NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

NUTRIENT MANAGEMENT

(Ac.)

CODE 590

DEFINITION

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

PURPOSE

- To budget and supply nutrients for plant production.
- To properly utilize manure or organic by-products as a plant nutrient source.
- To minimize agricultural nonpoint source pollution of surface and ground water resources.
- To protect air quality by reducing nitrogen emissions (ammonia and NO_x compounds) and the formation of atmospheric particulates.
- 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

Persons who prepare and approve or review and approve nutrient management plans shall be certified as a Nutrient Management Planning Specialist through the State of Maine Nutrient Management Planning Certification Program.

A nutrient budget for nitrogen, phosphorus, and potassium shall be developed that considers all potential sources of nutrients including, but not limited to animal manure and organic by-products, waste water, commercial fertilizer, crop residues, legume credits, and irrigation water.

Realistic yield goals shall be established based on soil productivity information, historical yield data, climatic conditions, level of management and/or local research on similar soil, cropping systems, and soil and manure/organic by-products tests.

For new crops or varieties, industry yield recommendations may be used until documented yield information is available.

Plans for nutrient management shall specify the source, amount, timing and method of application of nutrients on each field to achieve realistic production goals, while minimizing movement of nutrients and other potential contaminants to surface and/or ground waters.

Areas contained within established minimum application setbacks (e.g., sinkholes, wells, gullies, ditches, surface inlets or rapidly permeable soil areas) shall not receive direct application of nutrients.

Soil and Tissue Sampling and Laboratory Analyses (Testing). Nutrient planning shall be based on current soil and tissue (where used as a supplement) test results developed in accordance with University of Maine guidance, or industry practice if recognized by the University. Current soil tests are those that are no older than five years.

Soil and tissue samples shall be collected and prepared according to University guidance or standard industry practice. Soil and tissue test analyses shall be performed by Laboratories that follow procedures outlined in "Soil Testing Procedures for the

Northeastern United States" (1). See Appendix.

Soil and tissue testing shall include analyses for any nutrients for which specific information is needed to develop the nutrient plan. Request analyses pertinent to monitoring or amending the annual nutrient budget, e.g. pH, electrical conductivity (EC), soil organic matter, nitrogen, phosphorus and potassium.

Nutrient Application Rates. Soil amendments shall be applied, as needed, to adjust soil pH to an adequate level for crop nutrient availability and utilization.

Recommended nutrient application rates shall be based on University of Maine recommendations (or recommendations from an approved lab performing the soils tests) that consider current soil test results, realistic yield goals and management capabilities for each crop in the rotation.

The planned rates of nutrient application, as documented in the nutrient budget, shall be determined based on the following guidance:

- Nitrogen Application **-** Planned nitrogen application rates shall match the recommended rates as closely as possible, except when manure or organic by-products are a source of nutrients. When manure or organic by-products are a source of nutrients, see "Additional Criteria" below.
- Phosphorus Application **-** Planned phosphorus application rates shall match the recommended rates as closely as possible, except when manure or organic by-products are sources of nutrients. When manure or organic by-products are a source of nutrients, see "Additional Criteria" below.
- Potassium Application - Potassium shall not be applied in situations in which excess (greater than soil test potassium recommendation) causes unacceptable nutrient imbalances in crops or forages. (Consumption of forages high in potassium by late-gestation ruminants may lead to severe metabolic disorder and death. (See Appendix.)
- Other Plant Nutrients - The planned rates of application of other nutrients shall be consistent with University guidance or industry practice if recognized by the University of Maine.
- Starter Fertilizers - When starter fertilizers are used, they shall be included in the overall nutrient budget, and applied in accordance with University recommendations, or industry practice if recognized by the University.

Nutrient Application Timing. Timing and method of nutrient application (particularly nitrogen) shall correspond as closely as possible with plant nutrient uptake characteristics. Other factors to consider in timing include cropping system limitations, weather and climatic conditions, results from risk assessment tools (e.g., ME N&P Matrix, Leaching Index for Nitrates, Phosphorus Index, See Appendix)) and field accessibility.

Nutrient Application Methods. Application methods to reduce the risk of nutrient transport to surface and ground water, or into the atmosphere shall be employed.

