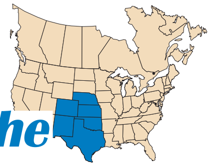

Soil Test Levels and Changes in the Southern and Central Great Plains Region

By Mike Stewart

The most recent (2005) PPI soil test summary for the six states in the Southern and Central Great Plains Region (SCGP) shows that median soil pH, phosphorus (P, Bray P-1 equivalent), and potassium (K, ammonium acetate) levels range from 6.1 to 7.9, 17 to 26 parts per million (ppm), and 150 to 364 ppm, respectively. Change in median levels of soil P in the region from the 2001 to the 2005 summaries varied from 1 to -5 ppm, while median soil K level decreased for each state except Nebraska. Comparison of frequency distributions between the 2001 and 2005 summaries suggests that for most states there has been some depletion of P in soils around the critical level, with a resulting shift to lower levels. Comparison also indicates that the luxury of naturally high soil K levels in the region is being slowly eroded.

The 2005 PPI soil test summary effort determined the distribution and median values of soil pH, P, and K in the SCGP Region. The majority of samples (54%) analyzed in the region are alkaline (pH ≥ 7).

Figure 1 shows the relative frequency (RF) distribution of soil pH by state. Colorado and New Mexico have the highest proportion of samples above pH 8. They also have the highest median pH values among the states, 7.6 and 7.9, respectively (**Table 1**). The percent of samples testing pH 7 or above is 90% in Colorado and 99% in New Mexico. These are the region's westernmost states and are thus less subject to weathering and the development of acid conditions. The eastern portions of Kansas, Nebraska, Oklahoma, and Texas receive the highest rainfall in the region and consequently have somewhat different RF distributions (**Figure 1**) and lower median soil pH values (**Table 1**). The median pH value for Texas is relatively alkaline (7.4) and the majority of soils tested above pH 7 (68%). Oklahoma has the highest percentage of acid soils...only 36% tested above pH 7.

Soil test P RF distribution among

Table 1. Median values for soil pH, P, and K from the 2001 and 2005 soil test summaries. The last column is the difference or change in median values (2005 minus 2001).

	Median		Change from
	2005	2001	2001 to 2005
	---------- Soil pH ----------		
Colorado	7.6	7.4	0.2
Kansas	6.8	6.8	0
Nebraska	6.4	6.3	0.1
New Mexico	7.9	7.9	0
Oklahoma	6.1	6.1	0
Texas	7.4	7.5	-0.1
	--- Bray P-1 equivalent, ppm P ---		
Colorado	26	25	1
Kansas	21	20	1
Nebraska	22	21	1
New Mexico	17	21	-4
Oklahoma	19	20	-1
Texas	18	23	-5
	- Ammonium acetate equivalent, ppm K -		
Colorado	328	348	-20
Kansas	294	332	-38
Nebraska	364	362	2
New Mexico	229	247	-18
Oklahoma	150	164	-14
Texas	221	232	-11

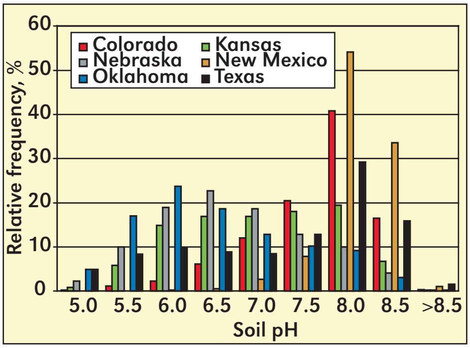

Figure 1. Relative frequency distribution of soil pH from the 2005 PPI soil test summary in the six states of the SCGP.

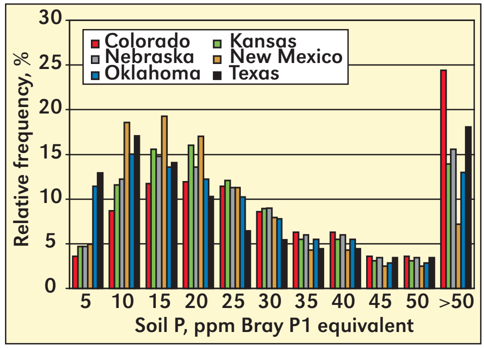

Figure 2. Relative frequency distribution of soil P level from the 2005 PPI soil test summary in the six states of the SCGP.

states in the SCGP generally follows a skewed or log normal distribution (**Figure 2**) that is typical and expected. This distribution is characterized by a peak in the lower ranges with a long "tail" as ranges or values increase. The highest RF range (>50 ppm P) appears to show a large increase. However, this can be misleading since it contains all values above 50 ppm. If the lower range increments (5 ppm P) were maintained through the absolute highest P value measured, we would observe a very long and gradually tapering "tail"...keep this in mind when reviewing the RF figures. Median soil test P values in the SCGP states ranged from 17 to 26 ppm Bray P-1 equivalent **(Table 1)**.

