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 **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 is the UVM recommendation for the 2016 cropping season. These changes will be reflected in future iterations of the document Nutrient Recommendations for Field Crops in Vermont. *This memo should be considered to be a 2016 addendum to that document until it is fully updated.* The current UVM nitrogen recommendation for corn has been slightly modified and can be found in Table 1.

Table 1. Recommended nitrogen rates for annual crops not including credits for manure or previous crop. (replacement of Table 4 found in "Nutrient Recommendations for Field Crops in Vermont, 2004")

			Soil Drainage Class		
Corn	Expected yield[1]		Somewhat poorly to poorly drained	Well drained to moderately well drained	Excessively drained
	Silage[2] *ton/acre*	Grain *bu/acre*	N Rate[3], lbs. per acre		
	15	90	110	90	110
	20	120	140	120	140
	25	150	-	150	-
	30	180	-	180	-
	35	210	-	180[4]	-
Small grains	4.5	45	45	45	45
	6.0	60	60	60	60
	9.0	90	90	90	90
Summer annual forages[5] - sudangrass, sorghum-sudangrass hybrid, pearl millet			100	100	100
Sunflower			100	100	100
Dry beans, peas, buckwheat			40	40	40
Soybeans[7]			0	0	0

1 Upper yield limits depend on soil drainage class

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

3 Reduce rates for previous crop credits (Table 5) and manure application (Tables 14-17)

4 Higher yields may be due to other factors. Use PSNT or Adapt N to determine any additional N needs

5 Recommended rate at seeding; for regrowth, add additional 50 lbs right after first harvest

6 A low rate of N (5 to 10 lbs/a) may be applied in a 2"x2" placed starter band but avoid direct contact with seed

Besides the basic N recommendation found in Table 1, it is also important to estimate and account for manure and previous crop. These can still be found in Tables 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 the contributions from soil organic matter and applied manure in individual management zones.

Fine-tuning your nitrogen recommendation for field corn

Keep in mind that our basic N recommendations are and always have been a solid *starting place*, not an infallible prescription. The circumstances in a given 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.

Verifying the nitrogen status of the soil and corn crop during the growing season is a good idea. The concept of using integrated approaches to monitor nitrogen status is not new. 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 to the corn crop. This can be helpful because nitrogen is sometimes lost from the root zone or 'tied up' in the soil, for a range of reasons, and in a normal year the PSNT can yield very good 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: 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 he 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, anaerobic conditions, 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 computer models that can accurately predict the behavior, presence, and form of plant-available nitrogen in the soil/crop system. The 'Adapt-N' model was developed (and continues to be) by Cornell University and has been commercialized by a tech company. 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 and/or 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 from each field.

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 any tool function properly. Technological advances will continue to take place rapidly, but technologies such as these still need to be validated and applied appropriately. 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 to stick with the PSNT yet be able to fertilize for higher yields in zones where those yields are realistic, the table below was generated 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 your recommendation***.

Table 2. Recommended nitrogen rates for corn based on the Pre-sidedress Soil Nitrate Test (PSNT)

	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

- Prepared by Dan Hudson with input from Sid Bosworth, Jeff Carter and Heather Darby 5/25/16