Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

NUTRIENT MANAGEMENT

CODE 590

(ac)

DEFINITION

Manage rate, source, placement, and timing of plant nutrients and soil amendments while reducing environmental impacts.

PURPOSE

This practice is used to accomplish one or more of the following purposes:

- Improve plant health and productivity
- Reduce excess nutrients in surface and ground water
- Reduce emissions of objectionable odors
- Reduce emissions of particulate matter (PM) and PM precursors
- Reduce emissions of greenhouse gases (GHG)
- Reduce emissions of ozone precursors
- Reduce the risk of potential pathogens from manure, biosolids, or compost application from reaching surface and ground water
- Improve or maintain soil organic matter

CONDITIONS WHERE PRACTICE APPLIES

All fields where plant nutrients and soil amendments are applied. Does not apply to one-time nutrient applications at establishment of permanent vegetation.

CRITERIA

General Criteria Applicable to All Purposes

Develop a nutrient management plan for nitrogen (N), phosphorus (P), and potassium (K), which accounts for all known measurable sources and removal of these nutrients.

Sources of nutrients include, but are not limited to, commercial fertilizers (including starter and in-furrow starter/pop-up fertilizer), animal manures ***or other agricultural wastes***, legume fixation credits, green manures, plant or crop residues, compost, organic by-products, municipal and industrial biosolids, wastewater, organic materials, estimated plant available soil nutrients, and irrigation water.

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

Follow all applicable State requirements and regulations ***including the Required Agricultural Practices, The Large Farm Operations Rules and Large Farm Operations Individual Permits, and the General***

NRCS reviews and periodically updates conservation practice standards. To obtain the current version of this standard, contact your Natural Resources Conservation Service State office or visit the Field Office Technical Guide online by going to the NRCS website at https://www.nrcs.usda.gov/ and type FOTG in the search field.

USDA is an equal opportunity provider, employer, and lender.

Permit for Medium Farm Operations. State water quality regulations can be found at https://agriculture.vermont.gov/water-quality/regulations.

Soil and tissue testing and analysis

Base the nutrient management plan on current soil test results ***of the fields and buffers*** in accordance with ***University of Vermont (UVM) Nutrient Recommendations for Field Crops in Vermont*** guidance (referenced below), or industry practice when recognized by***UVM***. Use soil tests no older than 2 years when developing new nutrient management plans. ***Soil test analyses shall be performed by laboratories where results are based on the Modified Morgan analysis. Available phosphorus and reactive Aluminum are extracted. Available potassium is extracted using ammonium acetate, pH of 4.8.*** Use tissue testing, when applicable, for monitoring or adjusting the nutrient management plan in accordance with***UVM*** guidance, or industry practice when recognized by***UVM***.

For nutrient management plan revisions and maintenance, take soil tests on an interval recommended by***UVM*** or as required by local rules and regulations. ***Current soil tests for plan revisions and maintenance are those that are no older than 3 years. The area represented by a soil test must conform with UVM guidance or industry practice when recognized by UVM.***

Collect, prepare, store, and ship all soil and tissue samples following***UVM*** guidance or industry practice. The test analyses must include pertinent information for monitoring or amending the annual nutrient plan. Follow***UVM*** guidelines regarding required analyses and test interpretations.

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. Alternative certification programs must have solid stakeholder support (e.g.., State department of agriculture,***UVM***, water quality control entity, NRCS State staff, growers, and others) and be State or regional in scope.

Maintain soil pH within ranges which enhance the adequate level for plant or crop nutrient availability and utilization. Refer to ***UVM*** documentation for guidance.

