Northern NY Agricultural Development Program
2020 Project Report

Roll-Out of the New York Phosphorus Index 2.0 Across Northern New York Farms

Project Leader:

Quirine M. Ketterings, Ph.D., Cornell Nutrient Management Spear Program (NMSP), 323 Morrison Hall, Department of Animal Science, Cornell University.

Collaborators:

- Nutrient Management Planners: Eric Beaver and Mike Contessa; Champlain Valley Agronomics, Peru, NY
- Miner Institute: Laura Klaiber, MS, Nutrient Management Researcher
- Cornell NMSP staff: Martin Battaglia; PRODAIRY: Karl Czymmek
- Five Northern New York dairy farms

Background:

The New York Phosphorus Index (NY-PI) is used to score fields based on their risk of phosphorus (P) loss so that high-risk areas can be identified. Over the last four years (2017-2020) we developed and evaluated a new phosphorus index for New York (NY-PI 2.0) in collaboration with certified nutrient management planners, farmers, state agencies, hydrology specialists at Cornell University, and colleagues in similar positions at other universities in the Northeast and Mid-Atlantic Regions. The new NY-PI, released in December 2019, reflects advancement of knowledge over the past fifteen years, as well as challenges that were identified since the release of the first NY-PI in 2001.

Like the original index, the NY-PI 2.0 is designed to estimate the relative risk of phosphorus runoff from agricultural fields. It rates fields for relative risk of particulate and dissolved P runoff and triggers managerial changes designed to reduce P runoff risk. In the new approach, farm fields are first scored based on their inherent risk of P transport (derived from individual landscape-based factors such as soil erodibility, soil drainage, field distance to a stream, etc.). It then promotes use of best/beneficial management practices (BMPs) for manure application through use of a BMP crediting system (i.e., raw transport-based PI scores can be reduced if BMPs are implemented). This is called the ***transport × BMP approach*** (in contrast to the source

× transport approach of the orginal NY-PI). Soil test P serves as a classification tool (Table 1), which may also be used to quickly identify high-risk areas (fields with STP >160 lbs/acre).

The NY-PI 2.0 aims to incentivize evaluation of field STP levels to ensure these levels stay in the optimum range. For fields with STP <160 lbs/acre, the NY-PI 2.0 first assesses risk of runoff (potential for P transport from the field) based on field attributes. The result of the assessment is a "raw score" (prior to BMP selection). The raw score can then be reduced by implementation of BMPs selected from options related to (1) P application method, and (2) ground coverage/timing.

In addition to being more intuitive than the original NY-PI and incentivizing BMP implementation on higher risk fields, the transport × BMP approach of the NY-PI 2.0 has the advantage of also being easily adapted to the development of new nutrient management practices. This approach also allows for easier use and comparison across state boundaries.

Table 1. Manure management implications in the NY-PI 2.0, based on a transport × BMP score, and Morgan soil test P values.

		Morgan soil test P (lbs/acre)			
Inherent P loss risk	NY-PI score	< 40	40-100	101-160	≥ 160
Low	< 50	N-based	N-based	P-based	Zero
Medium	50 to 74	N-based	P-based	Zero	Zero
High	75 to 99	P-based	P-based	Zero	Zero
Very high	≥ 100	Zero	Zero	Zero	Zero

In 2020 we focused our work on evaluation of impact of BMP implementation on manure management decision for individual field and whole farms for five Northern New York farms and development of software tools to evaluate impact of BMP implementation on PI scores and ability to land-apply manure. We also developed extension materials for planners, extension and district offices, certified crop advisors and planners, and agriculture and animal science students.

Methods:

The first evaluation step for the new NY-PI is the ranking of fields on the farm in terms of relative risk of P transport under the most risky manure management scenario (surface application without incorporation, without a growing crop for row crops, and without setbacks; i.e. "raw scores"). The second step is evaluation of BMP options for farms (feasibility for specific farm fields, effectiveness in improving P balances and reducing risk of P loss). We were only able to complete one day of field visits in Northern NY during the summer of 2020 due to COVID-19 restrictions but were able to work remotely on data for five Northern NY farms, in collaboration with Champlain Valley Agronomics.

Results:

Extension Documents and Tool Development

The NY-PI 2.0 manual was written and made available to planners. A new fact sheet was developed to explain the structure of the NY-PI 2.0 and we updated the fact sheet on P removal. A standalone NY-PI calculator was developed for evaluation of a limited number of fields. This calculator was shared with CNMP planners and made available at the NMSP NY-PI website and

reporting functions were added to Cropware to allow for comparison of NY-PI 1.0 and 2.0 guidance on land application of manure and P fertilizer. Software advancements made it possible to evaluate BMP scenarios both at the single field level and at the whole farm level.

