How much manure?

Using CNMP tools to make manure application recommendations in NYS



Kirsten Workman

Sr. Extension Associate Nutrient Management & Environmental Sust. Specialist











Nutrient Management Planning

- Concentrated Animal Feeding Operations (*required*)
- Farms who receive financial assistance from AEM or NRCS for waste storage or other nutrient management practices
- Farms who WANT one...
 - NRCS
 - AEM
 - DAP
- Follow the NRCS 590 Standard







CORNELL GUIDANCE DOCUMENTS



NITROGEN GUIDELINES FOR FIELD CROPS IN NEW YORK

Quirine M. Ketterings¹ and Kirsten Workman^{1,2}

¹Nutrient Management Spear Program (NMSP) and ²PRO-DAIRY Department of Animal Science, Cornell University

July 12, 2022



In conjunction with the Cornell NMSP Advisory Committees

Correct Citation: Ketterings, Q.M., and K.C. Workman. 2022. Nitrogen Guidelines for Field Crops in New York. Cornell University, Ithaca NY. Accessible at: http://mmp.cals.cornell.edu/publicationes/extension/Ndoc2022.pdf.

Cornell University, Ithaca, NY 14853

Phosphorus Guidelines for Field Crops in New York. 2022

PHOSPHORUS GUIDELINES FOR FIELD CROPS IN NEW YORK

Quirine M. Ketterings¹ and Kirsten Workman^{1,2}

¹Nutrient Management Spear Program (NMSP) and ²PRO-DAIRY Department of Animal Science, Cornell University

July 20, 2022



In conjunction with the Cornell NMSP Advisory Committees

Correct Citation: Ketterings, Q.M., and K.C. Workman. 2022. Phosphorus Guidelines for Field Crops in New York. Cornell University, Huhaa NY. Accessible at: http://mnsp.cals.cornell.edu/publications/sctension/Pdoc2022.pdf.

Cornell University, Ithaca, NY 14853

Potassium Recommendations for Field Crops in New York. CSS E01-6. October 2001.

POTASSIUM RECOMMENDATIONS FOR FIELD CROPS IN NEW YORK

Quirine M. Ketterings, Stuart D. Klausner, and Karl J. Czymmek

Department of Crop and Soil Sciences Extension Series E01-6 Cornell University

October, 2001



Picture by Q. M. Kettering

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http://nmsp.cals.cornell.edu/guidelines/nutrientguide.html

CORNELL GUIDANCE DOCUMENTS

New York Nitrate Leaching Index

User's Manual and Documentation

Quirine Ketterings¹, Kirsten Workman^{1,2}, Dale Gates³, Josh Hornesky³, Amy Langner³, Sara Latessa⁴, Ron Bush⁵, Brendan Jordan⁵, and Greg Albrecht⁵

¹Nutrient Management Spear Program (NMSP), Department of Animal Science, Cornell University, ²PRODAIRY, ³United States Department of Agriculture Natural Resources Conservation Service (USDA-NRCS), ⁴New York State Department of Environmental Conservation (NYSDEC) ⁵New York State Department of Agriculture and Markets (NYSAGM)

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In conjunction with the Cornell NMSP Advisory Committees

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Cornell University, Ithaca, NY 14853

New York P Runoff Index - Documentation and User's Guide. Third Edition. 2021.

The New York Phosphorus Runoff Index: Version 2.0

User's Manual and Documentation

Karl J. Czymmek^{1,2}, Quirine M. Ketterings², Mart Ros², Sebastian Cela², Steve Crittenden², Dale Gates³, Todd Walter⁴, Sara Latessa⁵, Laura Klaiber⁶, Greg Albrecht⁷

¹PRODAIRY, 'Nutrient Management Spear Program (NMSP), Department of Animal Science, Cornell University, 'United States Department of Agriculture Natural Resources Conservation Service (USDA-NRCS), 'Department of Biological and Environmental Engineering, Cornell University, 'New York State Department of Environmental Conservation (NYSDEC) "The William H. Miner Agricultural Research Institute, and 'New York State Department of Agriculture and Markets (NYSAGM)

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In conjunction with the Cornell NMSP Advisory Committees

Correct Citation: Czymmek, K.J., Q.M. Ketterings, M.B.H. Ros, S. Cela, S. Crittenden, D. Gates, T. Walter, S. Latessa, L. Klaiber, and G.L. Albrecht. 2021. The New York Phosphorus Runoff Index: Version 2.0. User's Manual and Documentation. Cornell University, Ithaca NY. Accessible at: http://mmsp.cals.cornell.edu/publications/extension/NYPI_2_User_Manual.pdf.

Cornell University, Ithaca, NY 14853

Groundwater Protection Guidelines for Agriculture

10-28-2021

Quirine M. Ketterings¹, Greg Albrecht², Dale Gates³, Ron Bush², Brendan Jordan², Mary Kerstetter³, and Sara Latessa⁴



http://nmsp.cals.cornell.edu/guidelines/nutrientguide.html

CORNELL GUIDANCE DOCUMENTS

Cornell University Cooperative Extension

Agronomy Fact Sheet Series

Soil Sampling for Field (

from fie

because nutrients ca

layer which can impa

the fertility guideling

recommended to sam

no-till or minimum-t

two samples: one f

depth and another fr

nutrient analyses. Th

The 0-1 inch sample

determination of a

system, nitrogen fe

applied, and this red

surface, which can b

full-depth core, Early

soil surface is importa

maintain a no-till sy

material cannot be i

Without tillage, lime

react beyond the top

Obtain a Represent

To adequately repres

the field and to m

individual soil cores t

should be composit

clearly labeled with

Soil testing is done to determine pH and organic containers can cont matter as well as levels of macronutrients copper and zinc, so [phosphorus (P), potassium (K), calcium (Ca), augers are recomme magnesium (Mg)] and micronutrients [iron clean plastic bucket. (Fe), manganese (Mn), zinc (Zn)]. When paired

with data from crop response trials, chemical Sample the Proper soil test results can be used to determine crop-Lightly scrape the soi specific nutrient needs for profitable and before sampling to environmentally sound applications of soil surface residue. Rer amendments, including fertilizer, manure, and visible stones, pla lime. Soil test results and the fertility animal residues fr management guidelines derived from them are sample after taking t heavily dependent on the quality and For field crops, representativeness of the samples collected. As conventional tillage. such, the main goal of a sampling program the top 0-8 inches (F should be to obtain a reasonably representative This depth is in sample of the field or sub-field that is in line with because fertility g the farmer's field management objectives and derived vield potentials. This fact sheet provides research in New Y guidance on soil sampling for field crop based on soil test re production. this depth. Sampli

Establish a Regular Sampling Time

It is recommended to take soil samples at least once every 2 to 3 years. Where it is desired to track nutrient fluctuations more closely, having soil test results before the next crop is planted will help refine management decisions. Soil samples are best taken in the fall after harvest of the main season crop but can also be taken in the spring or summer. Consistently sampling around the same month of the year will help reduce seasonal variation in soil tests and as a result create more reliable information on impact of crop management decisions on soil fertility and pH over time.

