Wisconsin Conservation Planning Technical Note WI-1

Companion Document to NRCS FOTG Standard 590, Nutrient Management

September 2007

Introduction

Definition of Nutrient Management

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

Purpose

Nutrient management planning is an important and yet oftentimes cumbersome process. This Technical Note has been developed in order to provide guidance for nutrient management planning in addition to NRCS Field Office Technical Guide (FOTG) Standard 590.

NRCS, Field Office Technical Guide (FOTG), Section IV, Conservation Practice Technical Standard 590, Nutrient Management, provides specific criteria for nutrient management planners (section V). It identifies the necessary components of a nutrient management plan (section VII), and lists criteria for operation and maintenance of the practice (section VIII). Federal, state, and local laws may provide additional requirements and guidance. Please be aware that the Wisconsin Conservation Planning Technical Note WI-1 is the companion document to NRCS FOTG Standard 590 and includes criteria that are required where specified.

Periodic updates to material contained in this technical note may occur. To find the most current information for developing nutrient management plans, use Snap Plus nutrient management software from http://www.snapplus.net/ developed by the UW Madison, Soil Science Department and available free of charge. This nutrient management planning tool will allow nutrient management planners to use the most current application rate guidelines found in UWEX publication A2809 and the most current manure book values for estimating manure production and nutrient availablility. Snap Plus will also stay current and highlight soil map units that are susceptible to leaching N. These soils are found in Appendix 1 of this technical note and will be changing to numerical map units as county soil surveys are updated.

This technical note provides detailed guidance on the following:

Part I: Minimum Requirements for a Nutrient Management Plan

Part II: Items of Benefit for Nutrient Management Planning

Part III: Determining Manure Nutrient Credits

Part IV: DNR Regional Offices and Contacts

Appendix 1: Soils List with High Potential for Nitrate Leaching to Groundwater

Appendix 2: Certified Laboratories

Appendix 3: Nutrient Management for Wisconsin Cranberry Production

Appendix 2

Certified Soil Test Laboratories

The following laboratories have been approved as of the publication date of this document.

UW Soil & Plant Analysis Laboratory
5711 Mineral Point Road
Madison, WI 53705
Ph: (608) 262-4364

UW Soil & Forage Laboratory
8396 Yellowstone Drive
Marshfield, WI 54449
Ph: (715) 387-2523

Rock River Laboratory
710 Commerce Drive
P. O. Box 169
Watertown, WI 53094
Ph: (920) 261-0446

Dairyland Laboratories
217 E. Main Street
Arcadia, WI 54612
Ph: (608) 323-2123

Agsource Soil & Forage Laboratory
106 N. Cecil Street
Bonduel, WI 54107
Ph: (715) 758-2178

A&L Great Lakes Laboratories
3505 Conestoga Drive
Fort Wayne, IN 46808
Ph: (260) 483-4759

Mowers Soil Testing Plus, Inc.
117 E. Main Street
Toulon, IL 61483
Ph: (309) 286-2761

Appendix 3

Nutrient Management for Wisconsin Cranberry Production

This appendix to the Wisconsin Conservation Planning Technical Note WI-1 ("the technical note") has been developed in order to provide guidance for nutrient management planning on cranberry production systems. A cranberry nutrient management plan that meets the criteria included in this appendix should satisfy the requirements of the Wisconsin NRCS Nutrient Management Conservation Practice Technical Standard ("the 590 standard") and the technical note. Reference is made to particular sections of the 590 standard and the technical note, where special attention may be needed.

The guidance and instructions included in this appendix are in addition to those found in the 590 standard. Implementation of a plan developed based upon the guidance included in this document must be in accordance with the 590 standard. Federal, state, and local laws may provide additional requirements.

