

# Idaho Dairy Nutrient Management Standard

## PURPOSE

The Idaho Dairy Nutrient Management Standard (NMS) shall regulate the rate, source, placement, and timing of plant nutrients and soil amendments to improve soil health and crop productivity while reducing environmental impacts on all Grade A dairies in the State of Idaho.

## CONDITIONS WHERE NMS SHALL BE APPLIED

All fields operated by Grade A dairies where plant nutrients and soil amendments are applied.

## ENVIRONMENTAL/NUTRIENT MANAGEMENT PLAN (E/NMP) DEVELOPMENT

### General Criteria Applicable to All Plans

Develop an E/NMP for nitrogen (N), phosphorus (P), and potassium (K), which accounts for all known measurable sources and removal of these nutrients. These plans must include full and complete documentation of all nutrient imports, exports, and on-farm transfers.

An annual budget for phosphorus that considers all potential sources of nutrients, including, but not limited to commercial fertilizers, animal manures, legume nitrogen fixation, green manures, plant or crop residues, compost, organic by-products, municipal and industrial biosolids, wastewater, organic materials, soil, and irrigation water.

E/NMPs shall be written and/or approved by individuals who have met certification requirements as set forth by ISDA.

### Soil Testing and Analysis.

E/NMPs shall be drafted, approved and administered based on current soil test results (no older than one (1) year) from all dairy fields receiving nutrient application in accordance with UI guidance, or industry practice when recognized by the University of Idaho (UI). Soil test P shall be determined using the Bray 1 method for soils with no free lime (pH < 6.5) and the Olsen method (NaHCO<sub>3</sub>) for soils with free lime (pH > 6.5).

Soil samples shall be collected and analyzed annually from all fields receiving nutrient application according to Table 1 to accurately determine fertilizer needs utilizing the UI Fertilizer Guidelines or other published guidelines for crop production in the state. Soil samples collected from the first foot shall be analyzed for inorganic N (NO<sub>3</sub>-N and NH<sub>4</sub>-N), P and K, samples collected from the second foot should be analyzed for inorganic N.

**Table 1. Soil sampling depth and testing criteria for annual budget development. All analysis should be accepted by and follow UI guidelines.**

Depth (inches)	Soil Constituent Analyzed
0 -12"	NO <sub>3</sub> -N, NH <sub>4</sub> -N, P, & K
12-24"	NO <sub>3</sub> -N, NH <sub>4</sub> -N

Soil samples shall be collected and prepared such that they are representative of the entire field or portion of the field to be managed separately. Requirements for soil sampling shall follow the specifications outlined in the UI publication “Soil Sampling“ UI Bulletin 704.

Fields that are part of a long-term sod, pasture, or alfalfa rotation, may not require annual soil tests. Soil tests are to be taken when nutrients will be applied as part of an on-going management program.

For soil test analyses, use laboratories successfully meeting the requirements and performance standards of the North American Proficiency Testing Program under the auspices of the Soil Science Society of America and NRCS or use an alternative NRCS- or State-approved certification program that considers laboratory performance and proficiency to assure accuracy of soil test results.  
[http://www.extension.uidaho.edu/nutrient/soil\\_plant\\_water\\_manure/accredited.html](http://www.extension.uidaho.edu/nutrient/soil_plant_water_manure/accredited.html)

**Manure, Organic Byproduct, and Biosolid Testing and Analysis.**

Prior to application, all nutrients streams to be land applied shall be sampled and tested to determine the appropriate volume of nutrients to be applied to each field, pursuant to the expected phosphorus uptake of the crop to be planted and the current soil test P concentration recorded in each field (Phosphorus Threshold) or the Phosphorus Site Index Value (P Site Index). Collect, prepare, store, and ship all manure, organic by-products, and biosolids following UI guidance (CIS 1139) or industry practice when recognized by the UI. In the absence of such guidance, test at least annually (no more than 3 months prior to application), or more frequently if needed to account for operational changes (e.g., feed management, animal type, manure handling strategy, etc.) impacting manure nutrient concentrations.