To minimize nutrient losses:

- Apply nutrient materials uniformly to application area(s).
- Nutrients shall not be applied to frozen, snow-covered or saturated soil.
- Nutrients shall be applied considering the plant growth habits, irrigation practices, and other conditions so as to maximize availability to the plant and minimize the risk of runoff, leaching, and volatilization losses.
- Nutrient applications associated with irrigation systems shall be applied in a manner that prevents or minimizes resource impairment. The application rate (in/hr) and application amounts for material applied through irrigation shall not be at rates which result in runoff. (See NRCS standard, "Irrigation Water Management", code 449.)

Conservation Management Unit (CMU) Risk Assessment. In areas with identified or

designated nutrient related water quality impairment, a CMU specific risk assessment of the potential for nutrient transport from the area shall be completed using the appropriate tool(s). See Appendix

Additional Criteria Applicable to Manure and Organic By-Products or Biosolids Applied as a Plant Nutrient Source

Maine Department of Agriculture, Food, and Rural Resources (MDAFRR) Chapter 565 Nutrient Management Rules (2) hereafter referred to as "State Rules" will be followed (at minimum) if a farm is required by State Rules to have a Nutrient Management Plan (NMP). NMP's required by State Rules must be updated at least once each year and must be approved by a certified NMP Specialist at least once every 5 years, or sooner if there are significant changes in operation.

Manure will not be applied anytime between December 1st and March 15th in accordance with Maine State Nutrient Management Law and anytime when soils are frozen or covered with ice or snow.

For NMPs on livestock operations, a whole farm budget for nitrogen and phosphorus will be developed that includes the amount of manure produced on the farm and the amount of nutrients needed for the crops grown on the farm. This budget needs to be in enough detail to determine if more nutrients need to be brought onto the farm to grow crops or if excess manure is produced and needs to be exported. Follow the guidance in Chapter 7 of the "Maine Nutrient Management Certification Training Manual – 2007" (3) for developing a whole farm budget.

Residuals shall be analyzed for content and applied and managed as prescribed by Maine Department of Environmental Protection Chapter 419 Agronomic Use of Residuals (4) and MDAFRR Chapter 565 Nutrient Management Rules (2).

Municipal Shoreland Zoning Ordinances (5) need to be consulted for each affected town to determine locally required setbacks and other requirements for manure spreading and storage relative to great ponds, rivers, wetlands, tidal waters, and certain streams.

When animal manures or organic by-products are applied, a risk assessment of the potential for nutrient transport from the CMU shall be completed to adjust the amount, placement, form and timing of application of nutrient sources. Risk assessment may include visual assessment of presence of sensitive areas, including water bodies, water table, areas of shallow or exposed bedrock, and erosion, and the utilization of assessment tools, including RUSLE2, N&P Matrix, Leaching Index for Nitrates, and others.

Nutrient values of manure and organic by-products will be determined prior to land application. Samples will be taken and analyzed from each storage facility or by-product source. Allocation of each manure or organic by-product will be based on an average nutrient value developed through a sampling history.

Manure sampling frequency may vary based on the operation's manure handling strategy and spreading schedule. At minimum, where management variables remain constant, manure will be tested every 5 years, in accordance with State Rules.

Changes that require manure to be sampled more frequently include:

- Change in animal type
- Change in feed
- Change in bedding type or amount
- Change in handling and storage system (i.e. liquid, solid, roofed.)

These changes may also necessitate an update or revision of the Nutrient Management Plan.

In planning for new operations, acceptable "book values" recognized by the NRCS and/or the University of Maine may be used if they accurately estimate nutrient output from the proposed operation (e.g., Chapter 4, NRCS Agricultural Waste Management Field

Handbook (6)). Manure will be sampled and analyzed when it becomes available, and before it is applied to fields. Thereafter, the above rules apply.

Biosolids (sewage sludge) shall be applied in accordance with USEPA regulations. (40 CFR Parts 403 (Pretreatment) and 503 (Biosolids) and DEP Chapter 419 (4).

Residuals such as municipal sludge, septage, fish wastes, woodash, and compost shall be spread in accordance with the separation distances from surface waters, ditches, wetlands, tile inlets, waterways and potable water supplies listed in Maine Department of Environmental Protection Chapter 419 Agronomic Use of Residuals and MDAFRR Chapter 565 Nutrient Management Rules. Identify sensitive areas adjacent to or near the fields to receive animal manures and locate them on plan maps:

- Wells and other potable water supplies
- Vegetated drainageways or waterways
- Streams, rivers, lakes, ponds, and marine waters
- Property lines

Setbacks for spreading of manure shall be a minimum of 100 feet from drinking wells and non-community water supplies and a minimum of 300 feet from community water supplies. Greater site specific setbacks need to be considered where water supplies are located downslope from spreading sites.