This appendix provides detailed guidance on the following:

Section I: Criteria Unique to Cranberry Nutrient Management Planning

Section II: Cranberry Nutrient Management Tables

Section III: Cranberry Nutrient Management Plan Outline and Optional Forms

Section I: Criteria Unique to Cranberry Nutrient Management Planning

I. General

A. Cranberry nutrient management planning shall be based on plant tissue analysis. Plant tissue analysis shall be performed annually, on each individual nutrient management unit, in accordance with *Cranberry Tissue Testing for Producing Beds in North America* (Extension publication EM-8610). Tissue analysis should be performed by a reputable laboratory—preferably one that participates in the North American Proficiency Testing Program. A minimum of one sample shall be collected per management unit per year. In addition, a total of at least one sample per 5 acres of cranberry beds, within each nutrient management unit, shall be collected every 4 years. (For example, on a 25-acre nutrient management unit, collect at least one tissue sample every year and a total of at least 5 samples over a 4-year period.) Refer to EM-8610 and "How to Take a Cranberry Tissue Sample," (Teryl R. Roper, Professor and Extension Fruit Crops Specialist, UW-Madison, 2006) for further guidance.

B. Soil fertility analysis should also be considered in cranberry nutrient management planning. Soil samples must be analyzed by an approved Wisconsin laboratory. (Refer to Appendix 2 of this technical note for contact information.) Consider collecting a total of at least one composite sample per 5 acres of producing cranberry beds, within each nutrient management unit, every 4 years. Refer to *Sampling Soils for Testing* (UW-Extension publication A2100) and "How to Take a Cranberry Soil Sample," (Teryl R. Roper, Professor and Extension Fruit Crops Specialist, UW-Madison, 2006) for further guidance.

C. Additional considerations in cranberry nutrient management planning should include monitoring and observation of plant vigor and appearance, production history, and grower experience, in addition to the considerations described in the Extension publications referenced in this document.

D. Ensure that application equipment is properly calibrated.

E. Applications of nutrient and soil amendments should not be made when soil temperatures are low (<50 deg. F) or fields are saturated with water.

F. Applications of nutrient and soil amendments should be rescheduled when predicted weather conditions are likely to transport these amendments to non-target areas (*i.e.* precipitation events, planned irrigation events, frost protection events, etc.). The nutrient management plan shall document mitigation practices to be implemented when rescheduling is not possible.

G. An analysis of the water chemistry of irrigation and/or flood water should be considered when the conservation planning resource assessment has identified that water chemistry may significantly influence nutrient management by altering soil acidity and/or resulting in the application of significant quantities of plant nutrients.

H. Efforts should be made to limit the detachment and transport of vegetation and soil materials (i.e. material that is removed or disturbed in the processes of bed

renovation/construction or managed “floods”), which may result in the deposition of these materials into surface waters.

II. Soil Acidity

A. Maintain soil pH at or below 6.0, where practical. The “target pH” is 5.6 for mineral soils and 5.4 for organic soils, as identified in *Nutrient Application Guidelines for Field, Vegetable, and Fruit Crops in Wisconsin* (UWEX publication A2809). Note circumstances where the difference between the actual soil pH and the target pH is greater than 0.5, and describe procedures utilized to adjust pH, if such efforts are made.

B. Annual sulfur applications should not exceed 500 lbs elemental S per acre.

C. Individual sulfur applications should not exceed 150 lbs elemental S per acre.

III. Nitrogen (for producing beds)

A. Nitrogen management strategies shall be in accordance with *Nitrogen for Bearing Cranberries in North America* (Extension publication EM-8741). Note: Hybrid varieties, such as Stevens and Pilgrim, may benefit from tissue-N concentrations up to 1.3% (2006 Wisconsin Cranberry School Proceedings, Teryl Roper, UW-Extension).

B. Ammonium or urea forms of nitrogen fertilizer should be used.

C. Individual nitrogen applications should not exceed 20 lbs/ac.

D. Identify and implement water quality mitigation practices for beds where soil pH is greater than 5.5 and 70 lbs or more of nitrogen fertilizer are applied per acre per year.

E. Annual applications of fertilizer containing N should be made using a minimum of three passes, unless total planned applications for the season do not exceed 20 lbs N per acre.

F. Applications of fertilizer containing N should be timed to coincide with peak crop demand (active growth).

IV. Phosphorous (for producing beds)

A. Phosphorous management strategies shall be in accordance with *Phosphorous for Bearing Cranberries in North America* (UW-Extension publication, Nov. 2004).

B. Annual phosphorous applications shall not exceed 20 lbs actual P per acre (~45 lbs P_2O_5 per acre), unless the need for additional annual P is documented by plant tissue analysis or other considerations as outlined in *Phosphorous for Bearing Cranberries in North America*.