Manure, organic by-product, and biosolids testing and analysis

Collect, prepare, store, and ship all manure ***or other agricultural wastes***, organic by-products, and biosolids following LGU guidance or industry practice when recognized by***UVM***. ***Manure or other agricultural waste storages will be sampled annually as close as possible to the time of application (upon thorough agitation of liquid systems)*** or more frequently if needed to account for operational changes (e.g.., feed management, animal type, manure handling strategy, etc.) impacting manure nutrient concentrations. ***Satellite waste storage facilities must be sampled if the manure is stored there more than 3 months; however, if the storage is used temporarily then it can use the main storage where it was transferred from as the sample for planning purposes. An average of all of the waste storage facilities on the farm shall not be used to develop the NMP. Weighted averages of manure samples may be used when storage facilities are mixed, for example when storage facilities are physically connected, or waste is transferred between storages. Weighted averages must consider the volume of manure per the sample value to give a new weighted average. Actual manure sample values collected by the farm must be used in the NMP in lieu of textbook values when available sample values are less than five years old. Sample values older than five years cannot be used in developing an average manure value. Out of the five most recent annual sample manure values, the highest and lowest values are to be removed, leaving three values left to be averaged and used as the final manure sample value, allowing for a realistic manure sample average to be established.*** Follow***UVM*** guidelines regarding required analyses and test interpretations. Analyze, as a minimum, total N, ***ammonium-N,*** total P or P_2O_5, total K or K_2O, and percent solids.

When planning for new or modified livestock operations, and manure tests are not available yet, use the output and analyses from similar operations in the geographical area if they accurately estimate nutrient output from the proposed operation or use “book values” recognized by the NRCS (e.g.., NRCS

Agricultural Waste Management Field Handbook) and the ***UVM Extension Nutrient Recommendations for Field Crops in Vermont for 'typical values' of manure***.

For manure analyses, use laboratories successfully meeting the requirements and performance standards of the Manure Testing Laboratory Certification program under the auspices of the Minnesota Department of Agriculture or other NRCS-approved program that considers laboratory performance and proficiency to assure accurate manure test results.

For nutrient management plans developed as a component of a comprehensive nutrient management plan for an animal feeding operation (AFO) follow policy in NRCS directive General Manual (GM) 190, Part 405, "Comprehensive Nutrient Management Plans."***Nutrient Management Plans and Comprehensive Nutrient Management*** plans must include documentation of all nutrient imports, exports, and on-farm transfers.

Nutrient loss risk assessments
Use current NRCS-approved nitrogen, phosphorus, and soil erosion risk assessment tools to assess the site-specific risk of nutrient and soil loss.

Vermont Nitrate Leaching Index (VT NLI)

The VT NLI must be completed on all fields where nutrient management is planned. The planned rates of nitrogen application must be consistent with the VT NLI risk assessment and associated management recommendations per field as follows:

<2 inches (LOW) - Nitrogen application rates based on UVM recommendations.

2-10 inches (MODERATE) - Nutrient management practices such as split nitrogen application rates, pre-sidedress nitrogen (PSNT) and use of nitrification inhibitors should be considered.

>10 inches (HIGH) - Requires intense nitrogen management to minimize nitrate movement including avoidance of fall spreading on bare ground or dormant crop. At least one management practice outlined in the New York Nitrate Leaching Index (referenced below) documentation (reference below) will be implemented and documented to further reduce the potential for nitrate leaching to groundwater (e.g.., winter hardy cover crops to take up excess nitrogen, especially when fall manure is applied, limiting fall manure N applications to the greater of 50 lbs/acre of first year available N or 50% of the expected N requirement of next year's crop; foregoing fall incorporation of sods until spring to conserve nitrogen; etc.).

Vermont Phosphorus Index (VT PI)

The Vermont Phosphorus Index (VT PI) (referenced below) must be completed on all fields where nutrient management is planned. For the purposes of this section, "phosphorus applications" shall include, but are not limited to, commercial fertilizers (including starter and in-furrow starter/pop-up fertilizer), animal manures or other agricultural wastes, legume fixation credits, green manures, plant or crop residues, compost, organic by-products, municipal and industrial biosolids, wastewater, organic materials, non-sewage waste, estimated plant available soil nutrients, and irrigation water that are applied to a field and supply phosphorus. The planned rates of phosphorus application must be consistent with VT PI risk assessments and associated management recommendations per field as follows:

0-30 (LOW risk) ***- Phosphorus applications*** can be applied at rates to supply P at greater than crop removal not to exceed the N requirement for the ***current*** crop.