A database of public water supplies (community and non-community) is maintained as part of the Maine Drinking Water program administered by Health Engineering, a division within the Maine Department of Human Services, Bureau of Health. http://www.maine.gov/dhhs/eng/water/sources.htm

Site specific setbacks or buffers will be identified and prescribed to protect sensitive areas other than drinking wells from potential pollution from animal manure applications. In lieu of using site specific setbacks or buffers to protect sensitive areas, the following setbacks will be used:

- 25 feet from any waterway (drainageway) or property line.
- 100 feet from all surface waters including streams, springs, ponds, lakes, and marine waters.

The locations of sensitive areas and the setbacks or buffers to protect them shall be discussed with the producer during the development of the plan.

Odor and Insect Control. If the NMP is required to meet State Rules, it must include best management practices (BMP's) or other provisions for effective odor and insect control associated with manure storage and application

Manure and Organic By-Product Nutrient Application Rates.

Manure and organic by-product nutrient application rates shall be based on nutrient analyses procedures recommended by the University of Maine. As indicated above, "book values" may be used in planning for new operations. At a minimum, manure analyses shall identify nutrient and specific ion concentrations, percent moisture, and percent organic matter.

The application rate (in/hr) of liquid materials applied shall not exceed the soil intake/infiltration rate and shall be adjusted to minimize ponding and to avoid runoff. The total application shall not exceed the field capacity of the soil and shall be adjusted, as needed, to minimize loss to subsurface tile drains.

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

Nitrogen Application Rates

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

effectively utilize mineralized nitrogen and that minimize nitrogen losses through denitrification and ammonia volatilization. These include injection, incorporation, and timing of applications with weather conditions that are not excessively warm, dry, or windy.

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

Phosphorus Application Rates

- When manure or other organic by-products are used, the planned rates of phosphorus application for each field shall be determined using current soil test results and recommendations and the N and P Manure Priority Matrix or a Phosphorus Index for Maine when available. (See Appendix).
- The 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 the crop rotation or multiple years in the crop sequence*. When such applications are made, the application rate shall:
  - ◊ Not exceed the recommended nitrogen application rate during the *year of application*, or
  - ◊ Not exceed the estimated nitrogen removal in harvested plant biomass *during the year of application* when there is no recommended nitrogen application.
  - ◊ Be applied in accordance with the N&P Matrix.

Where needed, use P crop removal values recommended by the University of Maine or Chapter 7 of the "Maine Nutrient Management Certification Training Manual – 2007" (4). (Also see Appendix, Table 2.) If none are available for a specific crop, use values given in AWMFH, Chapter 6 (7).

Heavy Metal Monitoring. When sewage sludge (biosolids) is applied, the accumulation of potential pollutants (including arsenic, cadmium, copper, lead, mercury, selenium, and zinc) in the soil shall be monitored in accordance with the US Code, Reference 40 CFR, Parts 403 and 503, and/or Maine DEP Agricultural Use of Residuals, Chapter 419 (4), and MDAFRR Chapter 565 Nutrient Management Rules (2).

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

In areas with an identified or designated nutrient management related air quality concern, any component(s) of nutrient management (i.e., amount, source, placement, form, timing of application) identified by risk assessment tools as a potential source of atmospheric pollutants shall be adjusted, as necessary, to minimize loss.

When tillage can be performed, surface applications of manure and fertilizer nitrogen formulations that are subject to volatilization on the soil surface (e.g., urea) shall be incorporated into the soil within 24 hours after application.

When manure or organic by-products are applied to grassland, hayland, pasture or minimum-till areas the rate, form and timing of application(s) shall be managed to minimize volatilization losses.

When liquid forms of manure are applied with irrigation equipment, operators will select weather conditions during application that will minimize volatilization losses (injection, timing with weather conditions).

Operators will handle and apply poultry litter or other dry types of animal manures when the potential for wind-driven loss is low and there is less potential for transport of particulates into the atmosphere.

Weather and climatic conditions during manure or organic by-product application(s) shall be recorded and maintained in accordance with the operation and maintenance section of this standard.

Additional Criteria to Improve the Physical, Chemical and Biological Condition of the Soil

Nutrients shall be applied and managed in a manner that maintains or improves the physical, chemical and biological condition of the soil.