C. Develop a fertilizer reduction strategy where planned, annual applications of phosphorous fertilizer exceed 20 lbs actual P per acre (~45 lbs P_2O_5 per acre), on producing beds; tissue analysis demonstrates that nutrient concentrations are within or exceed recommended levels; and no deficiency of phosphorous has been demonstrated

through soil fertility analysis. Cranberry tissue nutrient content guidelines for producing beds and soil test interpretation categories for phosphorous are summarized in Section II of this appendix.

D. Applications of fertilizer containing P should be timed to coincide with peak crop demand (hook to fruit set). Multiple, lighter applications of fertilizer containing P are preferred over fewer, heavier applications.

V. Potassium (for producing beds)

A. The goal of potassium fertility management should be to maintain plant tissue concentrations within the recommended range (refer to EM-8610 or Section II).

B. Large doses of potassium fertilizer have the potential to disrupt the balance of available cations (positively-charged ions) in the soil. Because of this, individual applications of fertilizer containing potassium should not exceed ~62 lbs actual K per acre (75 lbs K_20 per acre).

C. Multiple, lighter applications of fertilizer containing K are preferred over fewer, heavier applications.

VI. New Plantings

A. Nutrient management strategies for new plantings shall be based upon soil fertility analysis and consideration of soil characteristics. Collect soil samples for analysis at a rate of one composite sample per 5 acres of cranberry beds after the beds have been prepared for planting. Refer to UWEX publication A2809, or Section II of this Appendix, for fertilizer application guidelines based on soil test results.

B. Annual applications of nitrogen should not exceed 150 lbs/ac.

C. Individual applications of fertilizer should not exceed 15 lbs N per acre.

D. If fertilizers containing phosphorous and/or potassium are to be applied after the plants have become established, consider alternating fertilizer applications between nitrogen-only products [i.e. urea or ammonium sulfate (21-0-0)] and complete, N-P-K blends [i.e. 13-13-13, 10-10-30, or similar products].

E. Pre-plant applications of fertilizer containing phosphorous and/or potassium should be incorporated into the soil. Applications must be based upon soil test results and UW-Extension guidelines (see A2809 or Section II of this Appendix).

F. Frequent, lighter applications of fertilizers are preferred on new plantings over fewer, heavier applications.

Section II: Cranberry Nutrient Management Tables

Table 1: Soil test interpretation categories for phosphorous (P) and potassium (K) for *common cranberry soils:

Nutrient	Very Low	Low	Optimum	High	Very High	Excessively High
P (ppm)	<18	18-25	26-37	38-55		>55
K (ppm)	<50	50-80	81-120	121-160	161-220	>220

* These categories apply to Subsoil Group E [Sandy, coarse-textured soils (sands and loamy sands)] and Subsoil Group O [Organic soils (mucks and peats)], as defined in *Nutrient Application Guidelines for Field, Vegetable, and Fruit Crops in Wisconsin* (UWEX publication A2809). Refer to A2809 if the dominant soil type does not meet either of these descriptions.

Table 2: Phosphorous and potassium fertilizer application rate guidelines [from UWEX publication A2809]:

Fertilizer Component	Very Low	Low	Optimum	High	Very High	Excessively High
P_2O_5 (lbs/ac)	†200	†125	NA	NA	--	NA
K_2O (lbs/ac)	†250	†200	NA	NA	NA	NA

† **These rates are only applicable prior to cranberry bed establishment**. Incorporate all P_2O_5 and K_2O before planting. For established cranberry beds, use tissue testing to guide fertilizer application rates.

Table 3: Cranberry tissue nutrient content guidelines for producing beds:

Nutrient	Normal Concentration (%)	Nutrient	Normal Concentration (ppm)
Nitrogen (N)	0.90 – ‡1.10	Boron (B)	15 – 60
Phosphorous (P)	0.10 – 0.20	Iron (Fe)	>20
Potassium (K)	0.40 – 0.75	Manganese (Mn)	>10
Calcium (Ca)	0.30 – 0.80	Zinc (Zn)	15 – 30
Magnesium (Mg)	0.15 – 0.25	Copper (Cu)	4 – 10
Sulfur (S)	0.08 – 0.25		

‡ Hybrid varieties, such as Stevens and Pilgrim, may benefit from tissue-N concentrations of up to 1.30%.