**OPTIONAL:** If no operational changes occur and operations can document a stable level of nutrient concentrations for the preceding 3 consecutive years, manure may be tested less frequently, if approved by ISDA. Follow UI guidelines regarding required analyses and test interpretations. Analyze, at a minimum, total N, total P or total  $P_2O_5$ , total K or total  $K_2O$ , and percent solids.

When planning for new or modified livestock operations, and manure tests are not available yet, use “book values” from the ASAE Standard D384.2 MAR2005.  
<http://www.agronext.iastate.edu/immag/pubs/manure-prod-char-d384-2.pdf>

For manure analyses, laboratories must meet the requirements and performance standards of the Manure Testing Laboratory Certification program established by the Minnesota Department of Agriculture.

**Nutrient Loss Risk Assessments.**

E/NMPs shall use one (1) of the following methods to calculate and manage P application:

P Site Index - To assess the site-specific risk of P loss, the P site index risk assessment must be completed for all fields under the E/NMP, pursuant to the 2017 Idaho Phosphorus Site Index Reference.

Phosphorus Threshold - Plans may use a soil test P threshold to determine P application (Table 2). Any field using the P threshold must have a documented agronomic need for P, based on soil tests of each field receiving nutrients and UI nutrient recommendation or industry practice when recognized by the UI, before additional nutrients can be applied. Soil samples taken for comparison to the P threshold and for tracking P trends will be taken from the 0-12” sampling depth.

<b>Table 2</b>	
<b>P Threshold Concentration</b>	
<b>Olsen</b>	<b>Bray 1</b>
40ppm <sup>†</sup>	60ppm <sup>†</sup>

<sup>†</sup>Soil phosphorus test results are understood to have an average variability of 10%

In addition, it is recommended to use the current approved N balance sheet (See Forms) to track N inputs and outputs from fields.

When soil test P concentrations are above the threshold value, the planner and producer will design a Environmental/Nutrient Management Plan E/NMP that will reduce soil test P. Grade A dairies that register a soil test P concentration of greater than one hundred (100) parts per million (via Olsen method) on at least one (1) field shall be required to resubmit an E/NMP to ISDA that utilizes the Phosphorus Site Index Method for nutrient management of all fields in the plan.

Irrespective of P Site Index rating or threshold value, no land application of P shall be permitted on any fields or pastures that possess a soil P level exceeding three hundred (300) parts per million, as determined by the required annual soil test (via Olsen method).

### **Application of Liquid Byproduct**

For purposes of this standard, animal byproduct containing less than 10% solids will be classified as a liquid.

Application of liquid byproduct shall not be made outside the active growing period of the crop, unless the producer receives direct prior authorization from ISDA under the following conditions:

1. The E/NMP is up-to-date and all fields to receive liquid nutrients are listed within the plan
2. The volume of nutrients to be land applied is predetermined
3. Recent soil samples exist on all fields to receive liquid nutrients
4. Application of nutrients is consistent with management plan of the field (i.e. will not exceed agronomic needs of the crop or force an upward trend in soil phosphorus)
5. Weather forecast predicts no measurable precipitation for the next 5 days.
6. Liquid byproduct shall be applied to crops at amounts not to exceed soil water holding capacity in the crop-rooting zone using UI irrigation scheduling technique (CIS 1039) or similar soil moisture balance method. Application of liquid byproduct through surface or sprinkler irrigation systems will be timed to prevent deep percolation or runoff.
7. ISDA affirms the need to apply liquid nutrients outside of the active crop growing period is necessary and appropriate.

### **Application of solid byproduct**

Do not surface apply nutrients when there is a risk of runoff, including when—

- Soils are frozen.
- Soils are snow-covered.
- The top 2 inches or more of soil are saturated.