Whole Farm Evaluations

All corn acres and hay acres were evaluated for various manure application BMPs with two years of data supplied by five Northern NY dairy farms. Because the number of options in the NY-PI 2.0 is quite large, we focused on a subset of BMPs represented in Table 2. Scenario 1 reflected the landbase available for manure spreading and P fertilizer application without implementation of any manure or fertilizer BMPs. Scenario 8 respresented available landbase when manure is injected for all fields with use of winter-hardy cover crops for the row cropped field (corn) or in growing sods (for all hay fields) (Figure 1).

The results show that farms vary in raw (pre-BMP) PI 2.0 scores, with on average (across farms and years) the incentive to implement BMPs on 46% of the acres. With the implementation of BMPs, increasingly more land became available for application of manure (Table 3). These analyses show opportunity to open up fields for manure spreading with implementation of BMPs that are commonly practiced (scenarios 4 and 6) in Northern NY and the opportunity to further reduce application restrictions with implementation of manure injection.

Table 2: Best/beneficial management practices (BMP) scenarios utilized to assess NY-PI 2.0 management implications across five in northwestern New York.

Scenario	Method of application (A)	Ground cover and timing (B)	A	B	BMP
			Coefficient		
1 (row)	Surface spread no setback	Bare ground, >2 wk before planting	1.0	1.0	1.00
1 (sod)	Surface spread no setback	Sod after last cutting (fall/winter)	1.0	0.6	0.60
2 (row)	Surface spread no setback	Bare ground, >2 wk before planting	1.0	1.0	1.00
2 (sod)	Surface spread no setback	Growing sod/row crop/planting green	1.0	0.5	0.50
3 (row)	Surface spread, 100 ft. setback	Bare ground, >2 wk before planting	0.8	1.0	0.80
3 (sod)	Surface spread, 35 ft. setback	Growing sod/row crop/planting green	0.7	0.5	0.35
4 (row)	Surface spread, 35 ft. setback	Bare ground, >2 wk before planting	0.7	1.0	0.70
4 (sod)	Surface spread, 35 ft. setback	Growing sod/row crop/planting green	0.7	0.5	0.35
5 (row)	Incorporation in 1 d, 15 ft. setback	Bare ground, >2 wk before planting	0.7	1.0	0.70
5 (sod)	Surface spread no setback	Sod after last cutting (fall/winter)	1.0	0.6	0.60
6 (row)	Incorporation in 1 d, 15 ft. setback	Bare ground, >2 wk before planting	0.7	1.0	0.70
6 (sod)	Surface spread, no setback	Growing sod/row crop/planting green	1.0	0.5	0.50
7 (row)	Injection, 15 ft. setback	Bare ground, >2 wk before planting	0.5	1.0	0.50
7 (sod)	Injection, 15 ft. setback	Growing sod/row crop/planting green	0.5	0.5	0.25
8 (row)	Injection, 15 ft. setback	Winter-hardy cover crop (fall/winter)	0.5	0.8	0.40
8 (sod)	Injection, 15 ft. setback	Growing sod/row crop/planting green	0.5	0.5	0.25