Use Proper Sampling Tools

Soil probes are often the best tool for the job because they collect soil in a continuous core from the surface through the entire sampling depth with minimal soil disturbance. In stony soils, an auger may work better. A spade or shovel may be used, but with care to avoid over-sampling surface soil and under-sampling at depth. All sampling tools must be clean and free of rust. Brass or galvanized tools or

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Agronomy Fact Sheet Series

Soil pH for Field Cror

The pH of a soil is among the most important | the New York lime b soil characteristics for crop production. The pH along Interstate 90 ranges from 7-8.5. N of a soil is a measure of the activity of hydrogen (H⁺) ions in the soil solution usually soils in New York var obtained by shaking soil with distilled water.

Mathematically, the pH is the negative In humid climates s logarithm of the hydrogen ion activity of a soil York State, the which means that for each unit increase in pH magnesium, potass there is a 10 times change in acidity (so a soil naturally causes a c with a pH of 5 is 10 times more acid than a soil because they leave t with a pH of 6 and 100 times more acid than a H⁺ and aluminum in soil with a pH of 7). A soil with a pH value of 7 can change the pH of or greater is called an alkaline or basic soil. If most nitrogen fertili the pH is less than 7, the soil is called acidic. sources (compost formation of nitric a acid (H2SO4). Both a

As soils become increasingly acidic (decreasing an increase in soil a pH), important nutrients like phosphorus pH of the soil). become less available to plants (Figure 1), Other elements, like aluminum, become more available and may actually become toxic to the The soil pH ranges crops are given in T plant, resulting in reduced crop yields, Liming test soil to determin to optimum pH not only increases the availability of essential nutrients, but also desired range. If maintained, increase supplies additional calcium and magnesium, improves soil conditions for microorganisms, varieties can not be can not fix a problem increases the effectiveness of triazine

scille scille scill sites	Madum Szorgly akalina akalina Crop Species	Normal
Phospherux	Alfalfa	6.5
Petsakum	Barley	6.3
Setter Chicken	Birdsfoot trefoil	6.0
Vagoadan	Clovers	5.8
190	Com	5.8
Variantee	Grasses	5.8
Deren	Oats	5.8
Copper and Zinc	Soybeans	6.5
Ve	Wheat	6.3

tv at least containing free calcium carbonates such as per rotation. Take a Honeoye, Lima, Ontario, and Kendaia soils) in samples from acros



Cornell University Cooperative Extension

Agronomy Fact Sheet Series

Corn Stalk Nitrate Test (

Recent increases in nitrogen (N) fertilizer costs | 3 of the 4 quarter have caused producers to strive for better use drying process wit of the N already on the farm (manure, sods, cover crops, etc.) to meet N requirements of silage corn. However, at the end of the growing season, unless drastic yield losses are observed, it is often difficult to determine if the corn crop had enough N for optimum yield that growing season. An end-of-season stalk nitrate test for evaluation of the N supply during the growing season is useful as a management tool as it helps identify if adjustments in N management are needed in future years. In 1996 researchers at Iowa State University

Nitrate Test (CSNT). Since it was first developed, the CSNT has gained use in several parts of the US and over the past three years we have tested its performance under New York growing conditions. In this fact sheet we summarize our research findings and give interpretations for New York soils and growing conditions.

Sampling procedure

Timina For corn silage, samples could be collected starting one week prior to harvest until four days after harvest. Low CSNTs for 1st year corn can occur even if sufficient N from sod decomposition was available. We recommend CSNT sampling of 2nd or higher year corn only.

Method

The portion of the stalk used for the test is important as the test is calibrated for the nitrates that accumulate in this part of the stalk. First measure up 6 inches from the soil surface and cut the plant. Then measure 8 inches up from this first cut, and make a 2" cut. These cuts result in an 8-inch sample taken from between 6 and 14 inches above the ground (see Figure 1). Make sure not to touch the soil with the corn stalk segment; contamination with soil will impact test results. Split each stalk into four parts by cutting it lengthwise using a clean kitchen knife. Discard

number of plants s (≤15 acres in size should be randomly one sample to be si differing in manage sampled separately more than 15 acres into smaller samplir



Figure 1: Sample an 8 between 6 and 14 inches

Sample submissio Samples can be sto days but should b collection as poss placed in a paper b for some drying to (of mold. See http download a sample

> can be submitted fo Ouiri Nutrient Manac Dept. of Animal S Cornell Univer

Interpretation of Research conducted following interpretat Low = less th Marginal = 25 Optimal = 75(Excess = great

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Agronomy Fact Sheet Series

Fact Sheet 71

Measuring Corn Silage Yield

the multi-agency partnership involved in nutrient management planning in New York allows for added nitrogen fertility for higher yielding corn fields if the farmer: (1) documents individual field vield data for each of the years where yield potential (YP) is adjusted for increased yield and (2) works to manage corn stalk nitrate test (CSNT) results to be below 3,000 ppm. See Agronomy

Factsheets 77 and 78 for more detail. In this factsheet, we focus on methods to determine corn silage yield.

Methods to Determine Corn Silage Yield

Various methods can be used to determine corn silage yield. Examples range from totaling the actual weight determined by running each truck or wagon over a scale, to use of calibrated data from a forage chopper yield monitor, to tallying of loads multiplied by an estimated average load weight, or by using a yield check in a specific area of each field to estimate yield of the entire field. These methods will be discussed briefly.

Yield Check

A representative area in a field can be used to estimate whole field yield. Given spatial variability in many fields, this method is less accurate than measuring all loads off a field. If machine harvest is possible, harvest a chopper-width along the length of a field,

determine net harvest weight, determine the dry matter (DM) content of a subsample (see below), adjust the yield for DM, and divide by the total area harvested. Ideally, three subareas are harvested and measured in this way per field. When hand-harvest is the only option, the

sample area should be at least 40 feet in length and include two or more rows of corn. A subset of a minimum of five plants from this area should be taken to determine the moisture content. There are 43,560 ft² in one acre. If harvest consists of two rows (30 inch row spacing) each 40 feet long, weighing 220

New guidance developed in consultation with | lbs, the fresh silage yield is estimated at 24 tons/acre ([220/2000]/[2*30/12*40/43560]). If the forage sample is 35% dry matter, the yield is 8.4 tons of dry matter per acre (24*0.35). For either approach, it is important to select representative areas within a field.