To the extent practicable nutrients shall not be applied when the potential for soil compaction and rutting is high.

CONSIDERATIONS

The use of management activities and technologies listed in this section may improve both the production and environmental performance of nutrient management systems.

For sites on which there are special environmental concerns, other sampling techniques may be appropriate. These include soil profile sampling for nitrogen, Pre-Sidedress Nitrogen Test (PSNT), Pre-Plant Soil Nitrate Test (PPSN) or soil surface sampling for phosphorus accumulation or pH changes.

Additional practices to enhance the producer's ability to manage manure effectively include modification of the animal's diet to reduce the manure nutrient content, or utilizing manure amendments that stabilize or tie-up nutrients (generally phosphorus).

Soil test information should be no older than one year when developing new plans, particularly if animal manures are to be used as a nutrient source.

Excessive levels of some soil nutrients can cause induced deficiencies of other nutrients.

If increases in soil phosphorus levels are expected, consider a more frequent (annual) soil testing interval.

To reduce nitrogen losses from manure or fertilizer, use products or materials (e.g. nitrification inhibitors, urease inhibitors and slow or controlled release fertilizers) that more closely match nutrient release and availability for plant uptake. These materials may improve the nitrogen use efficiency (NUE) of the nutrient management system by reducing losses of nitrogen into water and/or air.

Considerations to Minimize Agricultural Nonpoint Source Pollution of Surface and Ground Water.

Erosion control and runoff reduction practices can improve soil nutrient and water storage, infiltration, aeration, tilth, diversity of soil organisms and protect or improve water and air quality (Consider installation of one or more NRCS FOTG, Section IV – Conservation Practice Standards).

Cover crops can effectively utilize and/or recycle residual nitrogen.

Apply nutrient materials uniformly to the application area. Application methods and timing that reduce the risk of nutrients being transported to ground and surface waters, or into the atmosphere include:

- Split applications of nitrogen to provide nutrients at the times of maximum crop utilization,
- Use stalk-test to minimize risk of over applying nitrogen in excess of crop needs.
- Avoid winter nutrient application for spring seeded crops,
- Band applications of phosphorus near the seed row,
- Incorporate surface applied manures or organic by-products as soon as possible after application to minimize nutrient losses,
- Delay field application of animal manures or organic by-products if precipitation capable of producing runoff and erosion is forecast within 24 hours of the time of the planned application.

Considerations to Protect Air Quality by Reducing Nitrogen and/or Particulate Emissions to the Atmosphere.

Odors associated with the land application of manures and organic by-products can be offensive to the occupants of nearby homes. Avoid applying these materials upwind of occupied structures when residents are likely to be home (evenings, weekends and holidays).

When applying manure with irrigation equipment, modifying the equipment can reduce the potential for volatilization of nitrogen from the time the manure leaves the application equipment until it reaches the surface of the soil (e.g., reduced pressure, drop down tubes for center pivots). N volatilization from manure in a surface irrigation system will be reduced when applied under a crop canopy.

When planning nutrient applications and tillage operations, encourage soil carbon buildup while discouraging greenhouse gas emissions (e.g., nitrous oxide N_2O, carbon dioxide CO_2).

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

CAFO operations seeking permits under USEPA regulations (40 CFR Parts 122 and 412) should consult with their respective state permitting authority for additional criteria.

PLANS AND SPECIFICATIONS

Plans and specifications for nutrient management 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 resource impairment.

Nutrient management plans shall include a statement that the plan was developed based on requirements of the current standard and any applicable Federal, state, or local regulations, policies, or programs, which may include the implementation of other practices and/or management activities. Changes in any of these requirements may necessitate a revision of the plan.

The following components shall be included in the nutrient management plan:

- aerial site photograph(s) or site map(s), and a soil survey map of the site,
- location of designated sensitive areas or resources and the associated, nutrient management restriction such as application setbacks,
- current and/or planned plant production sequence or crop rotation,
- results of soil, water, manure and/or organic by-product sample analyses,
- results of plant tissue analyses, when used for nutrient management,
- realistic yield goals for the crops,
- complete nutrient budget for nitrogen, phosphorus, and potassium for the crop rotation or sequence,
- for livestock operations, a whole-farm nutrient budget for nitrogen and phosphorus will be developed that includes the amount of manure produced on the farm and the amount of nutrients needed for the crops grown on the farm.
- listing and quantification of all nutrient sources,
- CMU specific recommended nutrient application rates, timing, form, and method of application and incorporation, and
- guidance for implementation, operation, maintenance, and recordkeeping required for practice certification. Recordkeeping shall include nutrient application type, amount, and dates, as well as crop yields.