Exceptions for the above criteria can be made when adequate conservation measures are installed to prevent any offsite delivery of nutrients. ISDA will define adequate treatment levels and specified conditions for applications of manure if soils are frozen and/or snow covered or the top 2 inches or more of soil are saturated. At a minimum, producers must consider the following site and management factors:

- Climate (long-term)

- Weather (short-term)
- Soil characteristics
- Slope
- Areas of concentrated flow
- Organic residue and living covers
- Amount and source of nutrients to be applied
- Setback distances to protect local water quality

## **PLANS AND SPECIFICATIONS**

An approved Environmental/Nutrient Management Plan document shall contain the following items:

- Aerial site photograph(s), imagery, topography, or site map(s).
- Soil survey map of the site.
- Soil information including: soil type, surface texture, erodibility factor ( $K_w$ ), slope, hydrologic soil group, drainage class, permeability ( $K_{sat}$ ), available water capacity, depth to water table, depth to bedrock, restrictive features, and flooding and ponding frequency.
- Distance to surface water
- Location of designated sensitive areas and the associated nutrient application restrictions and setbacks. Assessment of vulnerability of sensitive areas, on a site-specific basis, must address nitrogen, using a nitrogen balance worksheet (see Forms) and/or phosphorus, using the Phosphorus Site Index.
- Current and planned plant production sequence or crop rotation.
- Realistic yield goals for the crops.
- All available test results (e.g. soil, water, compost, manure, organic by-product, and plant tissue sample analyses) upon which the nutrient budget and management plan are based. This shall include nutrient testing results of all material exported from site.
- Results of P site index ratings
- Nitrogen Balance Worksheet, where appropriate
- Recommended application rates for N, P, and K for the entire plant production sequence or crop rotation.
- Listing, quantification, application method and timing for all planned nutrient sources and documentation of all nutrient imports, exports, and onsite transfers.
- Listing of all management practices to control nutrient runoff from site
- When soil P levels are above an agronomic level of 30 ppm, include a discussion of the risk associated with P accumulation and a proposed P draw-down strategy.
- If soil P concentrations are expected to increase above an agronomic level (i.e., when N-based rates are used), E/NMP must include the following documentation:
  - Soil P levels at which it is desirable to convert to P-based planning.
  - A long-term strategy and proposed implementation timeline for soil test P drawdown from the production and harvesting of crops.
  - Management activities or techniques used to reduce the potential for P transport and loss.

- Calculation of manure produced in excess of crop nutrient requirements.

## **OPERATION AND MAINTENANCE**

Review or revise plans at least annually to determine if adjustments or modifications are needed with each soil test cycle, P Site Index calculation, and change in crop type, crop and manure management, or volume analysis.

Changes greater than ten (10%) percent in animal numbers or a change in feed management shall necessitate additional manure analyses to establish a revised average nutrient content. Grade A dairies implementing such changes into their operation shall be required to submit a revised/updated E/NMP document to be approved by ISDA.

Document the nutrient application rate. When the applied rate differs from the planned rate, provide appropriate documentation to explain the difference.

Maintain records for at least 5 years to document plan implementation and maintenance. Records must include—

- All test results (soil, water, compost, manure, organic by-product, and plant tissue sample analyses) upon which the nutrient management plan is based.
- Listing and quantification of all nutrient sources that are planned for use and documentation of all nutrient imports, exports and onsite transfers.
- Date(s), method(s), and location(s) of all nutrient applications.
- Plants and crops planted, planting and harvest dates, yields, nutrient analyses of harvested biomass, and plant or crop residues removed.
- Dates of plan review, name of reviewer, and recommended adjustments resulting from the review.

Suggested additional records include:

- Irrigation Water Management evaluations
- Recommended conservation practices and management actions that can reduce the potential for nutrient movement.

## **Nutrient Stewardship and Best Management Practices**

Manage nutrients based on the 4Rs of nutrient stewardship—apply the right nutrient source at the right rate at the right time in the right place—to improve nutrient use efficiency by the crop and to reduce nutrient losses to surface and groundwater and to the atmosphere.

### *Nutrient Source.*

Choose nutrient sources compatible with application timing, tillage and planting system, soil properties, crop, crop rotation, soil organic content, and local climate to minimize risk to the environment.