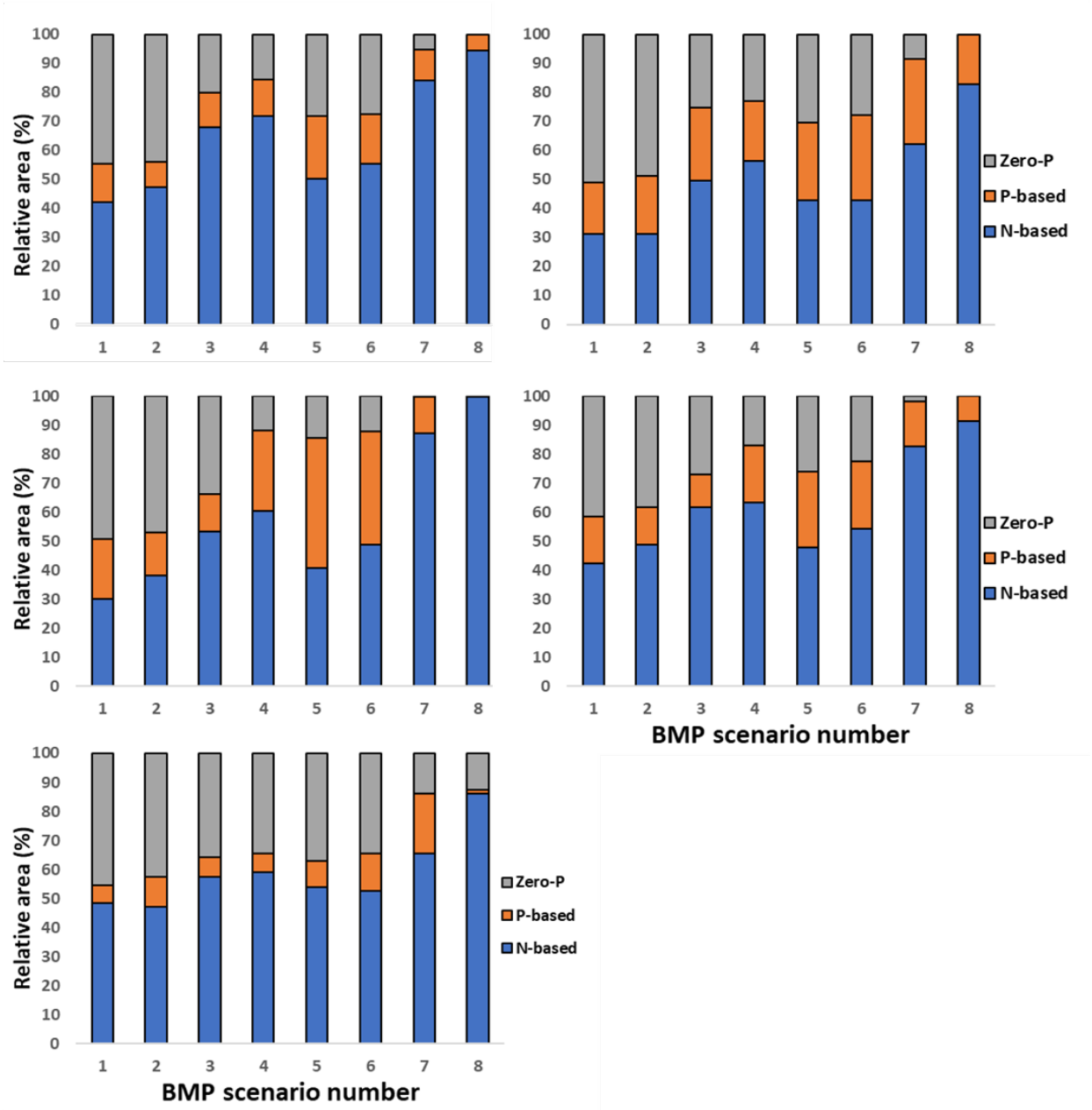

Figure 1: The impact of different management scenarios in the relative area available for N-based, P-based and Zero-P manure application in corn and hay rotations across five farms in NNY in 2019/2020. Scenarios are described in Table 2 and include implementation of BMPs for both row crops and sod crops.

Table 3: Percent of all farm acres available for manure speading across five farms, as impacted by BMP implementation (scenarios described in Table 2).

Scenario	N-based limits	P-based limits	Zero-P
1	39	15	46
4	62	17	21
6	51	24	25
8	91	7	3

Farm 1

Farm 2

Conclusions/Outcomes/Impacts:

The analyses of the five farms show that the NY-PI 2.0 is incentivizing BMP implementation for fields with the greatest risk of P runoff and is allowing farmers to open up considerably more fields for manure application with implementation of BMPs.

Outreach:

New/updated fact sheets:

- Fact Sheet #110: The New York Phosphorus Index 2.0: http://nmsp.cals.cornell.edu/publications/factsheets/factsheet110.pdf
- Fact Sheet #28: Phosphorus Removal by Field Crops: http://nmsp.cals.cornell.edu/publications/factsheets/factsheet28.pdf

Software tools:

- Standalone PI calculator: http://nmsp.cals.cornell.edu/software/pindex.html
- Incorporated NY-PI into Cropware.net: http://farminfotech.com/cropware.htm

Extension Articles:

- Czymmek, K.J., Q.M. Ketterings (2020). A new New York Phosphorus Index: Part 2: How the P index works. E-Leader. PRODAIRY.
- Czymmek, K.J., Q.M. Ketterings, M. Ros, S. Cela, S. Crittenden, D. Gates, T. Walter, S. Latessa, G. Albrecht (2020). New York Phosphorus Index 2.0. What's Cropping Up? 30:5-6.
- Czymmek, K.J., Q.M. Ketterings, M.B.H. Ros, S. Cela, S. Crittenden, D. Gates, T. Walter, S. Latessa, L. Klaiber, G.L. Albrecht (2020). The New York Phosphorus Runoff Index 2.0. User's Manual and Documentation. Cornell University, Ithaca NY.

Next Steps:

We will continue to evaluate if any changes in coefficients are needed across the soil types and management scenarios of relevance to NNY farmers before the NY-PI 2.0 is fully incorporated for use under the New York State CAFO Permit.

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For More Information:

Quirine M. Ketterings, Cornell Nutrient Management Spear Program (NMSP), Department of Animal Science, Cornell University, qmk2@cornell.edu, 607-255-3061, http://nmsp.cals.cornell.edu.