If increases in soil phosphorus levels are expected, the nutrient management plan shall document:

- the soil phosphorus levels at which it may be desirable to convert to phosphorus based planning,
- results of appropriate risk assessment tools to document the relationship between soil phosphorus levels and potential for phosphorus transport from the field

(RUSLE2, P Index for Maine when it becomes available),

- the potential for soil phosphorus drawdown from the production and harvesting of crops, and
- management activities or techniques used to reduce the potential for phosphorus loss (i.e. erosion control).

OPERATION AND MAINTENANCE

The producer is responsible for safe operation and maintenance of this practice including all equipment. The producer is also responsible for operating within guidelines of local, state, and federal laws that apply. Operation and Maintenance includes the following:

- Periodic plan review to determine if adjustments or modifications to the plan are needed. As a minimum, Nutrient Management Plans will be reviewed and revised with each soil test cycle, not to exceed 5 years.
- NMPs for livestock operations will be reviewed annually and updated or revised as appropriate.
- Manure from each storage or source will be sampled and analyzed at minimum, once every five years. Changes in management that affect manure nutrient content, manure consistency, and/or manure quantity, will necessitate additional manure sampling and analyses, and a NMP update or revision.
- Changes in acreage amounts or crops which affect the utilization of manure nutrients produced on-farm (or imported) also necessitate a review of the NMP, and an update or revision as appropriate.
- Manure will <u>not</u> be applied anytime between December 1 and March 15 in accordance with Maine State Nutrient Management Law, nor anytime when soils are frozen or covered with ice or snow.
- Use correct manure and by-product sampling techniques to ensure that application rates for the materials in your Nutrient Management Plan will supply nutrients in adequate quantities to meet crop needs, and prevent over-application of valuable nutrients. http://anlab.umesci.maine.edu/soillab_files/forms/Manure.pdf
- Protection of fertilizer and organic by-product storage facilities from weather and accidental leakage or spillage.
- Calibration of application equipment to ensure uniform distribution of material at planned rates.
- Documentation of the actual rate at which nutrients were applied. When the actual rates used differ from the recommended and planned rates, records will indicate the reasons for the differences.
- Maintaining records to document plan implementation. As applicable, records include:
    - Soil, plant tissue, water, manure, and organic by-product analyses resulting in recommendations for nutrient application,
    - Quantities, analyses and sources of nutrients applied,
    - Dates and method(s) of nutrient applications,
    - Weather conditions and soil moisture at the time of application; lapsed time to manure incorporation, rainfall or irrigation event.
    - Crops planted, planting and harvest dates, yields, and crop residues removed,
    - Dates of plan review, name of reviewer, and recommended changes resulting from the review.
    - Records should be maintained for five years; or for a period longer than five years if required by other Federal, state or local ordinances, or program or contract requirements.
- Workers should be protected from and avoid unnecessary contact with plant nutrient sources. Extra caution must be

taken when handling ammoniacal nutrient sources, or when dealing with organic wastes stored in unventilated enclosures.

- Material generated from cleaning nutrient application equipment should be utilized in an environmentally safe manner. Excess material should be collected and stored or field applied in an appropriate manner.

- Nutrient containers should be recycled in compliance with state and local guidelines or regulations.

REFERENCES

(1) Northeast Regional Publication No. 493, 2nd Edition. 1995. Soil Testing Procedures for the Northeast United States. http://ag.udel.edu/extension/agnr/soiltesting.htm

(2) Maine DAFRR Chapter 565 Nutrient Management Rules. ftp://ftp.state.me.us/pub/sos/cec/rcn/apa/01/001/001c565.doc

(3) Maine DAFRR, 2007. Maine Nutrient Management Training Manual.

(4) Maine DEP, 1999. Maine Solid Waste Management Rules Chapter 419, Agronomic Utilization of Residuals. http://www.maine.gov/sos/cec/rules/06/096/096c419.doc

(5) Maine Mandatory Shoreland Zoning. http://maine.gov/dep/blwq/docstand/szpage.htm

(6) NRCS Agricultural Waste Management Field Handbook. 1992 Chapter 4, Agricultural Waste Characteristics. http://www.wsi.nrcs.usda.gov/products/W2Q/AWM/docs/handbk/awmfh-chap4.pdf.