31-60 (MODERATE risk) - ***Phosphorus applications*** can be applied at rates not to exceed crop P removal rate or the soil test P recommended rate for the planned crops in rotation.

61-100 (HIGH risk) - ***Phosphorus applications*** can be applied at rates not to exceed crop P removal rate ***or the soil test recommendations for phosphorus*** if the following requirements are met:

- A soil P drawdown strategy has been developed, documented, and implemented for the crop rotation. ***The drawdown strategy should include eliminating or reducing manure applications. In addition, on cropland fields with "pattern tile drainage" (subsurface tile drainage systematically installed in a repeating pattern), apply nutrients at less than the UVM phosphorus crop nutrient removal rates.***
- Implementation of all mitigation practices determined to be needed by site-specific assessments for nutrients and soil loss to protect water quality.
- Any deviation from these high-risk requirements that would increase the risk of P runoff requires the approval of the Chief of the NRCS.

>100 (VERY HIGH risk) - No manure, phosphorus containing fertilizers or phosphorus applications shall be applied to this site. Active remediation techniques shall be implemented to reduce phosphorus loss potential from this site.

- ***A soil P drawdown strategy (e.g.., set a number of years to be drawn down to optimum nutrient levels under normal cropping conditions before additional nutrients can be added) has be developed, documented, and implemented for the crop rotation.***
- ***Implementation of all mitigation practices determined to be needed by site-specific assessments for nutrients and soil loss to protect water quality.***

The crop nutrient removal rates are found in UVM's Nutrient Recommendations for Field Crops in Vermont and from farm specific tissue tests in accordance with UVM guidance.

When manure or other agricultural wastes are applied, the soil erosion input of the VT PI must based on the annual soil loss rate for the crop year in which the manure is applied.

Soil Erosion

Each field must be planned and managed to maintain rotational soil erosion (average soil loss over the life of the rotation) at or below the tolerable soil loss limits (T) as determined by the current NRCS soil loss technology. Fields that have the same soil type, slope and slope length and crop rotation can be combined. Documentation of crop rotations and the crop year within a rotation shall be documented in the development and updating of the nutrient management plan. Areas of gully erosion shall be addressed with appropriate conservation practices. Ephemeral gully erosion is erosion that occurs from the action of runoff water which concentrates in shallow flow channels when rills converge. These flow channels are alternately filled with soil by tillage operations and re-formed in the same general location by subsequent runoff events. Classical gullies are also concentrated flow channels formed when rills converge. These are well defined, permanent incised drainageways that cannot be crossed by ordinary farming operations.

The 4Rs of nutrient stewardship

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***, all imported manure, agricultural waste, or non-sewage waste***) prior to land application.

Determine nutrient contribution of cover crops, previous crop residues, and soil organic matter ***as recommended by UVM***.

For operations following USDA's National Organic Program, apply and manage nutrient sources according to program regulations.

For enhanced efficiency fertilizer (EEF) products, use products defined by the Association of American Plant Food Control Officials as EEF and recommended for use by***UVM***.

In areas where salinity is a concern, select nutrient sources that limit the buildup of soil salts. When manures are applied ***or other agricultural wastes 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 ***other agricultural wastes or*** organic by-products on legumes at rates no greater than***75% of UVM*** 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 ***or other agricultural waste***, 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***UVM*** recommendations or industry practices when recognized by***UVM***. Lower-than-recommended nutrient application rates are permissible if the client's objectives are met.

At a minimum, determine the rate based on crop/cropping sequence, current soil test results, ***current manure and agricultural waste sample results as specified above under manure testing*** and NRCS-approved nutrient risk assessments. Realistic yield goals ***should always be used***. ***Realistic yield goals mean yield goals established using actual field-by-fields yields collected by the farm during the most recent five years. Actual field-by-field yields older than five years cannot be used in the calculation of realistic yield goals.***

For new crops or varieties where***UVM*** guidance is unavailable, industry-demonstrated yield and nutrient uptake information may be used.