Section III: Cranberry Nutrient Management Plan Outline and Optional Forms

A cranberry nutrient management plan shall be developed according to the 590 standard, as well as the criteria included in this technical note. The following outline should be used as a guide in the development of a cranberry nutrient management plan. The attached forms may be useful tools when developing a plan. These forms are not required. [Bracketed references to individual forms are included, for guidance, within this outline.] Note: Completing the optional forms may satisfy some of the items listed below. However, use of the optional forms will not preclude the need to develop a plan narrative, as some items will require further explanation.

Consider organizing the plan around nutrient management units. *Nutrient management units are groups of fields or beds that are managed similarly. A single management unit may include a group of beds with similar soil conditions, production status (new plantings, plantings of similar age, fresh-fruit beds, non-producing beds, etc.), or other considerations, which allow the unit to be managed as a whole.*

A cranberry nutrient management plan should satisfy the requirements of the 590 standard by satisfying the following items, as well as the criteria outlined in Section I of this appendix:

I. Plan Narrative:

The purpose of the narrative is to provide an overview of the operation and describe the nutrient management strategies for the growing season, including descriptions of how the plan will be implemented and why the proposed strategies were selected. The narrative should provide an overview of the operation, identify the nutrient management units on the marsh, explain past practices and results, explain how current strategies have been developed or refined, and discuss potential factors that may cause deviation from the intended strategies. The narrative should explain how the nutrient management plan will be implemented, with an explanation of how nutrient management decisions will be made.

A. Identify nutrient management units and include the following information:
[*Management Unit Identification Worksheet*]

1. Current production status.
2. A general description of the soil, including subsoil characteristics and soil characteristics within the rooting zone. Explain bed construction/renovation and management histories, including sanding practices. Focus on those characteristics and past activities that may influence nutrient management.

B. Summarize records of nutrient and soil amendment applications, tissue and soil fertility test results, and crop yields from previous years. If available, records from the most recent four years should be summarized in the narrative and either included with the plan or referenced if available in another format or easily accessible location. Include the following details per individual management unit:
[*5-Year Nutrient Management Summary per Management Unit*]

1. Applications of commercial fertilizers, organic byproducts (i.e. fish waste), and soil amendments (i.e. elemental sulfur), including the form, rate, and timing.
2. Plant tissue analysis results.

3. Soil fertility analysis results.
4. Historic crop yields.

C. Planned nutrient and soil amendment applications, including the rate, form, and timing. In addition, identify anticipated or expected yields per management unit. These should be based on historical production records, crop conditions, crop varieties grown, and grower experience.
[*Planned Nutrient Management Practices* worksheet]
[*Fertilizer Decision-Making Checklist*]

II. Aerial photographs and/or maps of the farm containing:

A. Boundaries, identification numbers, and acreage for all beds and nutrient management units. The Wisconsin DNR has a free, internet mapping program, which may be used to generate marsh maps based on aerial photography or topographic maps: http://maps.dnr.state.wi.us.

B. A soil map. NRCS has a free, internet mapping program, which may be used to generate soil maps: http://websoilsurvey.nrcs.usda.gov.

C. Locate and identify features that require additional protection. These may include groundwater risk areas (i.e. abandoned wells), surface water risk areas (i.e. water conveyance ditches, reservoirs, streams or lakes, wetlands, etc.), or other sensitive areas. Delineate boundaries for nutrient application restriction areas. Consider depicting routes of surface water flow, reservoirs, and key surface water control points (i.e. water control structures or bulkheads), which allow for the storage or recovery of discharges from beds. Include a legend of map symbols.

III. Documentation of nutrient management activities:

Document the following within-season activities per individual nutrient management unit:

A. Actual nutrient and soil amendment applications, including the rate, form, and timing.
[*Actual Nutrient Management Practices* worksheet]

B. Monitoring efforts (i.e. measurements of crop potential, upright growth, soil temperatures, precipitation, etc.) and observations (i.e. plant vigor and appearance, weather events and climatic conditions, etc.) made in support of nutrient management decisions. Nutrient management activities that are inconsistent with the plan narrative should be documented.
[Annual Nutrient Management Observation Checklist]

*****Cranberry Nutrient Management Optional Forms are included on the following pages*****