Western New York CROP MANAGEMENT

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Nitrogen Regulations for CAFO Farms

As a farmer, the goal when applying fertilizer is to maximize yields without spending more than necessary. A second goal for growers with animals is to apply manure in an environmentally responsible manner while offsetting fertilizer costs. As a consultant, fertilizer recommendations become more complex. In addition to trying to reach yield goals, specific soil properties of each field must be considered. When it comes to CAFO permitted facilities, these factors take priority.

CAFO farms are regulated with respect to two nutrients, nitrogen and phosphorus. The phosphorus index considers soil test P, distance to streams, and management practices to determine the allowable rate of manure. Nitrogen regulations are based on Cornell University's Nutrient Management Spear Program guidelines and incorporate four contributing factors which will be discussed in detail. The rate of nutrient application is limited to the most restrictive of the two nutrients.

Four Components Used to Calculate the Nitrogen Required for Corn Production

1. **Yield Potential (YP)-** Cornell's nitrogen guidelines assign a certain yield potential to each soil type in the state. Table 1 shows a few examples. These numbers are based on production tallies from the 1960s and average 115 bushel of corn grain or 17.2 tons of corn silage. Unless you have documented yields, these standardized numbers must be used. The good news is, expected yields can be substituted based on actual yield during the best 3 out of 5 previous corn production seasons. (To convert dry shell corn (15% moisture) to corn silage (35% DM) divide the grain by 6.7 bu/ton.)

Table 1: Examples of Cornell Spear Corn Yield Potential for NY Soils

Soil Type	Corn Yield Potential			
	Undrained (bushel/acre)	Undrained Silage (T/acre)	Drained (bushel/acre)	Drained Silage (T/acre)
Howard	135	20.1	135	20.1
Hamlin	155	23.1	155	23.1
Volusia	95	14.2	105	15.7
Rhinebeck	105	15.7	120	17.9

continued on p.2

continued from p.1

2. **Sod Nitrogen (Sod N)-** According to their research, sods contribute nitrogen for three years after termination. Table 2 shows the estimated N from previous sods.

Table 2: Sod N Release Rates in Pounds Per Acre

% Legume in Sod	Available N (lbs./acre)		
	Year 1	Year 2	Year 3
0	83	18	8
1-25	110	24	10
26-50	138	30	13
50 or more	165	36	15

3. **Soil Nitrogen (Soil N)-** Cornell soil nitrogen is based on soil type and drainage classification, not on soil test organic matter.

Table 3: Examples of Soil N Contributions for NY State Soils

Soil Type	Soil N	
	Undrained	Drained
Howard	70	70
Hamlin	80	80
Volusia	60	70
Rhinebeck	65	75

4. **Soil N Uptake Efficiency (Neff)-** The percentage of applied N that can become part of the plant is called the uptake efficiency. Based on research, NY soils range from 50-75% uptake efficiency.

Table 4: Examples of Soil N Uptake Efficiency

Soil Type	N Uptake Efficiency (Neff) (%)	
	Undrained	Drained
Howard	75	75
Hamlin	75	75
Volusia	60	65
Rhinebeck	60	65

These four factors must be combined in the following formula to determine maximum nitrogen rates for CAFO permitted farms: **N = (YP *1.2- Soil N-Sod N) /(Neff/100)**. Once this answer is derived, the total must be reduced by N supplied from the previous three years' manure applications.

Example Calculations:

The following calculations show the difference in allowable nitrogen for a field with Rhinebeck soil that has been tiled (drained classification) and is in the 3rd year from sod. Using Cornell's standard yield potential, nitrogen can total 86 lbs. N per acre.

((120 bushel (or 17.9 tons) *1.2) -75- 13)/(65/100) = 86 lbs. N/acre

If recorded yields average 175 bushel, an additional 102 pounds of nitrogen can be applied per acre.

((175 bushel (or 26.1 tons) *1.2)-75-13)/(65/100)= 188 lbs. N/acre

continued on p.3

continued from p.2

Many farms in our membership have averaged 175-200 bushels of corn per acre. An average corn silage yield of 26.1-29.8 tons is not common. Clearly, with the conversion factor currently in place, farms that can grow good corn grain yields have an advantage in potential nitrogen application.