Nutrient recommendations (lbs. N, P205 and K20 per acre) in the nutrient management plan shall be made based on UVM Nutrient Recommendations for Field Crops in Vermont (and/or industry practice when recognized by UVM) using up-to-date, actual soil test laboratory results, realistic yield goals as defined, management capabilities, Nitrogen (N) contributions from any manure application in the past two years, prior crop N credits, Vermont Nitrogen Leaching Index (VT NLI) and Vermont Phosphorus Index (VT PI). Other University recommendations for Nitrogen and Potassium, that are appropriate for the geographic area, may be used.

Nutrient application timing and placement

Consider the nutrient source, management and production system limitations, soil properties, weather conditions, drainage system, soil biology, and nutrient risk assessment to develop optimal timing of nutrients. For N, time the application as closely as practical with plant and crop uptake. For P, time planned surface application when runoff potential is low. Time the application of all nutrients to minimize potential for soil compaction.

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.

Applications on hay crops should be split applied before significant re-growth occurs for each crop to be harvested - in early spring and after each harvest.

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

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

- ***A frozen soil layer two inches thick or thicker in the top 10 inches, or***
- ***A snowpack of two inches or greater, or***
- ***Saturated soil conditions in the surface two inches.***

Exceptions for the above criteria related to surface-applied nutrients when there is a risk of runoff can be made when specified conditions are met and adequate conservation measures are installed to prevent the offsite delivery of nutrients. NRCS, in cooperation with the***Vermont Agency of Agriculture, Food & Markets***, will define adequate treatment levels and specified conditions for applications of manure ***or other agricultural wastes*** if soils are frozen and/or snow covered or the top 2 inches of soil are saturated.

Per Section 6.05(e) of the Required Agricultural Practices (referenced below), manure or other agricultural wastes shall not be applied in areas of croplands, perennial grass lands, or hay lands that are frozen or snow covered, unless the Vermont Secretary of Agriculture has approved an exemption consistent with the requirements of Section 6.06 of the Required Agricultural Practices.

Vermont Winter Manure Spreading Ban

Per the Required Agricultural Practices Section 6.05(a), manure or other agricultural wastes shall not be applied in Vermont between December 15 and April 1. The Vermont Secretary of Agriculture may approve an exemption consistent with the requirements of Section 6.06 of the Required Agricultural Practices.

Ground Water Protection

Manure or other agricultural wastes and nitrogen fertilizer shall not be mechanically applied within 100 feet of a private water supply or 200 feet of a public water supply. This prohibition shall not apply to private water supplies that have been established inconsistent with the Department of Environmental Conservation Water Supply Rules existing at the time that the water supply was established.

Surface Water Protection

A vegetative buffer zone of perennial vegetation shall be maintained between croplands and the top of the bank of adjoining surface waters and ditches consistent with the criteria in (a) through (i) below:

(a) Adjacent surface waters shall be buffered from croplands by 25 feet of perennial vegetation.

(b) Ditches shall be buffered from croplands by 10 feet of perennial vegetation unless determined to potentially transport significant waste or nutrients to surface water, in which case, 25 feet of perennial vegetation is required.

(c) Surface inlets or inlets of open drains shall be buffered from croplands by 25 feet of perennial vegetation.

(d) Mechanical application of manure or other agricultural wastes is prohibited within perennially vegetated buffer zones.

(e) The use of fertilizer or compost for the establishment and maintenance of a required vegetative buffer zone is allowed consistent with nutrient management plan requirements, soil analysis, and agronomic recommendations for the buffer zone.

(f) Tillage within the perennially vegetated buffer zone is prohibited other than for the establishment and maintenance of the buffer zone.

(g) Harvesting a vegetative buffer zone as a perennial crop is allowed.

(h) Spoils from agricultural ditch maintenance shall not be stored in the buffer zone or in such a manner as to discharge to surface water.

(i) Exceptions to the required vegetative buffer zone widths may be considered upon request on a site-specific basis from the VT Agency of Agriculture, but in no case shall a buffer zone be less than 10 feet in width.

Limit travel in the buffers.