Determine nutrient values of all nutrient sources (e.g. commercial fertilizers, manure, organic by-products, biosolids) prior to land application.

Determine nutrient contribution of cover crops, previous crop residues, and soil organic matter.

In areas where salinity is a concern, select nutrient sources that limit the buildup of soil salts. When manures are applied, and soil salinity is a concern, monitor salt concentrations to prevent potential plant or crop damage and reduced soil quality.

Apply manure or organic by-products on legumes at rates no greater than the UI estimated N removal rates in harvested plant biomass, not to exceed P risk assessment limitations.

For any single application of nutrients applied as liquid (e.g., liquid manure, nutrients in irrigation water, fertigation)—

- Do not exceed the soil's infiltration rate or water holding capacity.
- Apply so that nutrients move no deeper than the current crop rooting depth.
- Avoid runoff or loss to subsurface tile drains.

### *Nutrient Rate.*

Plan nutrient application rates for N, P, and K using UI recommendations or industry practices when recognized by the UI.

At a minimum, determine the rate based on crop/cropping sequence, current soil test results, and ISDA approved nutrient risk assessments (Phosphorus Site Index Evaluation) using realistic yield goals.

Use plant tissue testing, when applicable, for monitoring or adjusting the nutrient management plan in accordance with UI guidance, or industry practice when recognized by the UI.

For new crops or varieties where UI guidance is unavailable, industry-demonstrated yield and nutrient uptake information may be used when approved by ISDA.

Estimate realistic yield potentials or realistic yield goals using UI procedures or based on historical yield or growth data, soil productivity information, climatic conditions, nutrient test results, level of management, and/or local research results considering comparable management and production conditions.

Calibrate application equipment to ensure accurate distribution of material at planned rates. For products too dangerous to calibrate, follow equipment manufacturer guidance on proper equipment design, plumbing, and maintenance.

### *Nutrient Application Timing and Placement.*

Consider the nutrient source, management and production system limitations, soil properties, weather conditions, drainage system, and P site index assessment to develop optimal timing of nutrients. For N,

time the application as closely as practical with plant and crop uptake. For P, planned surface application when runoff potential is low.

For crop rotations or multiple crops grown in one year, do not apply additional P if it was already added in an amount sufficient to supply all crop nutrient needs.

To avoid salt damage, follow UI recommendations for the timing, placement, and rate of applied N and K in starter fertilizer and manure or follow industry practice recognized by the UI.

Apply conservation practices to avoid nutrient loss and control and trap nutrients before they can leave the field(s) by surface, leaching, or subsurface drainage (e.g., tile, other drainage) when there is a significant risk of transport of nutrients. Suggested best management practices (as defined in the 2017 Idaho Phosphorus Site Index) include, but are not limited to: Contour Farming, Cover & Green Manure Crop, Dike or Berm, Drip Irrigation, Filter Strip, PAM – Furrow Irrigation, PAM – Sprinkler Irrigation, Residue Management/Conservation Tillage, Sediment Basin, Tailwater Recovery & Pumpback Systems, Established Perennial Crop.

When irrigating, apply irrigation water in a manner that reduces the risk of nutrient loss to surface and ground water.

### **ADDITIONAL CONSIDERATIONS**

Excessive levels of some nutrients can cause induced deficiencies of other nutrients, (e.g., high soil test P levels can result in zinc deficiency in corn).

Use soil tests, plant tissue analyses, and field observations to check for secondary plant nutrient deficiencies or toxicity that may impact plant growth or availability of the primary nutrients.

Do not apply K in situations where an excess (greater than soil test K recommendation) causes nutrient imbalances in crops or forages.

Monitor fields receiving animal manures and biosolids for the accumulation of heavy metals.

Use winter hardy grass cover crops to take up excess N after the main growing season, and include the contribution of the N to next plant or crop in fertilizer calculations.

Use conservation practices that slow runoff, reduce erosion, and increase infiltration (e.g., filter strip, contour farming, or contour buffer strips).

