



**Feeling the Squeeze:
Manage Nutrients Efficiently to Offset High Fertilizer Prices**

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The projected high fertilizer prices, especially nitrogen (N), should encourage you to manage nutrients on your farm as efficiently as possible. The goal this year should be to reduce input costs without sacrificing yield. Below are three strategies that can help you manage nutrient supplies efficiently for 2010.

1) Don't Guess, Soil Test:

The first, best step to efficient fertilizer management is to discover what your soil needs to support crop growth. Soils should be sampled every three years and when crops are rotated. A standard soil test (\$14 at UVM Agricultural and Environmental Testing Lab) will measure available phosphorous (P), potassium (K), and micronutrients in soil as well as pH and organic matter content. Individual fields will vary greatly in their capacity to supply essential nutrients such as P and K. For example, recent summaries of UVM soil test results showed that one third of field crop samples tested high or excessive in phosphorus and needed no additional P for corn growth. But almost half tested below optimum and received a recommendation for P application. Reducing or eliminating P application on the high-testing fields would save money, but cutting out P on the low-testing fields could cost the farmer by lowering yields. Most farms have some fields in each category, and soil testing is the only way to tell the difference.

Nitrogen (N) is a different story. Nitrogen recommendations for corn are not based on a standard soil test but are an estimate made from expected yield, N credits from previous crop and manure, and soil drainage class. Table 1 shows the total amount of N needed to grow corn based on yield and soil drainage.

Table 1. Recommended nitrogen rates for corn based on expected yield and soil drainage.

Expected yield		Soil drainage class		
		Somewhat poorly to poorly drained	Well drained to moderately well drained	Excessively drained
Silage tons/acre	Grain bu/acre	-----N to apply, lb/acre-----		
15	90	90	80	90
20	120	120	100	120
25	150	150	130	150
30	180	150	150	150

Table adapted from Jokela et al., 2004. Nutrient recommendations for field crops in Vermont. University of Vermont Extension.

The N needed by the crop will come from a number of sources including manure, previous crops, soil organic matter, and fertilizer. However, it is difficult to predict how much N will actually be supplied to plants by manure and other soil sources. This is because much of the N is in the organic form, a form not directly available to plants. Microorganisms in the soil must break down the organic N

to ammonium or nitrate, simpler forms that plants can take up. To add to the complexity, all these processes vary greatly depending on rainfall, temperature, soil moisture, and other conditions. So nitrogen availability can be quite varied in different fields or in the same field in different years.

This is where the Pre-Sidedress Nitrate Test (PSNT) comes into play. The PSNT measures nitrate, the main form of nitrogen taken up by plants, shortly before the big demand for N by the corn crop in midsummer. The amount of nitrate at that time also serves as an indicator of the potential for N release during the rest of the season. If the PSNT calls for additional N fertilizer, you can apply it as a sidedress or topdress application. This is the best time to apply N fertilizer on most soils in Vermont to maximize the efficiency of uptake by corn and to minimize losses of N. The test is available through UVM and costs \$8.00. Results will be returned within 24 hours of receiving the sample.

2) Take All The Credit You Can:

The next time you look at your manure pile envision dollar bills. That's right proper application of manure can reduce fertilizer costs. The nutrient content of the average Vermont liquid dairy manure is displayed in table 2. Since manure nutrient content can vary considerably from farm to farm it is best to sample the manure on your farm to make the best estimate of application rate.

Total N	Ammonium-N	Organic-N	P ₂ O ₅	K ₂ O
-----lbs per 1000 gallons-----				
25	12	13	8	20

Table 2. Nutrient content of average Vermont liquid dairy manure.

Availability of N from manure will not be 100% like that of synthetic fertilizers. Therefore, even though the manure test indicates there is 25 lbs of N it will not all be immediately available for plant uptake. Manure nitrogen is divided into two fractions ammonium-N and the stable organic-N fraction. The organic-N is released over a longer period of time (years). The ammonium-N fraction of manure is generally equivalent to fertilizer N. Ammonium-N from manure can volatilize quickly from the soil surface and be lost into the atmosphere. Loss of ammonium-N can be prevented by incorporation of manure into the soil. Table 3 shows that immediate incorporation can increase N availability considerably.

Table 3. Availability of ammonium-N from spring/summer or fall applied manure.

Time to incorporation via tillage	Liquid manure (5 - 10 % dry matter)	
	Spring/Summer	Fall
-----% available-----		
Immediate (1 hr)	95	35
< 8 hr	70	25
1 day	55	25
2 days	50	20
3-4 days	45	20
5-7 days	40	15
> 7days or not incorporated	40	15

Table adapted from Jokela et al., 2004. Nutrient recommendations for field crops in Vermont. University of Vermont Extension.

Finally, you should evaluate the potential to modify your cropping system to reduce the need for supplemental fertilizer. Plowing down a legume or grass hay crop can provide the next crop with all or most of its N requirements (Table 4). Nitrogen that is tied up in roots and aboveground biomass is released over time as soil microorganisms break down the plants and release N in forms that plants can use. Although book values are displayed, a PSNT will more accurately reflect the amount of N available to your crop from the previous crop.

Table 4. Nitrogen credits for rotation crops.

Previous crop		Fertilizer N credit	
		Year 1	Year 2
-----lbs/acre-----			
Alfalfa	> 60% legume	120	60
	20 - 60%	80	40
Red clover	> 60% legume	90	40
	20 - 60%	70	30
Grass	Yield > 2 ton/acre	70	30
	Yield 2 ton/acre or less	40	20
Soybeans		30	0

Table adapted from Jokela et al., 2004. Nutrient recommendations for field crops in Vermont. University of Vermont Extension.

3) Resist the Impulse to “Top-off”:

From the plant’s point of view, it really doesn’t matter where the nutrients come from as long as there is enough food in the soil when the plant needs it. The plant’s capacity to uptake nutrients does have a limit and going beyond that limit is like flushing money down the toilet. The same rate of **actual N** should be applied regardless of the **fertilizer source**. For example, let’s say you have determined that the corn crop needs 150 lbs of actual N per acre. There are many fertilizers to choose from all with slightly different attributes. With urea (46% N) as a source, you need to apply 326 lbs/acre of fertilizer product (150 divided by 0.46) to obtain 150 lbs per acre of actual N. With ammonium sulfate (21% N) as the source, you would need to apply 714 lbs/acre of fertilizer product (150 divided by 0.21). You know that manure will supply some nutrients and the pit is mighty full so you decide to apply 7000 gallons of liquid manure to the acre. You apply the manure and incorporate it within 8 hours. This results in approximately 59 lbs of ammonium-N per acre. At this point you realize that you will need to purchase only 91 lbs of N fertilizer instead of 150 lbs per acre. Considering this field has had years of manure additions, you decide to take a PSNT sample before sidedressing. The PSNT results indicate that you actually only need 60 more lbs of N per acre. There was quite a bit of organic-N available to the crop that you had not planned on earlier. You decide to apply 130 lbs/acre of urea (60 divided by 0.46) to obtain 60 lbs of actual N. Following the strategies listed above may have just saved you money by reducing the amount of purchased fertilizer. Remember cutting down on fertilizer rates should be based on soil and manure testing (standard and PSNT). Reducing fertilizer on crops that need nutrients will cost you money by resulting in yield loss.

To learn more about fertilizer and soil management feel free to contact Heather Darby at (802) 524- 6501.