Total harvest weight from a field

As more farms install truck scales, this option is more viable than in the past. This method, when combined with subsampling to determine the moisture content of the silage at harvest, is the most accurate way to determine yield. The empty and full weight must be recorded for each load from every field harvested. This is most easily done when farm scales are installed at a convenient location, close to the bunks. Subsamples for moisture should be taken a few times over the course of a field harvest. Moisture samples can most easily be taken when silage is dropped off at the bunk (5-6 grab samples per load). Moisture can be determined using a Koster tester, a microwave, or an oven.



figure 1: Subsampling for moisture at the bunk. Inset

The sum of the net load weights per field can be tallied and multiplied by the percent dry matter in the samples from the field, and divided by the number of acres in the field, to determine an accurate per acre DM silage vield. For example: it took 20 trucks to harvest an 8 acre field. The average silage weight per

College of Agriculture and Life Scie

http://nmsp.cals.cornell.edu/guidelines/nutrientguide.html

Breakdown

- Basic information required FIRST
- Risk Assessments
- Crop Needs
- Nutrient Guidelines vs. Actual Rates
- Management during application to avoid losses
- Q&A...



REMINDER: This

ENTIRE process

gets repeated for

EVERY field in the

CNMP

Step 1: Field Information

- Location, size
- Soil type
- Field characteristics
 - Slope, concentrated flows, existing erosion
- Proximity to environmentally sensitive areas & setbacks required
- Soil test
- Cropping history & management
 - Yield, rotation, previous nutrient applications
- Soil, Water, Air, Plants, Animals, Humans, Energy analysis





Soils Analysis Report with Dairy One Nutrient Guidelines

Dairy One 730 Warren Road Ithaca NY 14850 Ph: 800.496.3344 Fax: 607.257.1350 www.dairyone.com

Sample #: 74860100 Date Sampled: Date Received: 2/23/2023 Date Mailed: 2/24/2023

Crop, 3 Years Ago: Crop, 2 Years Ago: Soybeans Crop, Last Year: Corn-Grain Plow Depth: Less than 9 inches Manure: No

Dairy One

arm Name / Client:
Field / Location:
Soil Name:
Acres:
Statement ID:

Fa

													So	il Test L	evels			
Comp	onent		Mehlich 3, ppm Morgan, lbs/acre				Very Lo	Very Low Low			Medium		High	Ver	y High			
Phosp	horus (P)				66.0	6.0 5.9			****	*****							
Potas	sium (K))			1	51.4	268.4			****	*****			***	******			
Calciu	ım (Ca)				1,4	32.0	2,500.0			****	*****							
Magn	agnesium (Mg)			155.8			282.4			****	*******							
	Buffer	Orga	nic	CF	-c	Exch	a Acidity	Nitra	ate-N	Total N	Sol	Salts	Base Saturation Values, %					
рН	рН	Matte	r, %	meq/	100g	me	eq/100g	pp	om	%	mmh	nos/cm	ĸ	Са	Mg	Na	н	Total
6.4	6.2	3.5	5	10).3		1.44						3.8	69.2	12.4	4 0.6	14.0	86.0
Other Nutrients, ppm																		
	N	a	ŀ	AI .	5	S	Zn		I	٧n	In Fe		Cu			В		Мо
	14	.8	89	7.9			2.7	2.7										

Step 2: Nutrient Information

- Types & volumes available
- Nutrient analysis
- Spreader calibration









6.11 % Dry Matter

8.34 Density (lbs per ga

Manure Test Report

Agricultural & Environmental Testing Laboratory and UVM Extension

Description	lbs/wet ton	lbs/1,000 gal	Dry Wt. Basis
			(%)
Total Nitrogen	4.2	17.4	3.41
Ammonium Nitrogen (NH₄-N, part of total)	1.1	4.8	0.94
Organic Nitrogen (part of total)	3.0	12.6	2.48
Phosphorus as P_2O_5	2.0	8.2	1.61
Potassium as K_2O	5.3	21.9	4.30
Calcium	3.3	14.0	2.74
Magnesium	0.9	3.9	0.76
Sodium	0.3	1.1	0.22
Micronutrients			(ppm or mg/kg)
Copper	<0.01	< 0.05	23
Zinc	<0.01	< 0.05	65
Iron	0.14	0.6	1,119
Manganese	<0.01	< 0.05	110
Boron	<0.01	< 0.05	29

Step 3: Risk Assessment

- Soil Loss Revised Universal Soil Loss Equation (RUSLE)
 - Must meet thresholds or 'tolerable' limits
- Phosphorus Runoff Index
- Nitrate Leaching Index

- Environmental Concerns Setbacks
 - Surface water
 - Ground water & wells
 - Plants, wildlife
 - Air

Hydrologic Soil Group (HSG)	Туре	Infiltration capacity/ permeability	Leaching potential	Runoff potential
А	Deep, well-drained sands and gravels.	High	High	Low
В	Moderately drained, moderately fine to moderately coarse texture.	Moderate	Moderate	Moderate
С	Impeding layer, or moderately fine to fine texture.	Low	Low	High
D	Clay soils, soils with high water table.	Very low	Very low	Very high





Phosphorus Runoff Index

National NRCS Code 590

P application shall be consistent with either:

- Agronomic soil test
 - If STP says no P needed, no P can be added
- P threshold
 - If STP > threshold, no more P
- P index risk determination
 - Combine source and transport risk

NY Phosphorus Index



NY-PI 2.0 User's Manual

New York P Runoff Index - Documentation and User's Guide. Third Edition. 2021.

