UNIVERSITY OF VERMONT EXTENSION
CULTIVATING HEALTHY COMMUNITIES

2016 Cropping Season Addendum to Nutrient Recommendations for Field Crops in Vermont

The recommended nutrient rates reported on the UVM Soil Test Report and found in the document Nutrient Recommendations for Field Crops in Vermont are based on crop response research and past experience. Periodically, nutrient recommendations need to be reevaluated due to new research, changes in cropping practices, and improvements in crop genetics. What follows are updated nitrogen recommendations for corn production in Vermont. These changes will be reflected in future iterations of Nutrient Recommendations for Field Crops in Vermont, beginning with a revision that is planned for 2016. *This memo is an addendum to that document until it is fully updated.* The current UVM nitrogen recommendation for corn has been slightly modified and the new recommendation can be found in Table 1 below.

Table 1. Recommended nitrogen rates for field corn not including credits for manure or previous crop. (Replacement of corn section of Table 4 found in Nutrient Recommendations for Field Crops for VT)

Corn	Expected yield[1]		Soil Drainage Class		
			Somewhat poorly to poorly drained	Well drained to moderately well drained	Excessively drained
	Silage[2]	Grain			
	ton/acre	*bu/acre*	N Rate[3], lbs. per acre		
	15	90	110	90	110
	20	120	140	120	140
	25	150	170	150	170
	30	180	na	180	190
	35	210	na	210	210

1 Expected yield should be realistic and based on field-specific average yield data

2 Silage yields are wet tons based at 35% dry matter content

3 Adjust final N rates accounting for previous crop credits (Table 5) and manure application (Tables 14-17)

Basing a nitrogen application rate on a realistic yield expectation is extremely important in order to avoid over-applications of N. As a rule, a realistic yield expectations should be based on longer-term (e.g., 5-year) yield averages and not the exceptionally high yields that can occur under extraordinarily favorable growing conditions.

Aside from the basic N recommendation found in Table 1, it is also important to estimate and account for nitrogen contributions from manure and the previous crop. Guidance for such 'nitrogen credits' can still be found in Table 5 and Tables 14-17 in the Nutrient Recommendations for Field Crops in Vermont bulletin. Adaptive nitrogen management approaches (described below) further fine-tune the recommendation by more precisely estimating nitrogen contributions from soil organic matter and applied manure in individual management zones.

Fine-tuning your nitrogen recommendation for field corn

Keep in mind that the basic N recommendations (Table 1) are and always have been a solid *starting place*, not an infallible prescription. The circumstances in an individual field might be such that a given recommendation would be either excessive or insufficient for that year. While it would be nice if 120 pounds of nitrogen inputs were always perfectly adequate to produce 20 tons/acre of corn silage, it is not always the case. Similarly, it would be convenient if a killed grass sod always contributed a nitrogen credit of exactly 70 lb/ac to the subsequent corn crop, but it could be more or less. Many variables affect nitrogen dynamics in the soil, crop, and environment, and integrated approaches are generally better than prescriptions.

Given how easily nitrogen can be lost from or immobilized in the soil, verifying the nitrogen status of the soil and corn crop during the growing season is an excellent idea. Table 6 from Nutrient Recommendations for Field Crops in Vermont gives guidance on using pre-sidedress nitrate test (PSNT) data to determine the need for in-season nitrogen additions for the corn crop. In a year when growing conditions are 'normal,' the PSNT can be a very helpful tool for generating solid sidedress nitrogen recommendations.

Producers should adhere to recommended rates unless they have field-specific information that provide superior information that suggests that the recommendation is inappropriate. At this point, UVM Extension agronomists recommend two different tools that are useful for improving our understanding of the nitrogen status of a field near sidedress time: the pre-sidedress nitrate test (PSNT), and 'adaptive nitrogen management'.

The pre-sidedress nitrate test (PSNT) attempts to predict the amount of sidedress nitrogen needed based on a) expected yield; b) the soil nitrate concentration just before sidedress time; and c) the assumption that the current nitrate concentration can predict the amount and availability of plant-available nitrogen during the remainder of the cropping season (which often is not true). For many years the PSNT has been the primary method used to generate somewhat reliable sidedress-N recommendations. This approach is useful in 'normal conditions' but has significant limitations. Aside from being time/labor intensive during a busy time of year (June, generally), it only gives a snapshot of the current nitrate status of the soil and makes a recommendation on that basis. It is completely blind to past and future weather conditions. Given that soil nitrogen is dynamic and heavily influenced by temperature, moisture, the oxygen status of the soil, water movement through soil, and soil biology, the PSNT has significant and obvious weaknesses.

While the PSNT continues to be an acceptable tool under 'normal' conditions, the concept of 'adaptive nitrogen management' has led to the development and validation of a computer-based model that can accurately predict the behavior, presence, and form of plant-available nitrogen in the soil/crop system. This model, known as 'Adapt-N,' was developed (and continues to be) by Cornell University and has been commercialized by a Agronomic Technologies, LLC. The model uses most relevant agronomic variables to generate sidedress nitrogen recommendations for all major types of corn production.

Given that nitrogen is dynamic and no model is perfect, managers are encouraged to occasionally 'ground-truth' the 'virtual PSNT' generated by Adapt-N with an actual PSNT from fields on their farm with different soil types, especially after abnormal weather events/patterns. As with standard nitrogen recommendations and those generated from the PSNT, recommendations generated using Adapt-N should be used in conjunction with common sense, past experience, and, at least initially, a Certified Crop Advisor who has been trained to use the tool appropriately. **Warning: if the data fed into the program is low-quality, the recommendations from Adapt-N will not be useful.** Whichever approach you use (Adapt-N or the PSNT), recommendations should be generated for each field; the recommendation from one field is not valid for any other field or an entire farm.

What other technologies are appropriate for generating sidedress nitrogen recommendations? Chlorophyll meters, active sensors, and aerial imagery have been put forth as tools useful for understanding plant health and/or nitrogen status. A validated protocol is necessary to make these tools function properly. All nitrogen fertilizer applications should be based on recommendations made using a protocol that has been developed and validated in a process of unbiased, transparent, and published research.

Particular guidance for using active sensors and chlorophyll meters to generate nitrogen recommendations can be found in these documents:

- *http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs144p2_011798.pdf*
- *http://www.agronext.iastate.edu/soilfertility/info/inseasonnstress.pdf*

For those wanting use the PSNT to generate sidedress nitrogen recommendations, Table 2 (below) was created/updated using the explanation given in Nutrient Recommendations for Field Crops in Vermont. ***Historical harvest data should support the 'expected corn silage yield' used to generate the recommendation***.

Table 2. Recommended nitrogen rates for corn based on the Pre-sidedress Soil Nitrate Test (PSNT). This table replaces Table 6 in the Nutrient Recommendations for Field Crops in VT
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	Expected corn yield (tons/ac) as harvested				
NO_3^- PPM	**15**	**20**	**25**	**30**	**35**
	----------N to Apply Per Acre----------				
<5	80	110	140	170	200
6	78	106	135	163	192
8	73	98	124	149	175
10	68	90	113	135	158
12	63	82	102	121	141
14	58	74	91	107	124
16	53	66	80	93	107
18	48	58	69	79	90
20	43	50	58	65	73
22	38	42	47	51	56
24	33	34	36	37	39
25	30	30	30	30	30
>25	0	0	0	0	0

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