATES FOR LIVESTOCK MANURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil Test P (ppm P)</td>
</tr>
<tr>
<td>---------------------</td>
</tr>
<tr>
<td>0-50</td>
</tr>
<tr>
<td>0-50</td>
</tr>
<tr>
<td>51-150</td>
</tr>
<tr>
<td>151-200</td>
</tr>
<tr>
<td>201+</td>
</tr>
</tbody>
</table>

Notice:

When applying nutrients based on P₂O₅ removal, do not exceed the recommended nitrogen (N) application for the crop.

When applying swine waste, do not exceed recommendations established by the Kansas Department of Agriculture’s Regulations when pertaining to K.S.A. 65-1, 178 et seq.

The application of phosphorus (P) applied as manure may be made at a rate equal to the recommended phosphorus (P) application, or estimated phosphorus (P) removal in harvested plant biomass for the crop rotation, or multiple years in the crop sequence. When such applications are made, the applicate rate shall:

- Not exceed the recommended nitrogen (N) application rate during the year of application.
• Not exceed the estimated nitrogen (N) removal in harvested plant biomass during the year of application, when there is no recommended nitrogen (N) application.

• Manure or organic by-products may be applied on legumes at rates equal to 1.5 times the phosphorus (P) removal rate in harvested plant biomass.

• Not be made on sites considered vulnerable to off-site phosphorus (P) transport, unless appropriate conservation practices, best management practices, or management activities are used to reduce the vulnerability.
  o *Field risk assessment

Follow guidance in the standard for field risk assessment. Nutrients shall not be applied to frozen, snow covered, or saturated soil if the potential risk for runoff exists. Potential runoff risk will be determined using the approved erosion prediction tools with site-specific cropping system data. If ephemeral and gully erosion are present, they will be included as all forms of water erosion. Soil leaching potential will be documented in the conservation plan.

Procedures for determining the soil leaching potential can be found in Section II of the Field Office Technical Guide (FOTG) or in ArcMap, using the soil interpretation layer in the geodata folder. Procedures for determining phosphorus (P) loss to surface waters will be assessed using the Kansas Site Assessment Index – Phosphorus, located in Section II of FOTG.

• *Location and identification of designated sensitive areas or resources and the associated nutrient management restriction.

When using Form KS-ECS-590, Nutrient Management, designated sensitive areas will be recorded in the “Environmental Risk Assessment” section of the form. At a minimum, attach a copy of an Arc-GIS as per National Planning Procedures Handbook (NPPH), Part 600.31. Form KS-ECS-590, Nutrient Management, will be used to locate sensitive areas.

• *Guidance for implementation, operation, maintenance, and record keeping.

Follow guidance in the standard for implementation, operation, maintenance, and record keeping.

3. Recording Procedure

The minimum specifications for this practice will be recorded in the conservation plan narrative, appropriate job sheet, or the conservation assistance notes.

4. Guidelines for Soil Sampling

The purpose of a soil sample is to determine the average nutrient status of a field. Sampling procedures should also identify nutrient variability in the field to accommodate nutrient application adjustments that will reduce costs and potential nutrient loss from the field.

The sampling procedure determines the quality and usefulness of the soil test information. The guidelines indicate minimum soil sampling guidelines.

Divide Fields:

The sampling zones (or grids) should represent uniform areas (such as soil type, slope, cropping history, known crop differences, or other factors that would indicate or influence nutrient levels in the soil).

• Grids should be three (3) acres or less.
• For fields not utilizing grids or zone management, samples shall represent no more than 40 acres unless field nutrient history has been established with evidence of at least two (2) prior soil tests.

• Separate samples by topographic features:
  1. Hilltops represented by at least one (1) composite sample.
  2. Side slopes or eroded areas represented by at least one (1) composite sample.
  3. Low areas represented by at least one (1) composite sample.

• Separate samples by cropping history, manure applications, cultural differences in the field, yield responses (i.e., yield maps or scale tickets), soil type, or any other feature that might influence crop nutrient removal and soil test values.

**Sampling Depth:**

• Surface samples for immobile nutrients zero (0) inch to six (6) inches (i.e., phosphorus [P], potassium [K], pH, and OM).
  o In long-term reduced or no-till systems, samples of zero (0) inch to three (3) inches may reveal a potential soil acidity (pH) change from nutrient application methods. For soils with a pH of 5.8 or lower, apply lime per Kansas State University’s recommendations and resample to check pH.
  o When sampling for mobile nutrients, such as nitrate, sulfur, and chloride (minimum of ten [10] cores per 20 surface cores), collect a separate zero (0) inch to 24 inch sample.
  o For example, in a wheat, sorghum, soybean rotation: sample in the fall prior to planting wheat and then sample in late winter or spring prior to sorghum. Sampling for the soybeans is not required since they “fix” the amount of nitrogen (N) needed for growth.

**Core Collection:**

• Maintain consistent core depth by marking collection tool.
• Collect 15 to 20 cores per sample.
• If random core collection represents the entire area being sampled, avoid loading and feeding areas, dead furrows, old fence rows, etc., that would give unusual results.
• Collect cores in a clean, plastic container.
• Collect a continuous core that will represent the entire sample layer.
• Collect samples from compressed or firm soil to assure consistency (e.g., from vehicle track).
• Thoroughly mix the sample, keep cool or air dry at room temperature, and immediately submit the samples to the laboratory.

**Timing of Sampling:**

Sample early enough to use for the nutrient management plan development. Sample at least two (2) to four (4) weeks prior to planting or fertilizing the intended crop.

**Frequency:**

• A sample is considered current if no older than two (2) years for phosphorus (P), potassium (K), pH, and zinc.
• For nutrient management plan revisions and maintenance, soil tests will be taken on a three (3) year interval for whole field plans and every four (4) years for precision nutrient application.
plans, or as required by local rules and regulations. Or, take soil tests during each crop rotation cycle until field history is established.

- When sampling for mobile nutrients (i.e., nitrates), sample annually prior to planting crops where nitrogen (N) will be applied.
- For example, in a wheat, sorghum, soybean rotation: sample in the fall prior to planting wheat and then sample in late winter or spring prior to sorghum. Sampling for the soybeans is not required since they “fix” the amount of nitrogen (N) needed for growth.

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<tbody>
<tr>
<td>Soil Test P (ppm P)</td>
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<tr>
<td>Bray-1 or Mehlich-3</td>
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<td>0-50</td>
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</tbody>
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5. References


USDA National Agricultural Library (NAL) Soil Nutrient Assessment Program (SNAP)

USDA NRCS Form KS-ECS-590, Nutrient Management

USDA NRCS Kansas Site Assessment Index - Phosphorous

USDA NRCS National Planning Procedures Handbook