(7) NRCS Agricultural Waste Management Field Handbook. 1992

(8) Chapter 6, role of Plants in Waste Management. http://www.wsi.nrcs.usda.gov/products/W2Q/AWM/docs/handbk/awmfh-chap6.pdf

Appendix
(Guidance Document for
Nutrient Management Code 590)

CNMPs

When writing a CNMP (Comprehensive Nutrient Management Plan), utilize Maine's CNMP Template located in the eFOTG, Sec. IV, Tools. This document serves as guidance for items that need to be included in a CNMP. It may be edited as needed. For CNMPs, it is important to document production area (barnyard) resource concerns and storage adequacy and needs.

Soils Testing

Soils testing procedures at the University of Maine Analytical Lab are done using a Modified Morgan Extract procedure. This test was chosen due to its effectiveness in Maine's acidic soils. Likewise, nutrient recommendations from the Lab are based upon years of trials and experience in Maine. Recommendations from other labs outside of the state may differ from the UME Lab. For this reason, soils test results and recommendations from the Lab are preferred. However, they are not required if a qualified lab is used. The Nutrient Management Standard, 590 requires that labs conform to procedures outlined in "Soil Testing Procedures for the Northeastern United States". http://ag.udel.edu/extension/agnr/soiltesting.htm.

Known Qualified Soils and Manure Testing Labs that are commonly used in Maine:

- University of Maine Analytical Lab
- A&L Laboratories
- Spectrum Lab

In writing a nutrient management plan, it is important to note what type of extraction method (Modified Morgan, Morgan Mehlich II, etc.) is used, and what reporting units are used (lbs/acre vs. parts per million (ppm)). These will affect your determination of the limiting nutrient (N & P Matrix) for making manure spreading recommendations.

For more information on soils test results and recommendations from UME, see "Interpreting Soils Test Results for Commercial Crops": http://anlab.umesci.maine.edu/soillab_files/under/commpam.pdf.

If needed, conversions from Melich III to Morgan (this is close enough to Modified Morgan, no need to convert, per Bruce Hoskins, UME) can be run at: http://nmsp.css.cornell.edu/software/morganequivalents.asp. Aluminum values are need for this conversion. If unavailable, use the following estimated values*:

For pH	Enter Aluminum ppm
< 5.0 – 6.0	2000 – 1600
6.0 – 6.5	1600 – 1200
6.5 – 7.5	1200 – 1000

*per Bruce Hoskins, UME Analytical Lab

Risk Assessment Tools:

Leaching Index

This Index provides a way to determine the degree to which water percolates below the root zone in certain soils. Percolating water containing **dissolved nitrates or other soluble nutrients** could be a hazard to ground water. The Method is based on a **Leaching Index**. For areas with ground water concerns, the LI should be determined to evaluate the potential for contaminating the ground water with soluble nutrients. The LI uses annual precipitation, hydrologic soil group, and rainfall distribution data. http://efotg.nrcs.usda.gov/references/public/ME/nitrateleaching.pdf. Where the LI is intermediate or high, consider the following practices to reduce nitrate leaching:

- Use realistic yield goals for obtaining soils test N recommendations.
- Do not exceed N recommendations or crop needs.
- Use a nitrification inhibitor when applying N fertilizer.
- Apply sidedress fertilizer on corn when it has at least 4 true leaves.
- If using a starter fertilizer, apply just prior to planting (3 days or less).
- For cereal, corn, and other row crops, apply starter at a rate of 50 lbs/ac or less.
- Evaluate the need for sidedress N based on a Pre-Sidedress Nitrate Test (PSNT).
- Do not incorporate sod crops in the fall. Delay chemical sod killing until soil temperature at a 4-inch depth is 45 degrees F.
- Utilize winter-hardy cover crops when fall manure is applied (rye, winter wheat, interseeded ryegrass.)

Phosphorus Index

At the time of this writing, there is not a Phosphorus Index in Maine. Currently, the **N&P Matrix** serves as a P Index. If a new P Index is developed for Maine, this tool will be used to determine risk of P loss from crop fields, and to determine the limiting nutrient (N or P) in nutrient management planning.

N&P Manure Priority Matrix

For nutrient management planning, fields with the same cropping systems and similar soil test recommendations may be grouped together. Where manure is utilized, the N&P Matrix will be used to determine the limiting nutrient (N or P) *for each field or group of fields*. Therefore, there may be multiple N&P Matrix sheets associate with a given plan. Each N&P Matrix should have the decision pathway highlighted, and should be labeled as to which field or group of fields it applies.