The New York Phosphorus Runoff Index: Version 2.0

User's Manual and Documentation

Karl J. Czymmek^{1,2}, Quirine M. Ketterings³, Mart Ros², Sebastian Cela², Steve Crittenden³, Dale Gates³, Todd Walter⁴, Sara Latessa⁵, Laura Klaiber⁶, Greg Albrecht⁷

¹PRODAIRY, ²Nutriest Management Spear Program (NMSP), Department of Animal Science, Comell University, ³United States Department of Agriculture Natural Resources Conservation Service (USDA-NRCS), ³Department of Biological and Environmental Engineering, Cornell University, ³New York State Department of Environmental Conservation (NYSDEC) ⁴The William H. Miner Agricultural Research Institute, and ³New York State Department of Agriculture and Markets (NYSAGM)

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Cornell University, Ithaca, NY 14853

Documentation and User's Guide:

http://nmsp.cals.cornell.edu/publications

• DAIRY

Education & Applied Research

/extension/NYPI_2_User_Manual.pdf



NY-PI 2.0:

Nutrient

Management

Spear Program

- Released Dec. 2019
- Added to NRCS 590 for NY
- NY CAFO Permit -2022 (2025 implementation)

Cornell University Cooperative Extension

time

Fact Sheet #110

The New York Phosphorus Index 2.0

Introduction

The New York Phosphorus Index (NY-PI) is used to assess relative risk of P loss from crop fields and select appropriate best/beneficial management practices (BMPs) to reduce P runoff. The goals of implementing the NY-PI are to protect clean waterbodies and to reduce P loss to impaired waterbodies, while providing options for recycling manure nutrients. After more than 15 years of field use, the NY-PI has been updated. Here we present the NY-PI as

Agronomy Fact Sheet Series

Determining a NY-PI Score for a Field

· A P drawdown plan is implemented and

tracked which includes annual soil testing

to show that P levels are decreasing over

· Applications are limited to the lesser of 20

Applied material must have attributes that

provide other benefits to crop yield and

therefore increase P removal, such as

supplying irrigation water and/or nitrogen.

Farms should document their whole-farm

nutrient mass balance to ensure that P is

being managed optimally (≤12 lbs P/acre).

Ibs P2O5/acre or 25% of crop removal.

Overall Approach

The original NY-PI used a source × transport approach (see Agronomy Factsheet #10). The NY-PI 2.0 uses a transport × BMP approach, where fields are first scored based on factors that drive transport of P from fields, and scores that cau be lowered by implementation of BMPs that reduce the risk of P transport (Figure 1). The field's soil test P (STP) no longer features directly in the NY-PI 2.0 score, but is used to determine the management implication (Nbased, P-based, or zero P; Table 1).



Step 2: Determining the Raw Transport Score If the STP is ≤ 160 , the NY-PI 2.0 raw scores are calculated, one for dissolved P (DP) and one for particulate P (PP) runoff transport risk. Both P forms are a concern for water quality. Coefficients differ for these two P forms in the vegetated flow distance (VFD), hydrologic soil group (HSG), and erosion categories. The sum of the transport factor coefficients multiplied by 10 determines a field's "raw NY-PI transport scores" before BMPs are selected (Table 2.).

Table 1: Management implication of the NY-D12.0. Plass risk PI solutes P (Carnell Morgani Ibd/arcs) Iow <50 Hbased IN-based [P-based Zero P High 75-99 Pbased Zero P Zero P High 75-99 Pbased Zero P Zero P Zero P High 75-99 Pbased Zero P Zero P Zero P When Cornell crop guidelines call for P above the STP or rate limits in the stabe, P can be added to not exceed land grant guidelines as long as the NY-P12.0. score ± 100 . Step 3: Best/Beneficial Management Practices Once a field's raw NY-PI scores are determined, they can be lowered by selecting BMPs for manure and/or fertilizer P application. The practices are related to method of application and to ground cover and timing of application (Table 3), and include implementation of setbacks, incorporation or injection of manure/fertilizer, and different types of ground cover strategies, such as cover crops, crop

Factsheet:

College of Agriculture and Life Science

http://nmsp.cals.cornell.edu/publications /factsheets/factsheet110.pdf



Dissolved P Both have to be <100 to apply P







Determining a Field NY-PI 2.0 Score

Four steps:

- Step 1: Soil Test P (STP) Screening Tool
- Step 2: Determining the Raw Transport Scores
- Step 3: Best/Beneficial Management Practices (BMPs)
- Step 4: Determine management implications (N-based, P-based, zero)

Additional considerations:

- Adaptive management option (farm with NMBs ≤12 lbs P/acre)
- Incidental P application to fields with STP > 160 lbs P/acre



Determining a Field NY-PI 2.0 Score

Step 1: Soil Test P Screening Tool Cornell Morgan STP >160 lbs P/acre: zero P, regardless of PI score

		Cornell Morgan-extractable soil test P (lbs P/acre)								
PI categories	PI score	< 40	40-100	101-160	> 160					
Low	< 50	N-based	N-based	P-based	Zero P					
Medium	50 to 74	N-based	P-based	Zero P	Zero P					
High	75 to 99	P-based	P-based	Zero P	Zero P					
Very High	≥100	Zero P	Zero P	Zero P	Zero P					





Step 2: Determination of Raw Transport Scores

Dissolved P (DP score) = 10*[FD+VFD_{DP}+FF+HSG_{DP}+CF]

Particulate P (PP score) = 10*[FD+VFD_{PP}+FF+HSG_{PP}+E+CF]

Nutrient

Management

Spear Program





Factor	Option	Coefficient			
Flow distance (FD) to	> 500	0			
stream in ft	301-500	Z	1		
	101-300	E	5		
	≤ 100	3	3		
Vegetated flow	<35 ft	()		
distance (VFD) ¹	≥35 ft	DP: -2	PP: -4		
Flooding frequency	Never	()		
(FF)	Occasionally		2		
	Frequent	ш,	5		
Hydrologic soil group	A	DP: 0	PP: 0		
(HSG)	В	DP: 4	PP: 1		
	С	DP: 6	PP: 3		
	D	DP: 8	PP: 5		
Erosion (E) in	≤ 1.0	()		
ton/acre ²	1.1-3.0	1	L		
	3.1-5.0	3			
	> 5.0	[5		
Concentrated flow	None/treated	0			
(CF)	Present		1		

¹Only for fields with FD \leq 500 ft. ²RUSLE2 A-value (yearly).

16

Step 3: Best/Beneficial Management Practices

Select One from Each List and Multiply BMP Method d Surface predom Surface from th Incorpo waters

score

Application method × Ground cover, timing

Method of application	
Surface spread without setback	1.0
Surface spread with ≥100-ft setback from the field boundary (start of the	0.8
predominant flow path) ¹	
Surface spread with ≥35-ft managed vegetated (sod/harvested) setback	0.7
from the field boundary (start of the predominant flow path) ¹	
Incorporation within 24 h with ≥15-ft setback from down-gradient surface	0.7
waters	
Injection with ≥15-ft setback from down-gradient surface waters	0.5
Ground cover and timing	
Bare ground and more than 2 weeks before planting	1.0
Bare ground and within 2 weeks of planting (in spring)	0.8
Winter-hardy cover crop (fall/winter)	0.8
Whole-plant crop residue (~80% or more ground cover, e.g. corn grain)	0.7
Sod after last cutting (fall/winter)	0.6
Growing sod or row crop/planting green	0.5





¹Only for fields with FD \leq 500 ft.

