A New and More Intuitive Structure for the New York Phosphorus Index

Sebastian Cela, Quirine M. Ketterings*, Karl J. Czymmek, and Stephen Crittenden

*Nutrient Management Spear Program, Department of Animal Science, Cornell University, Ithaca, NY. *Contact email: qmk2@cornell.edu*

INTRODUCTION

Phosphorus indices (PIs) are being evaluated across the US for their ability to rank fields based on their relative P loss risk. Feedback from nutrient management planners and analyses of field data suggested opportunities for improvement to the New York Phosphorus Index (NY PI). **Here we propose an alternative structure for the NY PI**.

FEEDBACK FROM NEW YORK NUTRIENT MANAGEMENT PLANNERS

Certified nutrient management planners (CNMP) in New York were surveyed to obtain their recommendations for improvements to the NY PI[1]. Planners were positive about the current NY PI but suggested:

- improvements to more strongly **encourage manure incorporation and injection** and **discourage application of manure under conditions of high potential P loss**.
- the addition of cover crop use to the list of **best management practices (BMPs)** (Table 1).

Table 1. Survey results of NY nutrient management planners.

NY PI should encourage	% of planners	NY PI should discourage	% of planners
Manure applications		**Manure applications**	
with incorporation	58	to frozen or saturated soils	61
to fields without connectivity	28	to fields close to streams	44
at lower rates	19	without incorporation	36
Credit BMPs		to fields with steep slopes	19
cover crops	39	to fields without crops	14
setbacks and buffers	36	at high rates	22

PROPOSAL FOR A REVISED NEW YORK PHOSPHORUS INDEX STRUCTURE

A modified structure of the NY PI is proposed (Table 2). The new NY PI:

- uses soil test P (STP) as an application cutoff (40 lb Morgan P/acre fertilizer application cutoff for agronomic response).
- determines the relative **inherent P transport risk** of each field based on field landscape and soil characteristics and assuming "worst case scenario" for manure addition.
- determines annual maximum P application rate based on the inherent transport risk (N based, P based, no application).
- incentivizes **implementation of BMPs** to reduce a field's NY PI score.

Table 2. Annual rate of manure or fertilizer that can be applied based on the field's inherent P transport risk and soil test P levels.

| Inherent P transport risk | New NY PI score | Morgan soil test P (lb P/acre) | | |
		< 40	40 to y	> y
Low	< 50	N based	N based	Zero
Medium	50 to 74	N based	P based	Zero
High	75 to 99	P based	P based	Zero
Very high	≥ 100	Zero	Zero	Zero

Concentrated Animal Feeding Operation (CAFO) permit and other guidelines will regulate manure applications to frozen, snow covered, and saturated fields.

MODIFICATIONS TO NEW YORK PHOSPHORUS INDEX PARAMETERS

- Transport factors are as in the current NY PI: flow distance (FD), flooding frequency (FF), soil erosion (SE), soil drainage class (DC), and untreated concentrated flow (CF) (Table 3).
- Two additional transport factors were added subsurface drainage (SD) and vegetated buffers (VB) (Table 3, in red).
- Best management practices, identified as desirable and effective in reducing runoff risk, are "credit factors" that lower the PI score and might, as a result, allow for manure application where otherwise not possible or only possible a P-based rates.
- The inherent transport risk is calculated as:

Particulate PI = (FD + FF + SE + CF + VB) x 10 x BMP

Dissolved PI = (FD + FF + DC + CF + SD + VB) x 10 x BMP

MODIFICATIONS TO NEW YORK PHOSPHORUS INDEX PARAMETERS

Table 3. Coefficients proposed for transport factor levels.

Transport Factor	Level	Coefficient
Flow distance to water body (FD) *(feet)*	> 300	6
	100 to 300	9
	< 100	12
Flooding frequency (FF)	Never	0
	Occasional	2
	Frequent	5
Soil erosion *(ton/acre)* (SE)	< 1	0
	1 to 3	1
	3 to 5	3
	> 5	5
Soil drainage class (DC)	Well	0
	Moderately well	2
	Somewhat poor	4
	Poor	8
Untreated concentrated flow (CF)	No	0
	Yes	4
Subsurface drainage (SD)	Random	1
	Pattern	2
Vegetated buffer (VB)	Absent	0
	Present	-4

BEST MANAGEMENT PRACTISES

Best management practices (Table 4) are designed to:

- motivate farmers to implement practices that reduce P loss.
- reduce a field's inherent transport NY PI score and hence lower risk of P loss.
- include manure application methods, ground cover, and setbacks.

Table 4. Coefficients proposed for best management practices.

Method of application	Coefficient
Surface spread without setback	1.0
Surface spread with 100-foot setback	0.8
Incorporation (within 24 hours and 15-foot setback)	0.6
Injection (with 15-foot setback)	0.5
Ground cover	
Row crop stubble outside 1-2 weeks of planting	1.0
Row crop stubble within 1-2 weeks of planting	0.8
Dormant sod or cover crop after corn harvest	0.8
Growing sod or row crop	0.6

NEXT STEPS

A review process is ongoing with NY and PA partners. Feedback from stakeholders including planners, state government and NRCS representatives in NY, and PA partners in the USDA-CIG Chesapeake Bay Watershed P evaluation project has been and will continue to be incorporated in the coming months. A database of more than 33 000 real fields in New York with PI data was collected and will be used to evaluate the potential impacts of any modifications to the NY PI. In addition, modeling efforts are underway to evaluate relative runoff risk of the various manure management practices of relevance to dairies in NY and PA.

ACKNOWLEDGEMENTS AND CONTACT INFORMATION

REFERENCE

[1]Cela, S., Q. Ketterings, K. Czymmek, J. Weld, D. Beegle, and P. Kleinman. Nutrient management planners' feedback on New York and Pennsylvania phosphorus indices. Journal of Soil Water Conservation (in press).