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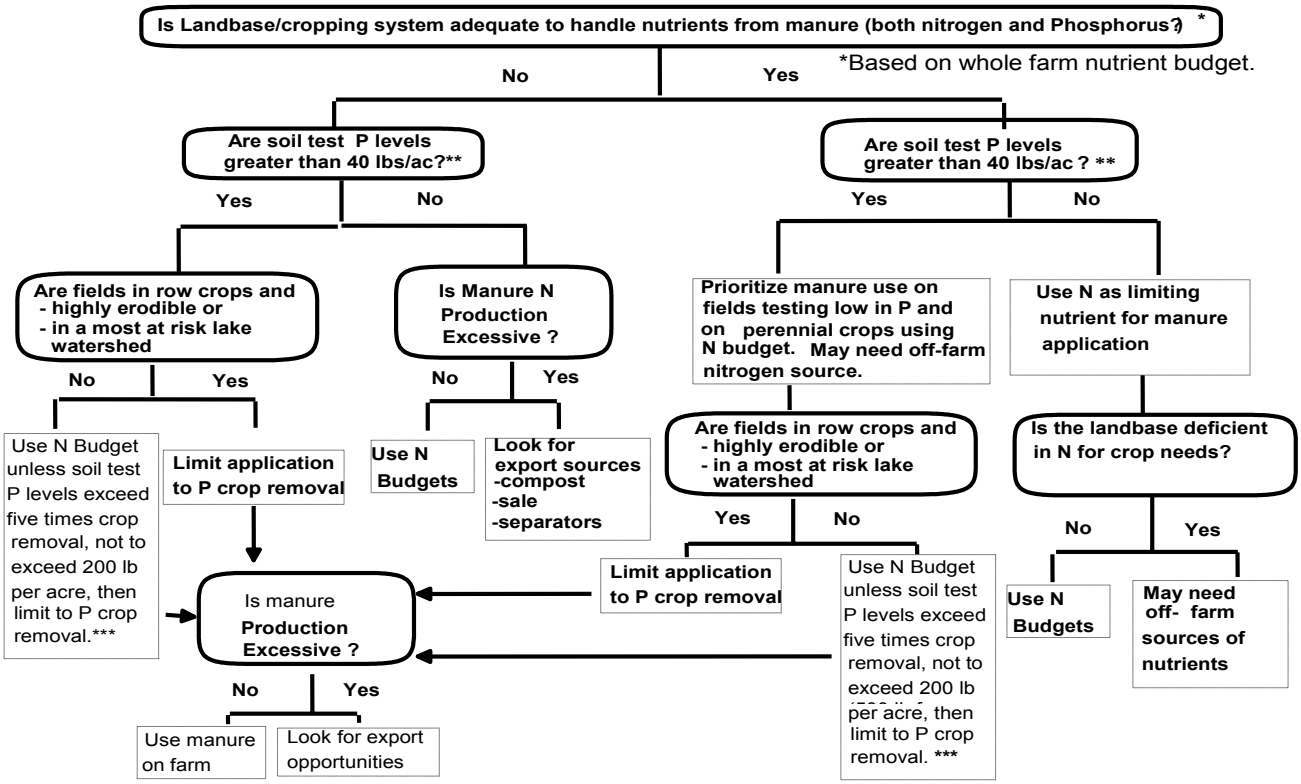
N & P Matrix for Maine

ENVIRONMENTAL ASSESSMENT AND MANURE ALLOCATION TOOL

(Soil Test P Levels Based on Modified Morgan Procedures as used by UM Lab) ∞

N and P Manure Priority Matrix



<u>N & P Priority Matrix Notes</u>

1) There may be multiple N&P Matrix sheets in this plan. The decision pathway which has been highlighted on this sheet applies to the following fields:

2) The Limiting Nutrient for the fields on this sheet is: N P (circle one)

3) Definitions of terms used in the Matrix:

<u>Fields in row crops</u> - Fields that are currently in row crops *or that are in rotation with row crops* to meet soil loss requirements.
<u>Highly erodible</u> - Land that is determined to be highly erodible as defined in NRCS Food Security Act Manual, 1985.
<u>Most at risk lake watershed</u> - Lakes that have been designated as Most At Risk From Development by DEP.