Implementing the Phosphorus Index 2.0

BMP COEFFICIENTS												
Method of Application								Co	oefficie	ent		
								Sc	en. A	Scen. B	Scen C*	
Surface spread without setback 1.0 1.0 1.0 1.0												
Surface spread with ≥100-f	Surface spread with ≥ 100 -ft setback from the field boundary (start of the 0.8 (0.8) 0.8								0.8			
predominant flow path)												
Surface spread with ≥35-ft	ma	anaged \	/egetate	ed (sod	l/h	arveste	d) setb	ack	0.	7	0.7	0.7
from the field boundary (st	ar	t of the p	oredom	inant f	lov	v path)						
Incorporation within 24 ho	urs	s with ≥1	.5-ft set	back fr	ron	n down [.]	-gradie	nt	0.	7	0.7	0.7
surface waters												
Injection with ≥15-ft setba	ck	from do	wn-grad	dient su	urfa	ace wat	ers		0.	5	0.5	0.5
Ground Cover/Timing	Ground Cover/Timing								\frown			
Bare ground and more that	n 2	weeks k	pefore p	blanting	g				1.	0	1.0	1.0
Bare ground and within 2 v	ve	eks of pla	anting (in sprir	ng)				0.	8	0.8	0.8
Winter-hardy cover crop (f	all,	/winter)							0.	8	0.8	0.8
Whole-plant crop residue (~8	0% or m	ore gro	und co	ve	r, e.g. co	orn gra	in)	0.	7	0.7	0.7
Sod after last cutting (fall/v	win	iter)							0.	6	0.6	0.6
Growing sod or row crop/p	Growing sod or row crop/planting green (0.5) 0.5 0.5							0.5				
Phosphorus Index Score												
Higher Total Transport Score		Method Coefficient Cover/Timing Coefficient						=		P Index Sco	re	
(<u>of</u> DP/PP above)		Scen. A	Scen. B	Scen. C		Scen. A	Scen. B	Scen. C		Scen. A	Scen. B	Scen. C
100	X	x 0.5 0.8 1.0 x 0.5 0.7 1.0								25	56	100

*You have the option to choose three different BMP Scenarios to compare results based on different combinations of BMP's. For example: Scen. A = 100 * 0.5 * 0.5 = 25 Scen. B = 100 * 0.8 * 0.7 = 56 Scen. C = 100 * 1.0 * 1.0 = 100





Determining a Field NY-PI 2.0 Score

Step 4: Determine management implications (N-based, P-based, zero)

		Cornell Morgan-extractable soil test P (lbs P/acre)							
PI categories	PI score	< 40	40-100	101-160	> 160				
Low	< 50	N-based	N-based	P-based	Zero P				
Medium	50 to 74	N-based	P-based	Zero P	Zero P				
High	75 to 99	P-based	P-based	Zero P	Zero P				
Very High	≥100	Zero P	Zero P	Zero P	Zero P				





N-based, P-based or No P?

P-Index Management	What does that mean
N-based	Manure and fertilizer application not to exceed annual nitrogen (N) needs for the crop grown based on the Cornell Nutrient Guidelines.
P-based	Manure and fertilizer P application not to exceed annual P removal with harvest.
Zero P	No manure or P-containing fertilizer.



Nitrate Leaching Index

- Identification of fields with elevated nitrate leaching risk and implementation of beneficial management practices (BMPs) to reduce nitrate loss
- Hydrologic Soil Groups
- Percolation Index and the Seasonal Index
 - **PI**=annual average precipitation and the hydrologic soil group
 - **SI**=annual precipitation and the sum of the fall and winter precipitation at the township level
- >10 = must implement practices
- 2-10 = should implement practices

New York Nitrate Leaching Index

User's Manual and Documentation

Quirine Ketterings¹, Kirsten Workman^{1,2}, Dale Gates³, Josh Hornesky³, Amy Langner³, Sara Latessa⁴, Ron Bush⁵, Brendan Jordan⁵, and Greg Albrecht⁵

¹Nutrient Management Spear Program (NMSP), Department of Animal Science, Cornell University, ²PRODAIRY, ³United States Department of Agriculture Natural Resources Conservation Service (USDA-NRCS), ⁴New York State Department of Environmental Conservation (NYSDEC) ⁵New York State Department of Agriculture and Markets (NYSAGM)

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In conjunction with the Cornell NMSP Advisory Committees

Correct Citation:

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Cornell University, Ithaca, NY 14853



Nitrate Leaching Index - BMPs

- Use Cornell N Guidelines
- Winter cover crops
- Avoid early and pre-plant N
- Utilize enhanced efficiency fertilizers
- Starter n <50 lbs/acre
- Split apply
- Use PSNT to eliminate unneeded side dress
- Minimize fall/winter manure applications
- Don't terminate sod in the fall
- Frost injections



New York Nitrate Leaching Index

User's Manual and Documentation

Quirine Ketterings¹, Kirsten Workman^{1,2}, Dale Gates³, Josh Hornesky³, Amy Langner³, Sara Latessa⁴, Ron Bush⁵, Brendan Jordan⁵, and Greg Albrecht⁵

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Cornell University, Ithaca, NY 14853

Step 4: Determine the nutrient need of the crop

- Which crop are you growing and what is your yield?
- Start with a soil test.
- Determine likelihood of a yield response to fertilizer for P & K
- Nitrogen calculation (not based on a soil test).
- Nutrient recommendations, manure nutrient availability are all based in decades of research on NY farms.



Soil Fertility – Soil Testing and P & K

Soil Fertility – Soil Testing, P & K Fertilization

Table 2.10.1 from 2022 Cornell Guide for Integrated Field Crop Management

	F	hospho	orus Soil Te	est Value	ue ² Potassium Soil Test Value Magnesium Soil Te						īest Value ³				
Soil Management	Very				Very	Very				Very	Very				Very
Group	Low	Low	Medium	High	High	Low	Low	Medium	High	High	Low	Low	Medium	High	High
I	<1	1-3	4-8	9-39	40+	<35	35-64	65-94	95-149	150+	<20	20-65	66-100	101-199	200+
Ш	<1	1-3	4-8	9-39	40+	<40	40-69	70-99	100-164	165+	<20	20-65	66-100	101-199	200+
Ш	<1	1-3	4-8	9-39	40+	<45	45-79	80-119	120-199	200+	<20	20-65	66-100	101-199	200+
IV	<1	1-3	4-8	9-39	40+	<55	55-99	100-149	150-239	240+	<20	20-65	66-100	101-199	200+
V	<1	1-3	4-8	9-39	40+	<60	60-114	115-164	165-269	270+	<20	20-65	66-100	101-199	200+

¹Values are in pounds per acre of soil test extractable nutrient using the Cornell Morgan soil test. Using a different test will add uncertainty to the interpretations and recommendations.