Do not apply nutrients within intermittent ditches, diversions, grassed waterways, drainage ditches or other areas of concentrated flow.

Manure or other agricultural wastes shall not be applied in areas of croplands, perennial grass lands, or hay lands that have exposed bedrock.

Avoid applying nutrients during normal flooding periods on fields with historical flooding. On row crops fields with overland flows, manure or other agricultural wastes shall be incorporated within 48 hours to the degree possible based on limiting site conditions.

Manure or other agricultural wastes shall not be applied to annual cropland, vegetable cropland, or small grain cropland where the average field slope exceeds 10%, unless a permanently vegetated buffer zone of 100 feet adjacent to downslope surface water or conveyance has been established. Manure or other agricultural wastes shall not be applied within the buffer zone.

Additional Criteria to Minimize Agricultural Nonpoint Source Pollution of Surface and Groundwater

Apply conservation practices ***such as Filter Strips (393), Riparian Forest Buffers (391), and Riparian Herbaceous Cover (390), Row Arrangement (557), Forage and Biomass Planting (512)*** 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, karst) when there is a significant risk of transport of nutrients.

Additional Criteria to Reduce the Risk of Potential Pathogens From Manure, Biosolids, or Compost Application From Reaching Surface and Groundwater

When applicable, follow proper biosecurity measures as provided in NRCS directives GM-130, Part 403, Subpart H, “Biosecurity Preparedness and Response.”

Follow all applicable Federal, Tribal, State, and local laws and policies concerning the application of manure ***or other agricultural wastes***, biosolids, or compost in the production of fresh, edible crops.

Apply manure***or other agricultural wastes***, biosolids, or compost with minimal soil disturbance or by injection into the soil unless it is being applied to an actively growing crop, a minimum of 30 percent residue exists, or there is a living cover that has a fibrous root system with 75 percent or more cover. Do not surface apply manure ***or other agricultural wastes*** if a storm event ***significant enough to cause runoff*** is forecast within 24 hours.

Additional Criteria to Reduce Emissions of Objectionable Odors, PM and PM Precursors, and GHG and Ozone Precursors

To address air quality concerns caused by odor, N, sulfur, and particulate emissions; adjust the source, timing, amount, and placement of nutrients to reduce the negative impact of these emissions on the environment and human health.

Do not surface apply solid nutrient sources, including commercial fertilizers, manure***or other agricultural wastes***, or organic by-products of similar dryness/density when there is a high probability that wind will blow the material and emissions offsite. Do not surface apply liquid nutrient sources when there is a high probability that wind will blow the liquid droplets applied from sprinklers or other applicable methods offsite.

Reduce the potential for volatilization by applying sources subject to volatilization during cooler, higher humidity conditions or by placement that minimizes vulnerability to volatilization.

Additional Criteria to Improve or Maintain Organic Matter

Design the plant or crop management systems so the soil conditioning index (SCI) organic matter subfactor is positive.

Apply manure***or other agricultural wastes***, compost, or other organic nutrient sources at a rate and with minimal disturbance that will improve soil organic matter without exceeding acceptable risk of N or P loss.

For low residue plant or cropping systems, apply adequate nutrients to optimize plant or crop residue production to maintain or increase soil organic matter.

CONSIDERATIONS

General Considerations

Consider development of nutrient management plans by conservation management unit (CMU). A CMU is a field, group of fields, or other land units of the same land use and having similar treatment needs and planned management. A CMU is a grouping by the planner to simplify planning activities and facilitate development of conservation management systems. A CMU has definitive boundaries such as fencing, drainage, vegetation, topography, or soil lines.

Develop site-specific yield maps using a yield monitoring system, multispectral imagery or other methods. Use the data to further delineate low- and high-yield areas, or zones, and make the necessary management changes. Use variable rate nutrient application based on site-specific factor variability. See NRCS directive Agronomy Technical Note (TN) 190, AGR.3, “Precision Nutrient Management Planning.”

