Ketterings, Q.M., J.E. Kahabka, W.S. Reid (2004). The Phosphorus Fertility Status of New York Agricultural Land. What's Cropping Up? 14(5): 3-6.

The Phosphorus Fertility Status of New York Agricultural Land

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Introduction

In New York State (NYS), an estimated 7.6 million acres equaling 25% of the total land area in the state were in agricultural production in 2002. For the long-term sustainability of NYS agriculture, it is important to maintain and increase farm profitability while protecting the environment. To evaluate crop fertilizer and manure management monitoring of soil test phosphorus (P) levels is important as P losses are known to increase with soil test P level. Our objectives were to determine at state and within-state regional scale: 1) the current status of P fertility, and 2) trends over time.

Methods and Materials

Three datasets were obtained:

- A set with 119,326 soil samples submitted to the Cornell Nutrient Analysis Laboratory in the period 1995-2001. This dataset contained fertility data for samples originating from commercial agriculture.
- A dataset of over 10,000 samples obtained in 2000-2001 from farms working with Agricultural Consulting Services Inc. (ACS).
- The complete soil test records for 30 dairy farms. Farms ranged in size from 319 to 2458 acres and were located in 14 different New York counties.

New York State was divided into regions using two different classifications: 1) the current Natural Resources Conservation Service (NRCS) classification (Figure 1), and 2) the Lathwell and Scott classification with eight major geographic farming regions (Figure 2). The latter allowed us to compare current within-state P distributions with those observed in 1957-1958. Soil sample results were analyzed for each of the regions and compared with current data.

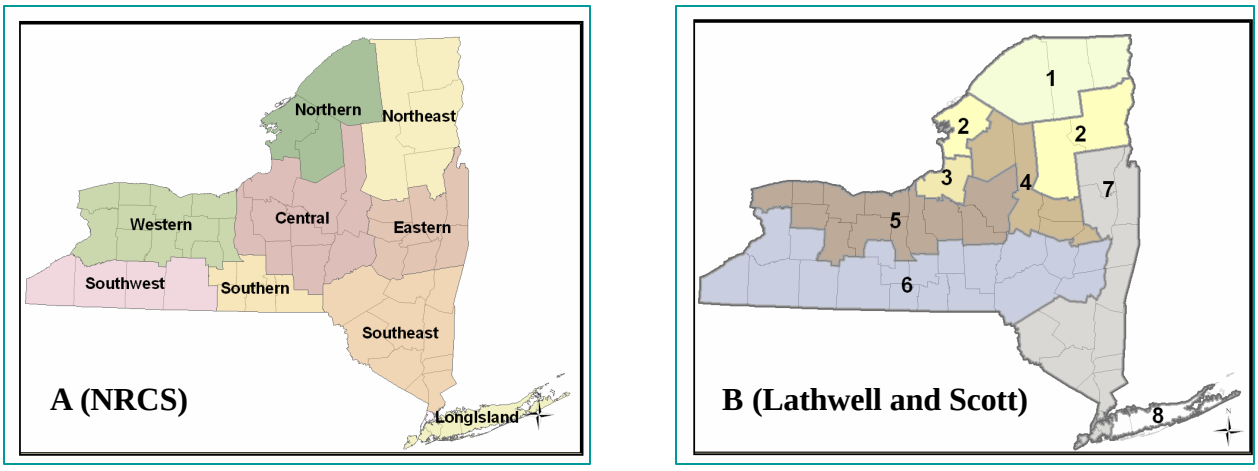

Figure 1: County regions according to NRCS (A) and Lathwell and Scott (B). NRCS defines nine geographic regions that were used to document the current soil P fertility status. The Lathwell and Scott classification was used to determine within-state regional trends in phosphorus fertility status over the past 40 years.

Results and Discussion

Statewide assessment

The 1995-2001 dataset identified 28% of the samples submitted to CNAL as very low or low in available P (less than 4 lbs P/acre on the Morgan test), 25% as medium in P (4-8 lbs P/acre), 37% as high (9-39 lbs P/acre) and 10% as very high (40 lbs P/acre or more). Thus, 47% of all samples in the database were high or very high in P. The ACS Inc. dataset dating from 2000-2001, showed 44% of all samples to be high or very high in P. The 30 farm dataset showed a similar distribution: 47% of the fields and 49% of the acres testing high or very high in P. These results suggest a lack of a bias in the origin/history of samples submitted to Cornell University.

