

The state of New York's phosphorus balance

Statewide phosphorus balances show New York farmers have responded to phosphorus concerns over the past decade

By Quirine Ketterings, Karl Czymmek and Sheryl Swink

New York producers have done an excellent job of improving phosphorus (P) management over time, according to a statewide and county-based cropland phosphorus balance assessment. Last year New York joined other states in the Mid-Atlantic Region Water Program to conduct the assessment, using data from the USDA Census of Agriculture for 1987, 1992, 1997 and 2002 and other data sources.

Basically, a statewide balance is the difference between the total amount of P in manure (manure P) and fertilizer (fertilizer P) used to produce crops and the amount of P taken up by the crops grown (crop P) on all the state's cropland, whether or not it received manure or fertilizer. This is the formula to compute P balance: $P \text{ balance} = \text{manure P} + \text{fertilizer P} - \text{crop P}$.

The P balance is useful to answer some important questions:

- Are there large-scale or regional nutrient imbalances?
- How serious is the imbalance?
- What potential strategies could effectively address any imbalance?

The goal is to avoid systematic P excesses and deficiencies. Both can have environmental and economic impacts on the long-term sustainability of Northeast animal feeding operations. Where P balances are negative, nutrients in the soil get depleted over time, resulting in nutrient deficiencies and declines in crop yields and quality. Where nutrient imports substantially exceed exports, nutrient losses to the environment increase.

Understanding nutrients

Each nutrient reacts a little differently. For example, nitrogen (N) imbalances tend to be seasonal. In our humid cli-

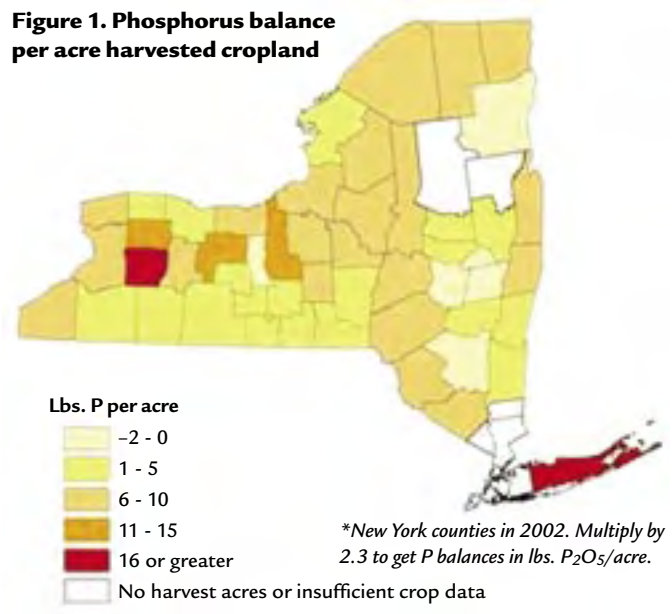
mate, N in nitrate form present in the soil after the last harvest of an annual crop like corn silage is generally lost during late fall, winter and early spring.

P behaves differently. Any not lost through run-off or leaching will be held in the soil, leading to increases in the soil-test P level over time. There are two main factors influencing the risk of P loss:

1. Day-to-day manure and fertilizer management – how and when it's applied determines if P will react with the soil or move to surface waters.
2. Long-term buildup in the soil. The statewide P balance assessment looks at this buildup and gives a rough measure of P loss risk. More P is lost from soil as soil-test P levels increase beyond what is needed for crop production because the soil is less able to hold onto additional P.

A statewide P balance assessment can help evaluate the potential for strategies to manage nutrients effectively. It's also a useful tool to determine the impact of current farm and watershed man-

Figure 1. Phosphorus balance per acre harvested cropland



FYI

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■ For more details on the cropland phosphorus assessment, see the full report from the Nutrient Management Spear Program website: <http://nmsp.css.cornell.edu/publications/articles/extension/Pbalance2006.pdf>

■ For results from the Mid-Atlantic region, see this website: <http://mawaterquality.agecon.vt.edu/default.html>

agement practices.

For example, many government programs that address nonpoint source pollution from animal feeding operations focus on promoting land-based best management practices (BMPs). These are likely to be more effective where nutrients are somewhat in balance. But where nutrient inputs far exceed crop removal, changing application timing or method isn't likely to be very effective at reducing nutrient losses to the environment. A statewide P balance can help us to begin to evaluate what steps may need to be taken.

P balance findings

The cropland P balance assessment showed:

- Statewide, P inputs in fertilizer and manure exceeded crop removal by +28.1 million pounds of P (+7.2 lbs P or +16.5 lbs P₂O₅ per harvested acre) in 2002. Not surprising for New York, dairies accounted for most of the manure P. Corn silage and grain, hay, and alfalfa accounted for more than 90% of all P removed by or stored in crops.

- Six counties had negative balances: Schoharie, Ulster, Essex, Schenectady, Seneca and Albany. The other 45 counties with sufficient data had positive, or excess, P balances. (Figure 1)

Negative balances aren't sustainable, nor do we strive for zero balances. We will never be able to achieve 100% nutrient-use efficiency. But excess P balances point to the need to monitor and manage soil-test P levels over time.

- On a statewide basis, and also for many counties, the amount of P in manure and in crop removal tended to balance. For example, at the state level the amount of P in manure was 46 million pounds while P in crops amounted to 46.5 million pounds.

Several Mid-Atlantic states observed similar trends. While manure P is not pound for pound immediately available to crops, the balance between manure P and crop removal suggests opportunities to manage manure more effectively. A modest amount of P fertilizer would be required if, in a perfect world, manure could be distributed better over cropland acreage.

- The overall per acre P balance for New York was substantially lower than for the Mid-Atlantic states. This is likely due to differences in agricultural industries. In New York, dairy farming dominates with a fairly low statewide animal density of 0.41 animal units per acre. Delaware, Maryland, Virginia, West Virginia and Pennsylvania have sizeable poultry or hog industries with more limited land resources and larger feed imports. This results in higher animal densities and greater P

imbalances than in New York.

- Farms have made great progress. The amount of fertilizer P used statewide on New York farms decreased from 56.6 million pounds in 1992 to 35.1 million pounds in 1997 and 28.1 million pounds in 2002. This decline contributed to reduced overall P balances in 2002 as compared to earlier years. (Figure 2)

- Our manure P assessment of 46 million pounds of P in 2002 is based on an estimated manure P excretion of 62 pounds P per milking cow per year. The Mid-Atlantic states estimated that this was representative of the past 20 years. Though we used that number to be consistent with the study's procedure, the actual amount of manure P in New York in 2002 could be several million pounds lower.

Two factors support the likelihood that New York farms have made even more progress than the study shows: Many dairies have reduced ration P levels over the last few years and a number of manure samples show fairly low levels of P.

We will monitor statewide and county P balances for the next census year. But so far results of the statewide assessments point to three goals for further work:

1. Improve understanding of a sustainable balance at state and farm levels.
2. Improve understanding of the causes of nutrient imbalances for all agricultural sectors and at state and farm levels.
3. Develop economically and environmentally sound solutions to unsustainable imbalances that include nutrient source reduction and manure nutrient export. ■

Figure 2. Phosphorus balances in pounds of P₂O₅/acre cropland, New York