Use application methods, timing, technologies or strategies to reduce the risk of nutrient movement or loss, such as—

- Split nutrient applications.
- Banded applications.
- Injection of nutrients below the soil surface.
- Incorporate surface-applied nutrient sources when precipitation capable of producing runoff or erosion is forecast within the time of a planned application.
- High-efficiency irrigation systems and technology.
- Enhanced efficiency fertilizers
  - Slow or controlled release fertilizers
  - Nitrification inhibitors
  - Urease inhibitors.
- Drainage water management.

- Tissue testing, chlorophyll meters, or real-time sensors.

Use legume crops and cover crops in lieu of commercial fertilizers to provide nitrogen through biological fixation and nutrient recycling.

Modify animal feed diets to reduce the nutrient content of manure following guidance contained in Conservation Practice Standards (CPS) code 592, Feed Management.

Use the adaptive nutrient management learning process to improve nutrient use efficiency on farms as outlined in the NRCS National Nutrient Policy in GM 190, Part 402, Nutrient Management.

Protect workers from and avoid unnecessary contact with nutrient sources. Take extra caution when handling anhydrous ammonia or when managing organic wastes stored in unventilated tanks, impoundments, or other enclosures.

Use material generated from cleaning nutrient application equipment in an environmentally safe manner. Collect, store, or field apply excess material in an appropriate manner.

## REFERENCES and RESOURCES

Certified Manure Testing Laboratories. <http://www2.mda.state.mn.us/webapp/lis/manurelabs.jsp>

ISDA. Phosphorus Site Index. <https://agri.idaho.gov/main/wp-content/uploads/2018/01/Phosphorus-Site-Index-reference-2017-revised.pdf>

North American Proficiency Testing Program Certified Soil Testing Laboratories. <https://www.naptprogram.org/pap/labs>

University of Idaho. Soil Sampling. Bulletin 704. <http://www.cals.uidaho.edu/edcomm/pdf/ext/ext0704.pdf>

University of Idaho. Manure and Wastewater Sampling. CIS 1139. <http://www.cals.uidaho.edu/edcomm/pdf/cis/cis1139.pdf>

University of Idaho. Irrigation Scheduling: Using water-use tables. CIS 1039. <https://www.cals.uidaho.edu/edcomm/pdf/CIS/CIS1039.pdf>

USDA NRCS. Conservation Practice Standard. Feed Management. Code 592. [https://efotg.sc.egov.usda.gov/references/public/WI/Archived\\_592\\_WI\\_CPS-\(2016-07\)\\_171011.pdf](https://efotg.sc.egov.usda.gov/references/public/WI/Archived_592_WI_CPS-(2016-07)_171011.pdf)

USDA NRCS. Adaptive Nutrient Management Process. Agronomy Technical Note No. 7. <https://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=33791.wba>



**FORMS**

**NITROGEN MANAGEMENT PLAN WORKSHEET**

NAME \_\_\_\_\_

Crop Year (Harvested) \_\_\_\_\_

Field ID \_\_\_\_\_

Acres \_\_\_\_\_

Crop Nitrogen Management Planning		N Applications/Credits	Recommended/ Planned N	Actual N
1. Crop		<u>Manure/Organic Material N</u>		
2. Production Unit		8. Available N in Manure/Compost (lbs/acre)		
3. Projected Yield (units/acre)		<u>Nitrogen Fertilizers</u>		
4. N Recommended (lbs/acre)		9. Dry/Liquid N (lbs/acre)		
		10. Foliar N (lbs/acre)		
Post Production Actuals		<b>11. Total Available N Applied (lbs/acre)</b>		
5. Actual Yield (units/acre)		<u>Nitrogen Credits</u>		
6. Total N Applied (lbs/acre)		12. Available N in soil (lbs/acre)		
7. N Removed (lbs/acre)		13. N in Irrigation Water (lbs/acre)		
Notes:		<b>14. Total N Credits (lbs/acre)</b>		
PSNT Test:		<b>15. Total N Applied &amp; Available</b>		

Certified By:	
Date:	