Use the adaptive nutrient management learning process to improve nutrient use efficiency on farms as outlined in NRCS’ national nutrient policy in GM-190, Part 402, “Nutrient Management.” Consider using an adaptive approach to adjust nutrient rate, timing, form, and placement as soil biologic functions and soil organic matter changes over time. See NRCS directive Agronomy Technical Note (TN) 190, AGR.7, “Adaptive Nutrient Management Process.”

When developing new nutrient management plans, consider using soil test information no older than 1 year rather than 2 years.

Develop a whole farm nutrient budget (nutrient mass balance), including all imported and exported nutrients. Imports may include feed, fertilizer, animals and bedding, while exports may include crop removal, animal products, animal sales, manure***or other agricultural wastes***, and compost.

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

Provide a nutrient analysis of all nutrient source exports (manure or other materials).

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.

Use bioreactors and multistage drainage strategies to mitigate nutrient loss pathways, as applicable.

Use legume crops and cover crops to provide N through biological fixation. Cover crops with a carbon to nitrogen ratio below 20:1 can release a large amount of soluble N after being plowed or tilled into the soil when an actively growing crop is not present to take up nutrients, leading to increased risks of nitrate movement and nitrous oxide emissions. The nitrous oxide emissions often occur in high soil moisture conditions, such as when a legume cover crop is plowed down in fall or early spring. To avoid these losses, use grass-legume or grass-legume-forbs mixtures with a more balanced carbon to nitrogen ratio.

Use winter hardy grass cover crops to take up excess N after the cash crop growing season and promote contribution of the nitrogen to next plant or crop.

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.
- Pathogen management considerations.

When a recycled product (e.g., compost) is to be used as a nutrient source on food crops or as food for humans or animals, make sure that pathogen levels have been reduced to acceptable levels (reference the Food and Drug Administration's Food Safety Modernization Act). www.fda.gov/FSMA When the

recycled product has come from another farming operation, implement biosecurity measures and evaluate the risk of pathogen transfer that could cause plant or animal diseases.

Use manure treatment systems that reduce pathogen content from manure.

Implementing a soil health management system that reduces tillage or other soil disturbance, includes a diverse rotation of crops and cover crops, keeps roots growing throughout the year, and keeps the soils covered to reduce nutrient losses, and improves—

- Nutrient use efficiency, rooting depth, and availability of nutrients.
- Soil organic matter levels.
- Availability of nutrients from organic sources.
- Aggregate stability and soil structure.
- Infiltration, drainage, and aeration of the soil profile.
- Soil biological activity.
- Water use efficiency and available moisture.

Use targeted or prescribed livestock grazing to enhance nutrient cycling and improve soil nutrient cycling functions.

Elevated soil test P levels may lead to reduced mycorrhizal fungal associations and immobilize some micronutrients, such as iron, zinc, and copper.

Apply manure***or other agricultural wastes***, compost, or other nutrient sources with minimal soil disturbance and at a rate that will improve soil organic matter without exceeding acceptable risk of N or P loss.

PLANS AND SPECIFICATIONS

In the nutrient management plan, document—

- Aerial site photograph(s), imagery, topography, or site map(s).
- Soil map of the site.
- Soil information including: soil type, surface texture, drainage class, permeability, available water capacity, depth to water table, restrictive features, and ***frequently floodedsoils***.
- Location of designated sensitive areas ***(include wells, springs, surface water, wetlands, field stack sites)*** and the associated nutrient application restriction ***buffers*** and setbacks ***in field maps***.
- Location of nearby residences, or other locations where humans may be present on a regular basis, that may be impacted if odors or PM are transported to those locations.
- Results of approved risk assessment tools for N, P, and erosion losses. ***State the management practices that will be implemented and documented that they are being implemented.***
- Documentation establishing the application site presents a low risk for P transport to local water if P is applied in excess of crop requirement.
- ***Previous crop, current year in rotation*** and planned plant production sequence or crop rotation.
- All available test results (e.g. soil, water, compost, manure ***or other agricultural wastes***, organic by-product, and plant tissue sample analyses) upon which the nutrient budget and management plan are based. ***Test results documented in the plan must include a copy of the original documentation provided by the certified laboratory. Documentation of which fields or section of fields are represented by each soil test.***
- ***All nutrient imports and exports, nutrient analyses and volumes.***
- When soil P levels are increasing above an agronomic level, include a discussion of the risk associated with P accumulation and a proposed P draw-down strategy.