Cornell Spear Adaptive N Management Approach

If late spring through early summer is normal or dry, it is feasible to manage nitrogen rates with this system. The challenge occurs when wet conditions persist through May and June, as was the case last year. On June 15, 2017, Rushford received 6.5 inches of rain in approximately 1.5 hours, and most of us have experienced similar events of intense rainfall. Under these saturated conditions, water will pond in the fields, denitrification will occur, and nitrogen will be lost.

Our staff uses in-season tools like Adapt-N and pre-season nitrogen tests (PSNTs) to dial in the right rate for supplemental N. In saturated conditions, these tools will often indicate a need for more nitrogen than allowed under the Spear Program regulations.

A provision exists within the Spear Program guidelines that permits additional nitrogen as long it is verified through one of three management systems. The first involves in-field yield checks, including a strip with no side-dressed N and one using the standard guideline. If the yield difference is not at least 13 bu/acre (2.0 wet tons corn silage) for two years, the nitrogen rate must be adjusted. The second option is to collect corn stalk nitrate tests (CSNT) at the end of the season from the highest yielding portions of the field to determine if too much nitrogen was applied. If results exceed 3,000 ppm for two years, N rates must be reduced. The third option is two-fold. At approximately dent stage, georeferenced photos must be taken of plants in the highest yielding areas of the field. If more than three of the lowest true leaves are yellowing, nothing further is required. If any of the three lowest leaves are still green, CSNT samples must be taken. One of these methods is required on each field that received a higher rate of nitrogen than permitted under the regulations. Additionally, **yields must be documented on all fields that exceed the standard rate.**

Cornell Spear staff is in the process of reviewing the current regulations. The evaluation guidelines were amended this year and they would like to update their yield potentials to more accurately reflect what is happening in the field. This requires actual yield information from real-farm situations. Any corn grain or silage harvested with yield monitors is welcome. If you would like to contribute information, please let Avery know and we will gather the data and forward it to the university.

The bottom line is this: as the harvesters enter the fields this fall, **keep track of yields.** Even without yield monitors or scales at your farm, this can be accomplished by determining a representative load weight and tracking the number of loads **from each field**. Without documented yields above Cornell's guidelines, their standardized yield potential must be utilized for nitrogen application, or one of the verification methods must be followed.

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Grid Sampling for Precision Application

by Josh Harvey

Western New York Crop Management exists to bring valuable services to the membership that enhance each farm's management. You, as growers, strive for the highest profit margins possible to maintain a successful business. With the current milk and grain prices, everyone realizes the importance of saving dollars where they can without negatively impacting the bottom line.

Over the past several months, we have had an increase of requests for grid soil sampling on our growers' fields. The interest comes from growers wanting to put fertilizer and lime where it is needed versus treating an entire field based on a composite soil sample that may show the need for more or less. With grid sampling and variable rate application equipment, we are able to more accurately pinpoint the soil needs, whether it's fertilizer or lime, and apply appropriate rates. This can potentially raise yields in poorer areas while eliminating overapplication in areas with sufficient fertility.

This past February, WNYCMA purchased a Wintex 1000. It is a hydraulic operated soil sampler that has been mounted on an ATV equipped with GPS. This machine was chosen particularly for its flexibility for this type of sampling and economics. Our goal is to grid sample based on what best suits your operation. We are offering soil sampling grid sizes that range from 0.5 acre to 2.5 acres. We want to make sure that the grid size and width meet the requirements of the materials you are using as well as the application equipment. The two products that are most commonly applied at variable rates are potash and lime. If your main goal is to target your pH, then we want to make sure that the grid width will match up with your lime application implement that is equipped with variable rate technology.

We had the opportunity to use this machine on a farm this spring, sampling 300 acres in 0.5-acre grids. On one 42-acre field, we pulled 84 samples. The following tables show the results, categorized by soil pH and available potassium. The pH across the field ranged from 5.6 to 7.8 (Table 1), and the potassium level ranged from low (L) to very high (VH), as shown in Table 2.