²Soil test phosphorus values differ for winter grains. High is 9-20 lbs P/acre and Very High is 20+ lbs P/acre.

³Magnesium levels shown are for all field crops except birdsfoot trefoil and soybeans. For these two crops, double the values shown above.







Soil Fertility - Lime! Lime! Lime!

Nutrient

Management

Spear Program

- pH management helps with nutrient management
- To know when to apply lime, soil test











A note about Cornell Guidance vs. other agronomic rates

- P-Index governs upper limits for manure application
- Fertility guidelines assume fertilizer use (purchased), so recommendations go to zero if no yield response expected in that year
- There are other benefits to manure beyond P content, which is why P-Index is soil test based and transport based
 - Increases soil carbon, improves soil structure, increases infiltration, reduces erosion
- Those benefits offset environmentally unfriendly purchases of fertilizer
 - Energy intensive production, importing nutrients into the watershed
- Not every pound of P applied (over a recommendation) is a pound lost
- Over 100 STP most and over 160 STP all fields would get cut off through P-Index assessment



A note about Cornell Guidance vs. other agronomic rates

		Cornell Mo	organ-extracta	ble soil test P (lbs P/acre)
PI categories	PI score	< 40	40-100	101-160	> 160
Low	< 50	N-based	N-based	P-based	Zero P
Medium	50 to 74	N-based	P-based	Zero P	Zero P
High	75 to 99	P-based	P-based	Zero P	Zero P
Very High	≥100	Zero P	Zero P	Zero P	Zero P

 Over 100 STP most and over 160 STP all fields would get cut off through P-Index assessment



Corn N Equations

Corn Grain

$$NetN = \frac{(YI_corngrain*A_SoilN_SodN)}{(N_eff/100)} - SoyN_CCN$$

Corn Silage

$$NetN = \frac{(YI_cornsilage*B_SoilN_SodN)}{(N_eff/100)} - SoyN_CCN$$

College of Agriculture and Life Sciences

NetN = the total N (lbs N/acre) from any source for optimum crop production.

YI is the soil and drainage specific yield index. A and B are YI multipliers (Table 6)

SoilN & **SodN** are N (lbs N/acre) from soil organic matter and alfalfa/grass sods

N_eff is the soil type and drainage dependent uptake efficiency (Appendix Table 2)

SoyN and CCN are soybean and cover crop N credits in lbs N/acre

Corn Yield Index Database

Corn Yield Database > Corn Yield Index

- About 230,000 acres of corn yield data were collected, cleaned through 2020
- About half was corn grain, the other half contributed to a new silage database
- ~90% from 2015-2020
- Developed yield distribution histograms for each soil type





Corn Yield Index Database

Corn Yield Database > Corn Yield Index

- Soil types included: ≥ 3 farms, 20 fields,
 250 acres
- Mean: Median ratio between 0.9 and 1.1
- Applying these filters resulted in reliable data for 58 soil types for grain and 66 soil types for silage
- Consensus among consultants: use these data to set new yield potentials for all ~600 soil types ("learn and apply")





New Corn Yield Index Database

Corn Yield Database > Corn Yield Index

Silage: 35% dry matter Grain: 85% dry matter

Name	SMG	D	FF	N_0	eff	N_s	up	YI_corr	ngrain	YI_corr	nsilage	YI_	_alf
				DR	UD	DR	UD	DR	UD	DR	UD	DR	UD
Acton	4	Μ	Rare/None	70	65	65	65	165	160	18.0	17.5	5.5	4.0
Adams	5	W	Rare/None	70	70	40	40	140	140	15.0	15.0	4.5	4.5
Adirondack	4	W	Rare/None	75	75	70	70	110	110	12.0	12.0	4.0	4.0
Adjidaumo	1	Ρ	Frequent	60	55	75	65	155	125	16.5	13.5	3.5	2.5
Adrian	6	V	Rare/None	65	55	120	90	165	105	18.0	11.5	4.0	2.5
Agawam	4	W	Rare/None	75	75	65	65	165	165	18.5	18.5	6.0	6.0
Allendale	3	Ρ	Rare/None	60	55	70	60	150	130	16.0	14.0	3.5	2.5







http://nmsp.cals.cornell.edu/publications/extension/Ndoc2022.pdf

Farms are encouraged to use their own yield data.







Yield Check



Nutrient

Management

Spear Program

- Subareas are harvested along the length of a field
- Determine net harvest weight
- Determine the DM of a subsample

Net Harvest weight x DM Yield = Harvested area 35







Total Harvest Weight





- Record empty and full weight for each load from harvested field
- Subsample to determine the moisture using a Koster tester, a microwave, or an oven

Sum of net load weights forfield x DM

Field acres







Yield =

Yield Monitor System



- Records information on location, mass flow, and moisture content while combine is traveling
- Typically records data every second
- It is very important that yield monitors are calibrated properly



If YI <= 155, use 1.2 If 160-225, use 1.9233-0.0047* If 230 or more, use 0.85	<u>YI</u> Corn Grain	If YI <= 17.0 tons, use 11 If YI 17.5-24.5 tons/acre, use 18.0 If YI 25.0 or more, use 7.7	013-0.4125*YP	orn Silage
Yield (bu/acre at 85% DM)	Α	Yield (tons/acre at 35% DM)	b	
150	1.20	16.0	11.0	
155	1.20	16.5	11.0	
	1.17	17.0	11.0	
	1.15	17.5	10.8	
witiplier. N/unit	1.12	18.0	10.6	
NICITA IB IDS 1	1.10	18.5	10.4	
vield X Ar viela	1.08	19.0	10.2	
¥10 0) / 185	1.05	19.5	10.0	
190	1.03	20.0	9.8	
195	1.01	20.5	9.6	
200	0.98	21.0	9.4	
205	0.96	21.5	9.1	
210	0.94	22.0	8.9	
215	0.91	22.5	8.7	
220	0.89	23.0	8.5	
225	0.87	23.5	8.3	
230	0.85	24.0	8.1	
235	0.85	24.5	7.9	
240	0.85	25.0	7.7	
276	0.85	25.5	7.7	38
Colle 300	0.85	26.0	7.7	

Corn N Equation

Name	SMG	D	FF	N_	eff	N_s	up	YI_corr	ngrain	YI_corr	nsilage	YI_	alf
				DR	UD	DR	UD	DR	UD	DR	UD	DR	UD
Acton	4	Μ	Rare/None	70	65	65	65	165	160	18.0	17.5	5.5	4.0

Yield (tons/acre at 35% DM)	В
16.0	11.0
16.5	11.0
17.0	11.0
17.5	10.8
18.0	10.6

$$\operatorname{Net} N = \frac{18 \times 10.6 - SoilN - SodN}{N_{eff}/100} - SoyN - CCN$$

190 lbs N required for this corn crop...



