

CROP NUTRITION

By Sheryl Swink, Quirine Ketterings,
Karl Czymmek and Larry Chase

Precision feeding and soil-test based P fertilization have greatly reduced cropland phosphorus balances

Dairies improve P management

Congratulations to New York State farmers: They have worked hard over the past several years to protect the environment and manage costs by reducing phosphorus (P) use in animal diets and crop fertilizers. They have reduced phosphorus applied per year to crop fields through manure and fertilizer by millions of pounds. These results are confirmed by a recently completed assessment of state, regional and county-level cropland P balances for New York State. The assessment looked at the change in statewide P balances from 1987 through 2006.

A few years ago, the Mid-Atlantic Regional Water Program conducted a study of statewide P balances over time. We used the same methods to calculate New York State's P balance. A statewide P balance is based on the amount of fertilizer P purchased plus the amount of manure P generated by the dairy and livestock on farms minus the P in harvested crops.

Based on agricultural statistics from New York State and the USDA, along with a sound industry knowledge base, the P balance study shows:

- Producers used at least 58 million fewer pounds fertilizer P equivalent (P_2O_5) in 2006 than in 1987.
- This represents a more than 50% decrease in use of fertilizer P between 1987 and 2006.
- Statewide P balance was reduced from +13.8 pounds of P per acre (+31.6 pounds of P_2O_5 per acre) in 1987 to +7.2 pounds P per acre (+16.5 pounds of P_2O_5 per acre) in 2002. It dropped to an estimated +1.5 pounds of P per acre (+3.4 pounds of P_2O_5 per acre) in 2006.
- Yields of major crops remained high or increased over this period. Silage and grain corn yields reached record highs in years 2003 to 2006.

Why is the improved P balance so important? When less P is placed into the environment, that much less is prone to environmental loss. Since dairy farmers often have built up fertility levels over time

through manure applications, many of their fields had the greatest opportunity to reduce P fertilizer purchases.

The reductions do not stop at fertilizer. Most dairy farms have made significant changes to ration P levels, resulting in a decrease in P excretion. It dropped from around 60 pounds of P per cow per year in 1987 to an estimated 40 pounds of P excretion per cow per year now. With more than 600,000 mature dairy cows currently in New York State, that's a huge reduction in manure P, equal to 24 million pounds of fertilizer P per year.

Taken together, these reductions confirm:

- Agriculture, in general, and dairy, in particular, are taking huge steps toward protecting the environment.
- These steps bode well for long-term sustainability of the state's dairy farms.

FYI

■ Sheryl Swink is a research aid with the Cornell Nutrient Management Spear Program, Quirine Ketterings is director of the program, Karl Czymmek is a specialist with PRO-DAIRY and Larry Chase, an animal science professor at Cornell.

■ The authors thank William Nastyn, assistant director of the Division of Plant Industry, New York State Department of Agriculture and Markets, and David L. Terry, coordinator of the Fertilizer Regulatory Program, University of Kentucky in Lexington, for assistance with fertilizer sales data.

■ A USDA Conservation Innovation Grant funded the P balance study.

■ For more information, contact Quirine Ketterings at 607-255-3061. Email: qmk2@cornell.edu.

■ See the Nutrient Management Spear Program website at: <http://nmssp.css.cornell.edu/cornell.edu>

Dairies improve P management
continued from page 20

Determining P balances

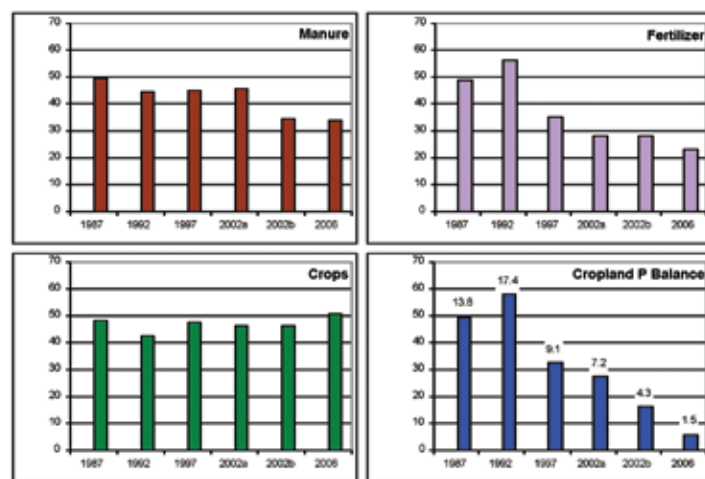
Cropland phosphorus (P) balances are the difference between major P inputs – manure and fertilizer – and outputs – harvested crops. To conduct the assessment of P balances in New York State, researchers employed the approach used in the Mid-Atlantic Regional Water Program: $P \text{ balance} = \text{Manure P} + \text{Fertilizer P} - \text{Crop P}$.