Within-state regional assessment

High and very high P sites were regionally distributed, identifying areas of high intensity dairy and vegetable agriculture. Of the 8 NRCS regions, the region with the highest P levels was Long Island where almost 87% of all samples tested high or very high in P. This is dominated by Suffolk County where nursery and greenhouse crops, vegetables and potatoes are the most important crop and large and frequent P fertilizer applications to these crops are not uncommon. NRCS regions with 45-60% of the samples testing high or very high in P included northeastern, western, central, southern, and southeastern regions where 36-46% of the samples tested high in P, while 9-14% of the samples were very high in P. Regions with less than 40% testing high or very high in P included northern, eastern, and southwestern New York. In these regions, 31-33% fell into the high P category while 3-8% of the soils were classified as very high in P.

State and within-state regional trends over time

Comparing data summarized in 1961, 1979, 1981, 1983 and from 1995-2001 (the soil extraction method remained the same although equipment was updated over time), we see comparable data in 1957-58 and 1977-78 but a steady increase in soil test P levels from 1977-78 when 26% of the samples tested high or very high to 47% currently (Figure 2). This increase was observed in all eight regions classified by Lathwell and Scott in 1961 with the largest increases occurring in the Northern NYS region (more than 2-fold increase in percentage of samples testing high or very high in P in 40 years). The intensification of crop production, long-term P imbalances on dairy and livestock farms, and high P fertilizer rates on the vegetable farms could explain steady increases in soil test P levels. This increase in soil test P also increases environmental risk.

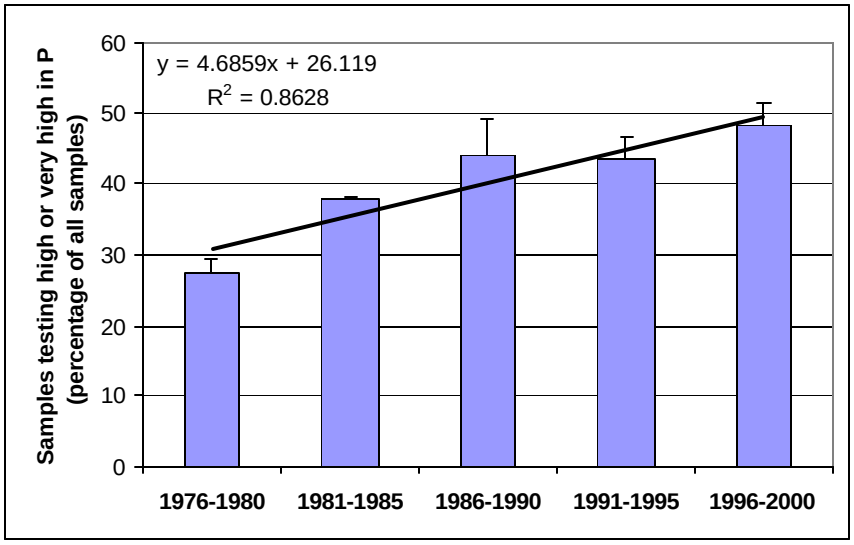

Figure 2: Past and current records show an increase in the percentage of soils testing high or very high in P over time. Levels were very stable from 1957 to 1979.

County assessment

The soil test P distributions for the top ten dairy, potato and cabbage producing counties in New York State are listed in Table 1. This table shows that 5 of the top 10 dairy counties had a greater percentage of soils testing high or very high in P than the state average, while for the potato and cabbage producing counties, 7 and 6 of the 10 counties showed elevated P levels, respectively.

Table 1: Distribution of phosphorus soil test levels for the top ten New York State counties for production of milk, potato and cabbage.