Table 1: Potassium Levels

Potassium Level	# of Grids
VH	12
H	46
MH	17
M	14
LM	5
L	1

Table 2: pH Ranges

pH Ranges	# of Grids
pH < 6.2	7
pH 6.3-6.6	19
pH 6.7-7.2	37
pH > 7.2	9

You might be wondering how much yield is being lost in those lower fertility areas not detected in a composite soil sample. The information in Tables 3 and 4 is based on yield monitor data of 1,350 acres of corn grain using composite soil samples every 3 years. Table 3 shows yield variation based on potassium fertility. Between VH and LM, there is a 28-bushel difference. At September's corn price of $3.43/bu, that is a $96/acre loss in profits. Potassium is an easy nutrient to fertilize for and one that can be mined from the soil relatively quickly. So, it is very important that we are fertilizing each year in the areas that require potash. Breaking down the fields into 0.5 to 2.5-acre grid sizes allows targeting of problem areas, and maybe an opportunity to save money on areas that don't require as much potash. It is interesting to note in Table 4 that yield reduction occurs not only in low pH but in high pH as well.

continued on p.5

continued from p.4

Table 3: Yield Variation Based on Potassium

K Level	Acres	Bushels/Acre
VH	588	205
MH	159	201
L	39	189
M	181	188
H	345	184
LM	37	177

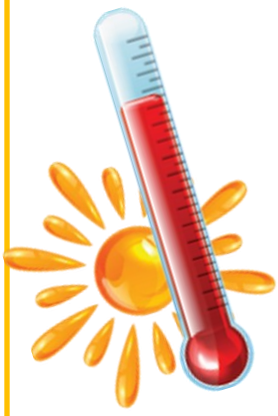
Table 4: Yield Variation Based on pH

pH	Acres	Bushel/Acre
5.8-6	11	196
6.1-6.3	52	186
6.4-6.7	261	193
6.8-7	384	196
7.1-7.3	323	205
7.4-7.6	160	189
7.7	27	160

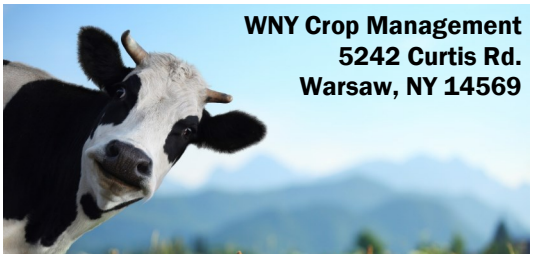
Soil samples representing ten to twenty-acre fields or soil splits, may be leaving a lot of yield in the field. Within the 42-acre field used for illustration, there were 11 soil variables just between soil pH and available potassium that can be yield limiting but would not have been detected in a composite sample. It is important for you to analyze your farm and see if fertility is your limiting factor in yield potential. Although varying application of all commercial fertilizers may not be realistic, adjusting potash and pH to appropriate levels for maximum yield will be a step in the right direction.

We would like to offer this service to any interested growers. Our only requirement at this time is a minimum of 100 acres must be signed in. If you are interested in more information about this service, including cost, please speak with your crop consultant. If this is a service that you are considering, the importance of setting up the grids properly from the start, based on the equipment that will be applying the lime or commercial fertilizer, cannot be over emphasized.

Corn **growing degree days** (GDD) are calculated by subtracting the plant's lower base or threshold temperature of 50°F from the average daily air temperature. Average daily air temperature is calculated by averaging the daily maximum and minimum air temperatures measured in any 24-hour period. The chart at the right shows accumulated GDDs from a random selection of locations throughout our service area.



GDD May 1st- August 29	
Bath	1823
Clifton Springs	2208
Clymer	2045
Eden	2301
Fillmore	1976
Freedom	1874
Gasport	2366
Groveland	2248
Oakfield	2295
Perry	2078
Randolph	2072
Ulysses, PA	1692



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