∞ Soil test numbers on this chart refer to results obtained using the Modified Morgan soil test procedure used by the University of Maine Plant and Soil Testing Lab. Soil test values from other testing methods will be different and need to be converted to be consistent with these values. **For OTHER LABS – make note of extraction type and reporting units and adjust accordingly.**

For Soils Test results from ***Spectrum Lab* (Mehlich III): Are Soil Test P levels greater than **100 ppm**?

NRCS, ME
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*** For Soils Test results from ***Spectrum Lab***: not to exceed **500 ppm**.

Table 1. Phosphorus Application When Using Manure Based on soil Test Phosphorus and Phosphorus Crop Removal

Soil test P Level*	Phosphorus Application
Low	N based budget
Med	N based budget
High	N based budget
Excessive (greater than 40lbs per acre)	N based budget
• Permanent Sod; or row crop and not HEL and not in most at risk watershed.** Soil test P is **LESS** than 5 times crop P removal (not to exceed 200 lbs /ac)	N based budget
• Permanent sod; or row crop and not HEL and not in most at risk watershed.** Soil test P is **GREATER** than 5 times P crop removal (not to exceed 200 lbs/ac)	P based budget (Limit to P crop removal)
• **Row Crop and HEL; or row crop and in "Most at Risk" Watershed****	P based budget (Limit to P crop removal)

*Based on Modified Morgan soil test procedures used by the University of Maine Plant and Soil Testing Lab.

40lbsP/ acre using Modified Morgan procedures equates to 200 lbs/ac or 100 ppm Melich III (Spectrum Labs).

200 lbs P/ac using Modified Morgan procedures equates to 1000 lbs/ac or 500 ppm Melich III (Spectrum Labs).

**Maine Dept. of Environmental Protection's List of Lakes Most at Risk From Development.

***Table 2. Crop Nutrient Uptake Values for use with N&P Matrix**

Crop (units)	N	P2O5	K2O	Typical yield/Ac	N	P2O5	K2O	P*
Corn (bu)	.75	0.4	0.3	120 (bu)	90	50	35	22
Corn silage (T)[4]	9	5	11.	20 (T)	180	100	220	37
Grain sorghum (bu)	0.5	0.6	0.8	120 (bu)	60	70	95	20
Forage sorghum (T)[4]	9	3	10	15 (T)	135	45	150	46
Sorghum/sudangrass[4]	8	7	7	15 (T)	120	105	105	33
Alfalfa (T)2,[5]	50[1]	15	50	5 (T)	250	75	250	24
Red clover (T)[2,5]	40[1]	15	40	3.5 (T)	140	55	140	30
Trefoil (T)[2,5]	50[1]	15	40	3.5 (T)	175	55	140	26
Cool-season grass (T)[2,5]	40	15	50	4 (T)	150	60	200	26
Bluegrass (T)[2,5]	30	10	30	2.5 (T)	75	25	75	26
Wheat/rye(bu)[3]	1.5	1	1.8	60 (bu)	90	60	110	30
Oats (bu)[3]	1.1	0.9	1.5	80 (bu)	90	70	120	20
Barley (bu)[3]	1.4	0.6	1.5	75 (bu)	105	45	110	17
Soybeans (bu)	3.21	1	1.4	40 (bu)	130	40	56	24
Small grain silage (T)[4]	17.0	7.0	26	6 (T)	100	40	160	13

Note: Adapted from Beegle, 2003.

[1] Legumes fix all their required nitrogen. However, they also are able to use nitrogen as indicated.

[2] For legume-grass mixtures, use the predominant species in the mixture.

[3] Includes straw.

[4] 65% moisture.

[5] 10% moisture.

*Elemental P removed

****For vegetable crops**, refer to the most recent version of the New England Vegetable Management Guide. http://www.nevegetable.org/

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Excessive Soil Potassium

There are no known deleterious effects of **potassium** (K) on fresh or saline waters except to increase the salt content and electric conductivity. However, excessive soil potassium (K) poses several threats to animal health. First, soils excessive in K will produce hay with a high K content. Feeding hay high in K increases the risk of milk fever in dry cows that are within 4 weeks of calving. Hay harvested from low K fields should be reserved for feeding to dry cows, especially to those within 4 weeks of calving. Second, lactating animals grazing on lush grass in fields with high soil K levels are at risk from grass tetany. Providing magnesium supplements or feeding supplemental dry hay reduces the risk. A Cooperative Extension Educator with a background in animal nutrition can give detailed recommendations