- ***Soil P Drawdown strategy for fields with high and very high VT PI ratings needs to be developed, documented and implemented for the crop rotation.***
- ***NLI documentation for selected management practices for high-risk fields.***
- Realistic yield goals for the crops (where applicable for developing the nutrient management plan).
- Nutrient recommendations for N, P, and K for the ***crop year of the plan.***
- Listing, quantification, application method and timing for all nutrient sources (including all enhanced efficiency fertilizer products) that are planned for use and documentation of all nutrient imports, exports, and onsite transfers.
- ***Contingency Plan identifying fields for emergency manure spreading and animal mortality should an approval be given by the VT Secretary of Agriculture.***
- Guidance for implementation, operation and maintenance, and recordkeeping.

For variable rate nutrient management plans, also include—

- Geo-referenced field boundary and data collected that was processed and analyzed as a GIS layer or layers to generate nutrient or soil amendment recommendations per management zone. Must include site-specific yield maps using soils data, current soil test results, and a yield monitoring system with GPS receiver to correlate field location with yield.
- Nutrient recommendation guidance and recommendation equations used to convert the GIS base data layer or layers to a nutrient source material recommendation GIS layer or layers.
- After implementation, provide application records per management zone or as applied map within individual field boundaries (or electronic records) documenting source, timing, method, and rate of all nutrient or soil amendment applications.

OPERATION AND MAINTENANCE

Review plans ***annually*** to determine if ***revisions,*** adjustments or modifications are needed. Revise plans as needed ***to include*** changes in manure***, other agricultural wastes, and plant nutrient*** management, ***soil tests, crop rotation, manure and other agricultural*** volume or analysis, plants and crops, or plant and crop management ***or land base, including previous or current year nutrient application records***.

Monitor fields receiving animal manures ***or other agricultural wastes*** for the accumulation of heavy metals and P in accordance with***UVM*** guidance and State law.

For animal feeding operation, significant changes in animal numbers, management, ***nutrient imports*** and feed management will necessitate additional manure analyses to establish a revised average nutrient content.

It is recommended to soil sample on a schedule (i.e. one third of fields every year in a rotation) to ensure soil tests are accurate.

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

Document the nutrient application rate. ***When deviations from the NMP occur in a crop year (e.g. the applied rate differs from the planned rate, greater nutrients are applied than planned, a different crop type is grown) provide appropriate documentation to explain the difference using an amended VT PI with updated information.***

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.

Recycle or dispose of nutrient containers in compliance with State and local guidelines or regulations.

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. ***Test results must include a copy of the original documentation provided by the testing laboratory.***
- Listing and quantification of all nutrient sources (including all enhanced efficiency fertilizer products) that are planned for use and documentation of all nutrient imports, exports and onsite transfers.
- ***Field-by-field yearly records maintained for crop yields and nutrient applications, including manure, other agricultural wastes and fertilizer applied including*** date(s), method(s), and location(s) of all nutrient applications.
- Weather conditions and soil moisture at the time of application, elapsed time from manure ***or other agricultural wastes*** application to rainfall or irrigation event(s).
- ***Field-by-field records of*** plants and crops planted, planting and harvest dates, yields, nutrient analyses of harvested biomass, and plant or crop residues removed. ***Nutrient analyses of harvested biomass should also be recorded.***
- Dates of plan review, name of reviewer, and recommended adjustments resulting from the review. ***All persons (NRCS, non-NRCS personnel, technical service providers) who review or approve nutrient management plans will be certified in accordance with the Technical Service Providers (TSP) proficiency criteria available on the NRCS TechReg website (referenced below).***

For variable rate nutrient management plans, also include—

- Maps identifying the variable application location, source, timing, amount, and placement of all plant and crop nutrients applied.
- GPS-based yield maps for crops where yields can be digitally collected.

REFERENCES

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