Soil N Contribution

40 – 80 lbs N/acre is typical in NYS

Name	SMG	D	FF	N_0	eff	N_s	up	YI_corr	ngrain	YI_corr	nsilage	YI_	_alf
				DR	UD	DR	UD	DR	UD	DR	UD	DR	UD
Acton	4	Μ	Rare/None	70	65	65	65	165	160	18.0	17.5	5.5	4.0
Adams	5	W	Rare/None	70	70	40	40	140	140	15.0	15.0	4.5	4.5
Adirondack	4	W	Rare/None	75	75	70	70	110	110	12.0	12.0	4.0	4.0
Adjidaumo	1	Ρ	Frequent	60	55	75	65	155	125	16.5	13.5	3.5	2.5
Adrian	6	V	Rare/None	65	55	120	90	165	105	18.0	11.5	4.0	2.5
Agawam	4	W	Rare/None	75	75	65	65	165	165	18.5	18.5	6.0	6.0
Allendale	3	Ρ	Rare/None	60	55	70	60	150	130	16.0	14.0	3.5	2.5





DAIRY

ducation &



Soil N Contribution

Name	SMG	D	FF	N_	eff	N_s	up	YI_corr	ngrain	YI_cori	nsilage	YI_	alf
				DR	UD	DR	UD	DR	UD	DR	UD	DR	UD
Acton	4	Μ	Rare/None	70	65	65	65	165	160	18.0	17.5	5.5	4.0

Net N =
$$\frac{18 \times 10.6 - 65 - SodN}{N_{eff}/100} - SoyN - CCN$$

190 lbs N required for this corn crop... but 65 lbs coming from Soil OM = 125 lbs



Table 1: Expected nitrogen availability for corn from sods in years following sod turnover.

% legume	Total N pool	Year 1	Year 2	Year 3
		lbs N/a	acre	
0	150	83	18	8
1-25	200	110	24	10
26-50	250	138	30	13
50 or more	300	165	36	15
		1 st Year	2 nd Year	3 rd Year

Corn







Fact Sheet 21

trogen Needs of 1st Year Corn

Corn

Fact Sheet Series

Corn

Corn N Equation

Table 1: Expected nitrogen availability for corn from sods in years following sod turnover.

						% legume	Total N pool	Year 1	Year 2	Year 3
Name	SMG	D	FF	N_	eff			lbs N/a	acre	
				ΠD		0	150	83	18	8
					00	1-25	200	110	24	10
Acton	4	Μ	Rare/None	70	65	26-50	250	138	30	13
						50 or more	300	165	36	15
							500	105	50	15

Net N =
$$\frac{18 \times 10.6 - 65 - 15}{0.7} - SoyN - CCN$$

190 lbs N required for this corn crop...
but 65 lbs coming from Soil OM = 125 lbs
15 lbs from alfalfa sod turned down three years ago = 110 lbs

Soil type is 70% efficient = 160 lbs



Soybean Credits

The optimum economic N rate for corn grown after soybeans in New York can be lowered by 20-30 lbs N/acre (SoyN credits) as compared to corn after

corn



Cornell University Cooperative Extension

Agronomy Fact Sheet Series

Fact Sheet 30

"Soybean N Credits"

Introduction

Soybean acreage has more than doubled in New York State over the last 10 years. In response to high fertilizer prices, growers with soybean-corn rotations are asking about possible nitrogen (N) fertilizer savings for corn after soybean. We reviewed the scientific literature on soybean N fertilizer replacement values and potential causes of differences in N needs for corn after soybean as compared to corn after corn. In this agronomy fact sheet, our findings are summarized and Cornell guidelines are listed.





Figure 1: The optimum N rate for corn after soybean is often lower than for corn after corn. The difference is called the N fertilizer replacement value of soybean for corn.

Terminology

The term "soybean N credit" has been applied to the estimated N savings when corn follows soybean as compared to continuous corn. This term is confusing as N savings for corn after legumes are not necessarily due to N release of the previous crop alone. Two types of rotation effects are identified in the literature:

- N rotation effects
- Effects that can be compensated for with an application of fertilizer N.
- Non-N rotation effects
 - Effects for which an application of fertilizer N is unable to compensate such as:
 - Soybean interruption of pest cycles.
 - Enhanced corn root functioning in the year after soybean (possibly due to soybean root exudates or changes in mycorrhizal fungi communities).
 - Changes in physical soil properties and moisture availability as a result of the year of soybean production.

To avoid confusion, we will use the more general term "N fertilizer replacement value" (NFRV) when talking about differences in optimum N rates for corn after soybean as compared to corn after corn, and use the term "soybean N credits" for direct references to N release from soybean residue.

Findings

- Nitrogen fixation by soybean is often not a major factor in the overall N fertilizer replacement effect of soybean on corn in a soybean-corn rotation.
- Soybean residue decomposes more rapidly than corn residue. This leads to more rapid immobilization and also N mineralization resulting in an earlier N release peak than would be seen for corn after corn.
- Non-N rotation effects can and usually have a positive impact on yield beyond what an



Cover Crop Credits (CCN)

Management Spear Program

- 20-30 lbs winter cereal (after corn)
- **40-50 lbs** for winter cereal interseeded or after cereal grain
- 70-120 lbs for clover
- IF...C:N ratio of the cover crop biomass is less than 25

The Fe	ekes Sca	le of Wh	eat Deve					A A				
1	2	3	4	5	6	7	8	9	10	10.1	10.5	11
One Shoot	Tillering Begins	Tillers Formed	Leaf Sheaths Lengthen	Leaf Sheaths Strongly Erected	First Node of Stem Visible	Second Node Visible	Last Leaf Just Visible	Ligule of Last Leaf Just Visible	In "Boot"	Head Visible	Flowering (Wheat)	Ripening
		Tillering			14	Ste	em Exten	sion		Hea	ding	



