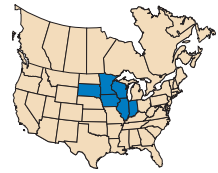

Northcentral Soil Test Summary: Changes in Phosphorus and Potassium

By Scott Murrell

Shifts in median soil test levels for phosphorus (P) and potassium (K) in the Northcentral states from 2001 to 2005 were minor, even though most state nutrient budgets were negative.

Median soil test P and K levels and their changes from 2001 to 2005 are shown in **Table 1**. Across the region, little change occurred in soil test P. Median levels in 2005 were -4 to +3 parts per million (ppm) of what they were in 2001. Frequency distributions of soil test P trended downward in Indiana and upward in South Dakota. Median levels of soil test K tended to be higher in 2005 for the four eastern-most states in the region, but only the Illinois shift was significant.

To aid in the interpretation of changing soil test levels from 2001 to 2005, cumulative nutrient budgets were calculated from 2001 to 2004 for each state (**Table 2**). Yields of field crops, vegetable crops, and fruit and nut crops reported by the USDA National Agricultural Statistics Service were converted to nutrient removal rates, based on published sources. All crops were considered for each state. Manure additions reported by the USDA Natural Resources Conservation Service (Kellogg et al., 2000) were used for the 2001-2004 time period. Fertilizer use was that reported by the Association of American Plant Food Control Officials and The Fertilizer Institute (TFI). Budgets were calculated by subtracting nutrient additions from nutrient removal. Negative budgets therefore indicate that removal rates exceed those of nutrient additions. In addition, removal to use ratios were calculated.

Phosphorus budgets for the 2001-2004 time period were negative for all states, whether or not manure additions were considered (**Table 2**). The negative budgets were not correlated to changes in soil test P levels from 2001 to 2005 (**Table 3**).

Potassium budgets during the years 2001 to 2004 were negative for all states except Indiana and, when manure was considered, Illinois (**Table 2**).

Across the six states in the Northcentral Region, median soil test K levels generally went up when K budgets were positive or not as greatly negative (**Table 3** and **Figure 1**). Averaged across states in the Northcentral Region, the data in **Figure 1** show that balanced nutrient

Table 1. Comparing results from the 2001 and 2005 summaries: shifts in median soil test levels and statistical significance of the shift in soil test distributions.

State	Number of samples	Median P, ppm 2005	Median P, ppm Change	Median K, ppm 2005	Median K, ppm Change	Sign. of dist. change[1] P	Sign. of dist. change[1] K
IL	509,000	36	0	178	29	NS	0.08
IN	163,000	29	-4	144	16	0.25	NS
IA	356,000	25	0	172	20	NS	NS
MN	104,000	18	2	156	-2	NS	NS
SD	34,000	14	3	268	-10	0.11	NS
WI	131,000	39	-2	125	14	NS	NS

[1] Based on Chi Square analysis; NS = probability of years being the same >0.25.

Table 2. Cumulative nutrient budgets for 2001 to 2004.

State	Fertilizer – removal		Fertilizer + manure – removal	
	P_2O_5	K_2O	P_2O_5	K_2O
	million lb			
IL	-1,831	-291	-1,523	101
IN	-664	370	-300	742
IA	-2,143	-1,785	-1,207	-625
MN	-1,302	-3,328	-522	-2,432
SD	-352	-2,577	-124	-2,289
WI	-1,059	-1,839	-543	-951

budgets tended to produce increases in state median soil test levels while negative budgets were needed to maintain them. However, both Wisconsin and Iowa showed numerical increases in median soil test K levels with negative K budgets. These findings, like those for P, indicate that negative budgets don't necessarily result in measurable decreases in median soil test K levels in the short term.

Soil test K levels, more than those for P, are sensitive to environmental conditions during sampling. How soil test levels change depends on many factors, some of the most important of which are soil mineralogy and wetting and drying cycles. For this reason, precipitation data from the National Oceanographic and Atmospheric Association were examined. During the fall sampling period (September through November) of 2000, moisture was near normal, with only two states, Indiana and South Dakota, being above normal. In the fall of 2004, Wisconsin and Iowa had near-normal precipitation, but all other states were above or much above normal, indicating that the fall in 2004 was generally

Table 3. Correlation between cumulative nutrient budgets and changes in median soil test levels, 2001 to 2004.

	P change	Sign.*	K change	Sign.*
Fertilizer - removal	-0.013	NS	0.737	0.10
(Fertilizer + manure) - removal	0.024	NS	0.845	0.03

*Probability that the correlation is due to chance alone; NS = probability >0.25.

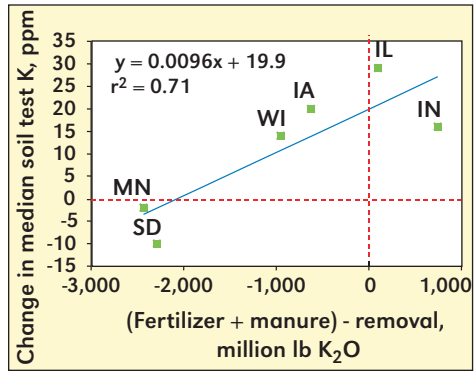

Figure 1. Relationship between cumulative K budgets and changes in median K levels from 2001 to 2004.

wetter than that in 2000. During the 2001 spring sampling season (March through May), Indiana and Illinois were drier than normal, but all other states in the Northcentral region were above and much above normal. During the same time period in 2005, Illinois, Indiana, and Wisconsin were much drier than normal, Iowa was near normal, and Minnesota and South Dakota were above normal. Thus, the spring of 2005 was generally drier than that of 2001 in the Northcentral region. How these precipitation differences affect soil test K is not well known, but it should be recognized that significant differences did exist in precipitation between the two soil test monitoring years.

In addition to weather-induced changes in soil test levels, crop roots can access non-soil test extractable forms of P and K in surface soils and subsoils that lead to short-term buffering of soil test levels. Shifts in sampling times, tillage systems, and cultural practices may also cloud the relationship between nutrient budgets and soil test level changes. BC

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Reference

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