State and county P balances were derived for U.S. Census of Agriculture years 1987, 1992, 1997 and 2002. The census supplied state and county animal population data, crop yields and acreage, and cropland use.

The P balances were developed to quantify P accumulation and to derive general trends in cropland P loadings over time. However, these are partial balances because of the inability to accurately determine all P inputs and outputs for cropland.

P balances shouldn't be equated to annual P losses. A higher P balance may indicate greater P loss potential, but actual P losses depend on such factors as within-farm distribution of P, landscape patterns, soil resources and management, and climate or weather patterns.

Figure 1. Total amount of phosphorus in manure (top left), fertilizer (top right), harvested crops (bottom left) and the statewide P balance (bottom right).



The 1987-2002a cropland P balances assume a P excretion of 62 pounds P per cow per year. Improved herd nutrition was taken into account in the assessments of 2002b and 2006. The P balance per acre of cropland is indicated above the bar for each year and was estimated to be +1.5 pounds P per acre in 2006.

Can shallow manure incorporation conserve ammonia N? continued from page 19

of soil information before each plot received its targeted manure application rate of 8,000 to 10,000 gallons per acre along with its designated treatment. This included soil fertility analysis, compaction readings and surface residue measurements.

Seed-bed preparation and corn planting took place a minimum of five days after spreading to allow for complete volatilization of ammonia-N from the plots that received surface-applied manure without incorporation. At planting, fields received no more than 30 pounds N per acre in the starter, and no sidedress N was applied.

Each field was sampled three more times throughout the season: at planting, sidedress time and harvest. Soil moisture measurements were included at each of these sampling times. Both the Illinois Soil N Test (ISNT) and the Presidedress Nitrogen Test (PSNT) were run on samples taken at sidedress time.

Eight of the 10 sites were harvested for silage; the remaining two were grain corn sites. At harvest we collected data on yield and samples for forage quality, and the Late Season Stalk Nitrate Test and samples are currently being analyzed. The same trials will be repeated in 2009.

These data will help to determine the agronomic, economic and environmental benefits of shallow incorporation. The information collected in the next two years will help the Cornell Nutrient Management Spear Program to develop guidance for farmers on manure management practices that are compatible with reduced tillage systems and provide a relatively cheap solution in times of cost and price uncertainty. ■

Field trial yields well

Dan Chambers, who operates a 700-cow dairy in Heuvelton, N.Y., enrolled a strip of his 2,000 acres of cropland for the manure incorporation study last year. It allowed him to see how incorporating manure using an Aerway compares to his current practices of chisel plowing or field cultivating.

Chambers just received the 2008 results from the trial on his dairy and learned the chisel and Aerway incorporation treatments both resulted in 19.4 tons per acre silage yield. That's 2 tons per acre more than yields from the plots with manure surface-applied and not incorporated.

"The trial showed that the Aerway gives the same results as field cultivating, but there's a 2-ton difference between incorporating and not incorporating manure," Chambers says. "We're definitely going to look at Aerway and how it would fit on our dairy. We're looking at the horsepower requirements for the Aerway vs. the field cultivator."

In the trial, the Aerway was easier to pull, Chambers says, but that might be because it was just 12 feet, and he had ample horsepower for that size implement.



Dan Chambers, Heuvelton, N.Y., participated in the manure incorporation trial last year. Both chisel and Aerway incorporation yielded 2 more tons of corn per acre than not incorporating manure.

Chambers is converting his manure application operation to a drag line, and that may give him further impetus to look at incorporation options.

Chambers doesn't hesitate to participate in research trials. "I learn from them," he says. "I get new information."

Even better, he can see how different tools, such as an Aerway, and cutting edge technologies perform without having to make a huge investment. "They (Researchers) bring in tools that I couldn't justify buying," Chambers says.