Corn N Equation

120 lbs N/acre =
$$\frac{18 \times 10.6 - 65 - 15}{0.7} - 20 - 20$$

190 lbs N required for this corn crop... but 65 lbs coming from Soil OM, 15 lbs from alfalfa sod turned down three years ago = 110 lbs N

Soil type is 70% efficient = 160 lbs N

Subtract 30 lbs for a cover crop = 130 lbs Net N needed for your 18-ton corn silage crop



Step 5: Determine the manure application rate (and/or fertilizer) to meet the crop need

- MUST use a current manure test for each source (or rolling average of the farm/source) that includes the inorganic and organic portions of N, P & K
- Calibrate spreaders so you know you are applying the right rate

6.11 % Dry Matter 8.34 Density (lbs per ga	Agricultural & Environmental Testing Laboratory and UVM Extension							
Description	lbs/wet ton	lbs/1,000 gal	Dry Wt. Basis					
			(%)					
Total Nitrogen	4.2	17.4	3.41					
Ammonium Nitrogen (NH₄-N, part of total)	1.1	4.8	0.94					
Organic Nitrogen (part of total)	3.0	12.6	2.48					
Phosphorus as P_2O_5	2.0	8.2	1.61					
Potassium as K_2O	5.3	21.9	4.30					
Calcium	3.3	14.0	2.74					
Magnesium	0.9	3.9	0.76					
Sodium	0.3	1.1	0.22					
Micronutrients			(ppm or mg/kg)					
Copper	<0.01	< 0.05	23					
Zinc	< 0.01	< 0.05	65					
Iron	0.14	0.6	1,119					
Manganese	< 0.01	< 0.05	110					
Boron	< 0.01	< 0.05	29					

Manure Test Report



Start with Manure



- Nitrogen occurs in two major forms
 - Organic N
 - Behaves like a slow-release nitrogen source with credits over 3 years
 - Inorganic N
 - Behaves like urea and can easily be lost if not incorporated and applied when plants need it





Don't forget to credit previous year's manure N credits (from organic portion of N) 35% liquid/25% solid from THIS YEAR 12% from last year 5% from two years ago 48

Start with Manure

Phosphorus Based

N recommendation = 130 lbs Net N needed for your 18-ton corn silage crop

P Crop removal = 70 lbs P_2O_5 (18 tons/acre x 3.85 lbs P_2O_5 /ton)

Rate/Method	N/Acre Target = 130	P2O5/Acre Target = 70	K2O/Acre Target = 100	Additional N Fertilizer Needed
10,000 injected	135	70	210	0
10,000 incorporated in 1 day	100	70	210	20
10,000 incorporated in 3 days	76	70	210	44
10,000 incorporated in >5 days	35	70	210	85



Start with Manure

Nitrogen Based

N recommendation = 130 lbs Net N needed for your 18-ton corn silage crop

P Crop removal = 70 lbs P_2O_5 (18 tons/acre x 3.85 lbs P_2O_5 /ton)

Rate/Method	N/Acre Target = 130	P2O5/Acre Target = 70	K2O/Acre Target = 100	Acres covered by 1,000,000 gal
10,000 injected	135	70	210	100 acres
13,000 incorporated in 1 day	127	105	314	67 acres
17,000 incorporated in 3 days	129	119	357	59 acres







Step 6: Management of actual applications

- Follow the plan
 - Rate, timing, method (by source)
- Check the weather...and record it
- Winter & Wet Weather Guidance
- Groundwater Guidance
- Keep records





Winter & Wet Weather Guidelines

- If Wet...significant precipitation or snowmelt forecast
- If Winter...soil frozen >4", snow cover >4", surface icing
- Low risk fields identified ahead of time
 - No history of runoff, groundwater issues
 - Limited surface connections to streams/ditches
 - Mild slopes
 - No concentrated flows
 - No karst/shallow soil features
 - High crop residue and surface roughness
- Emergency fields identified ahead of time
 - Same as above +...300 feet away from water features, accessible, not prone to flooding
- BMPs used
 - Inject, incorporate, reduced rates, increased setbacks, groundcover, spread out applications





Animal Science Publication Series No. 245

Revised winter and wet weather manure spreading guidelines to reduce water contamination risk

December 2015

Karl Czymmek¹, Larry Geohring², Quirine Ketterings¹, Peter Wright³, Todd Walter², Greg Albrecht⁴, Jacqueline Lendrum⁵ and Angus Eaton⁵

¹Department of Animal Science; ²Department of Biological and Environmental Engineering, Cornell University; ³Department of Animal Science and formerly New York Natural Resources Conservation Service (NY-NRCS); ⁴New York State Department of Agriculture and Markets (NYS-DAM), and ⁵New York State Department of Environmental Conservation (NYS-DEC)

Groundwater Guidelines

- CNMP must identify sensitive soil types
- Follow winter/wet weather guidelines <u>AND</u>
 - Inject/incorporate same day
 - 100-foot setbacks from wells/springs
 - If Karst features (sinkholes, exposed bedrock), 35-foot vegetative buffer and 100-foot setbacks from entry points

Groundwater Protection Guidelines for Agriculture

10-28-2021

Quirine M. Ketterings¹, Greg Albrecht², Dale Gates³, Ron Bush², Brendan Jordan², Mary Kerstetter³, and Sara Latessa⁴

¹Nutrient Management Spear Program (NMSP), Department of Animal Science, Cornell University, ²New York State Department of Agriculture and Markets (NYSAGM), ³United States Department of Agriculture Natural Resources Conservation Service (USDA-NRCS), ⁴New York State Department of Environmental Conservation (NYSDEC)



In conjunction with the Cornell NMSP Advisory Committees

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Cornell University, Ithaca, NY 14853



How do we avoid spreading in winter & wet weather and maximize nutrient efficiency in manure?





Camillus neighbors protest

proposed manure pit

NOT \$\$ BIG BUSINESS

otect

by: <u>Madison Moore</u> Posted: Jul 26, 2022 / 09:58 PM EDT Updated: Jul 26, 2022 / 11:08 PM EDT

LOCAL NEWS

Let's Chat

- Questions
- Scenarios
- Challenges
- Concerns







Thoughts? Questions? Kirsten C. Workman Senior Extension Associate Nutrient Management & Environmental Sustainability Specialist <u>kw566@cornell.edu</u> 607-255-4890

> <u>http://nmsp.cals.cornell.edu/</u> <u>https://cals.cornell.edu/pro-dairy</u>



College of Agriculture and Life Sciences



Nutrient Management Spear Program



