



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 2.0.

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 then can 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 (N-based, P-based, or zero P; Table 1).

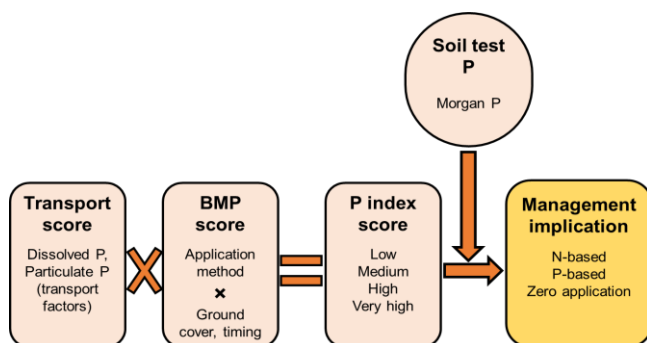


Figure 1: The NY-PI 2.0 has a transport × BMP approach.

Table 1: Management implication of the NY-PI 2.0.

P-loss risk	PI score	Management implication ¹			
		Soil test P (Cornell Morgan; lbs/acre)			
		<40	40-100	101-160	>160
Low	<50	N-based	N-based	P-based	Zero P
Medium	50-74	N-based	P-based	Zero P	Zero P
High	75-99	P-based	P-based	Zero P	Zero P
Very high	≥100	Zero P	Zero P	Zero P	Zero P

¹When Cornell crop guidelines call for P above the STP or rate limits in this table, P can be added to not exceed land grant guidelines as long as the NY-PI 2.0 score ≤100.

Determining a NY-PI Score for a Field

Step 1: Soil Test P Screening Tool

Fields with a Cornell Morgan STP greater than 160 lbs/acre are generally restricted from P application, regardless of the PI score, because they are well above the crop response range (Table 1). Incidental P applications with treated effluent or a very dilute source may occur to fields with STP exceeding 160 lbs/acre given all of the following criteria are met:

- The NY-PI 2.0 score for the field is <100.
- A P drawdown plan is implemented and tracked, which includes annual soil testing to show that P levels are decreasing over time.
- Applications are limited to the lesser of 20 lbs P₂O₅/acre or 25% of crop removal.
- 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).

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).

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

residues and sod. The multiplication of raw scores and BMP scores gives the final NY-PI 2.0 scores for DP and PP. The final NY-PI 2.0 score of a field is then determined by the *greater* of the DP and PP scores after BMP selection. Both scores must be below 100 for P to be applied.

Table 2: The raw NY-PI transport score of a field consists of two scores, one for dissolved P (DP score = $10 * [FD + VFD_{DP} + FF + HSG_{DP} + CF]$) and one for particulate P (PP score = $10 * [FD + VFD_{PP} + FF + HSG_{PP} + E + CF]$).

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

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

Table 3: Manure and fertilizer best/beneficial management practices (BMPs) and coefficients used in the NY-PI 2.0.

Method of application	Coefficient
Surface spread without setback	1.0
Surface spread with ≥100-ft setback from the field boundary (start of the predominant flow path) ¹	0.8
Surface spread with ≥35-ft managed vegetated (sod/harvested) setback from the field boundary (start of the predominant flow path) ¹	0.7
Incorporation within 24 h with ≥15-ft setback from down-gradient surface waters	0.7
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

¹ Only for fields with FD ≤ 500 ft. Setbacks are within field boundaries.

Adaptive Management Approach

Farms with a whole-farm P balance (3-year running average) ≤12 lbs P/acre meet the feasible P balance threshold established for New York dairies (see Agronomy Factsheets 25 and 85). For these farms, on fields with STP ≤100 lbs/acre, manure application can shift from P-

based to N-based rates, as long as the selected BMPs to get to the (initial) P-based score are implemented (Table 4). This adaptive management option in the NY-PI 2.0 is designed to help improve whole-farm P management by rewarding excellent farm-wide P management.

Table 4: Adjusted management implication of the NY-PI 2.0 for farms with a whole farm P balance (3-year running average) at or below 12 lbs P/acre.

P-loss risk	PI score	Management implication			
		Soil test P (Cornell Morgan; lbs/acre)			
		< 40	40-100	101-160	> 160
Low	< 50	N-based	N-based	P-based	Zero P
Medium	50-74	N-based	N-based	Zero P	Zero P
High	75-99	N-based	N-based	Zero P	Zero P
Very high	≥ 100	Zero P	Zero P	Zero P	Zero P

In Summary

The NY-PI 2.0 uses a transport × BMP approach. It is designed to assess relative risk of potential P loss from crop fields and to incentivize appropriate BMP implementation to reduce P runoff. Scores for DP and PP loss potential are combined with STP to determine the management implication for a field: (1) manure and/or fertilizer may be applied at N-based rates; (2) application rates are limited to expected P removal with harvest; or (3) zero P application. The NY-PI 2.0 provides a pathway for farms with an adequate land base to reduce risk *and* apply manure nutrients generated on the farm.

Additional Resources:

- NY Phosphorus Index User Manual and Documentation: nmsp.cals.cornell.edu/publications/extension/NYPI_2_User_Manual.pdf.

Disclaimer

This fact sheet reflects the current (and past) authors' best effort to interpret a complex body of scientific research, and to translate this into practical management options. Following the guidance provided in this fact sheet does not assure compliance with any applicable law, rule, regulation or standard, or the achievement of discharge levels from agricultural land.

For more information

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