		Distribution of field among soil test phosphorus classifications				
	No. of samples	Very Low + Low	Medium	High	Very High	High+ Very High
Top 10 Milk Producing Counties						
Genesee	2,572	11.9	20.1	53.0	15.0	68.0
Livingston	3,038	15.7	20.9	46.9	16.5	63.4
Wyoming	10,170	20.2	22.9	47.0	9.9	56.9
Cayuga	4,030	18.4	26.5	44.8	10.3	55.1
Washington	1,977	26.8	25.6	35.2	12.4	47.6
Madison	2,444	34.7	24.9	32.0	8.4	40.4
Jefferson	2,526	32.1	29.2	33.5	5.2	38.7
Lewis	2,070	33.4	29.0	33.3	4.3	37.6
St. Lawrence	4,323	39.5	25.6	30.7	4.2	34.9
Chautauqua	5,726	43.1	27.8	27.8	1.3	29.1
Top 10 Potato Producing Counties						
Suffolk	1,533	6.6	6.9	25.9	60.6	86.5
Genesee	2,572	11.9	20.1	53.0	15.0	68.0
Livingston	3,038	15.7	20.9	46.9	16.5	63.4
Oswego	833	26.2	16.7	29.1	28.0	57.1
Wyoming	10,170	20.2	22.9	47.0	9.9	56.9
Orleans	1,223	17.3	26.0	50.6	6.1	56.7
Erie	2,756	28.2	23.2	40.9	7.7	48.6
Wayne	1,297	30.5	23.7	33.5	12.3	45.8
Steuben	1,824	33.3	25.9	35.4	5.4	40.8
Franklin	1,956	30.2	31.4	35.4	3.0	38.4
Top 10 Cabbage Producing Counties						
Suffolk	1,533	6.6	6.9	25.9	60.6	86.5
Ontario	2,244	9.4	13.5	58.7	18.4	77.1
Genesee	2,572	11.9	20.1	53.0	15.0	68.0
Monroe	793	11.5	24.2	53.1	11.2	64.3
Orleans	1,223	17.3	26.0	50.6	6.1	56.7
Erie	2,756	28.2	23.2	40.9	7.7	48.6
Yates	1,733	24.7	28.2	36.8	10.3	47.1
Wayne	1,297	30.5	23.7	33.5	12.3	45.8
Onondaga	4,149	28.0	29.8	35.6	6.6	42.2
Niagara	1,049	29.4	29.9	36.0	4.7	40.7
State Total	*119,326*	*27.7*	*24.9*	*37.3*	*10.1*	*47.4*

Figure 3 shows the counties with less than 25% (white), between 25 and 50% (gray), and more than 50% (black) of the samples in the high or very high P categories. One may ask: are these results biased for small or large fields or fields? To answer this question, we compared the distribution of high and very high P fields per total number of fields with the distribution expressed as percentage of the total acreage of arable land for thirty New York State dairy farms. The results showed very similar P distributions suggesting that our estimates of the percentage of fields testing high or very high in P at state, within-state regional level, and at county-levels may be reliable indicators of the total acreage testing high or very high in phosphorus.

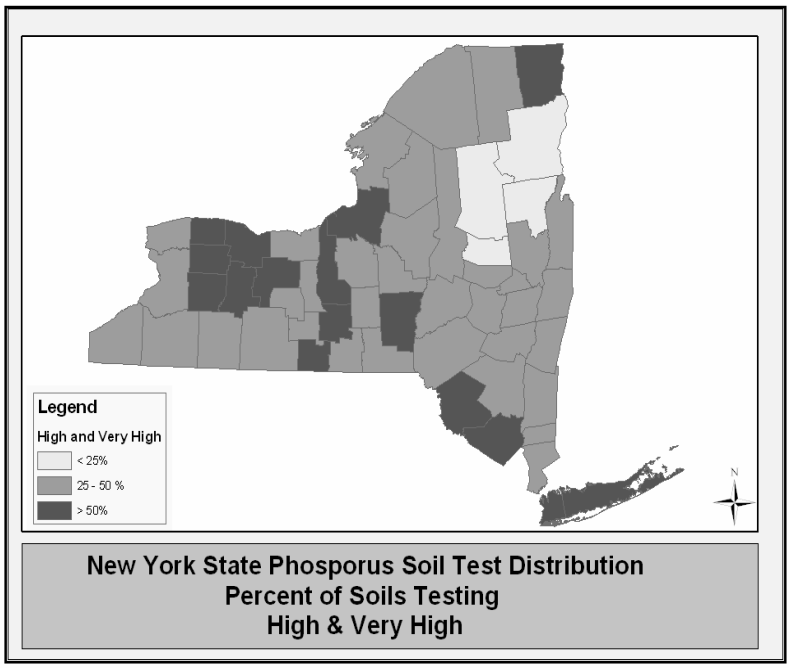

Figure 3: Counties with more than 50% of the samples in the high or very high P categories are colored dark.

Summary and Conclusions

In the past forty years New York State has seen an increase in the percentage of fields testing high and very high for phosphorus. Given the current soil fertility distribution in the state (28% testing very low or low, 25% medium, and 47% high and very high which is above the agronomic optimum), fertilizer P use could be limited to small starter or top-dress applications for almost half of the field crop acreage in the state. As these soils reach progressively higher P levels they may require more attentive management to minimize environmental impacts.

Acknowledgments and for Further Information

This project was funded with grants from the Northern New York Agricultural Development Program and a 319 non-point source pollution grant from the Department of Agriculture and Markets. For further information contact Quirine M. Ketterings at (607) 255 3061 or qmk2@cornell.edu.

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A collaboration among the Department of Crop and Soil Sciences, Pro-Dairy, and Cornell Cooperative Extension.