Median soil K levels in the region are relatively high (**Table 1**), with values ranging from 150 to 364 ppm K (ammonium acetate equivalent). More than 60% of soils in all states except Oklahoma test over 160 ppm K (level commonly considered high). Only 46% of samples tested over 160 ppm K in Oklahoma. This is all reflected in the soil K RF distribution shown in **Figure 3**. Depending on crop and conditions, response to P and K fertilizer in the higher soil test ranges is possible and has been demonstrated in recent and ongoing research within the SCGP (see Gordon, BC No. 2, 2005, p. 8-10).

Changes from 2001 Summary

This is the second PPI summary where detailed distributions and medians of soil test pH, P, and K have been evaluated. It is the first summary in the history of our efforts where an evaluation of changes across time in RF distribution is possible.

There was practically no change in median soil pH from 2001 to 2005 among states in the SCGP (**Table 1**). Most of the region is characterized by soils with relatively high buffer capacity.

Change in median levels of soil P in the region varied from 1 to -5 ppm (**Table 1**). Colorado, Kansas, Nebraska, and Oklahoma showed relatively small changes in median soil P level. New Mexico and Texas median P levels changed substantially, by -4 and -5 ppm P, respectively.

To further investigate soil P dynamics in the region from 2001 to the present, sum-

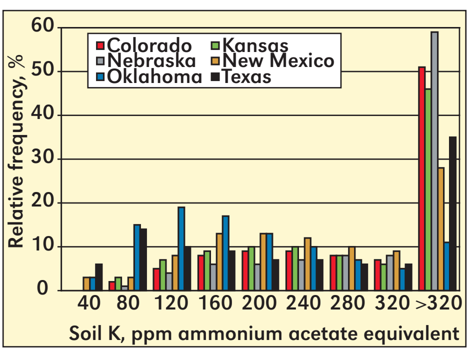

Figure 3. Relative frequency distribution of soil K level from the 2005 PPI soil test summary in the six states of the SCGP.

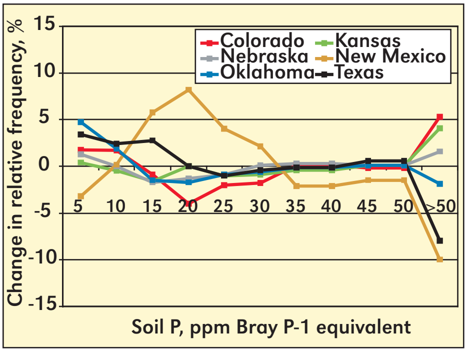

Figure 4. Difference in distribution of soil P level in the six states of the SCGP between the 2001 and 2005 PPI soil test summaries (i.e., 2005 minus 2001).

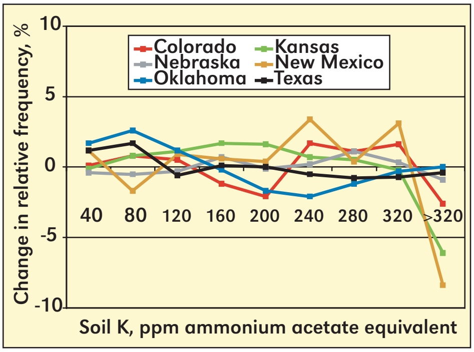

Figure 5. Difference in distribution of soil K level in the six states of the SCGP between the 2001 and 2005 PPI soil test summaries (i.e., 2005 minus 2001).

mary differences in RF within the ranges evaluated have been calculated (**Figure 4**). Notice that the general trend for New Mexico is fairly erratic. This is likely a reflection of the relatively low sample numbers from New Mexico in both summaries. Because of this, statements and conclusions concerning RF trends and differences in New Mexico will be avoided. The remaining five states showed increases in the RF in the lowest soil test P category (<5 ppm P) and decreases in RF around the critical level (20 to 25 ppm) from 2001 to 2005. This suggests that there has been some depletion of P in soils that were around the critical level with a resulting shift to lower levels. Texas had the largest increase in samples below 20 ppm P, which partially explains the large decrease in median P level from 2001 to the current summary. There was very little change in P levels from 30 to 50 ppm P among states between the two summaries. However, above 50 ppm P there was substantial difference among states with Colorado, Kansas, and Nebraska, showing increases in the RF of samples above 50 ppm and Texas and Oklahoma showing decreases. The increase in the highest range in the three states (CO, KS, and NE) is likely attributable to nutrient management planning requirements around confined animal feeding operations. But the reason for the large decrease in Texas is not clear.

Median soil K level decreased for each state except Nebraska (**Table 1**). This is reasonable since all states in the region have negative K budgets (i.e., more K removed than applied as fertilizer). An explanation for the lack of significant change in median K level in Nebraska is not immediately apparent since it is not consistent with the relatively large negative K budget for that state.

The change in RF distribution in soil K is shown in **Figure 5**. New Mexico will again be omitted from this discussion because of low sample numbers. There was very little change in RF distribution of K in Nebraska. The remainder of the states (CO, KS, OK, and TX) showed increases in the RF of samples below 160 ppm and corresponding decreases in those above. Much of the production area in the SCGP receives relatively little K fertilizer because of inherently high soil K levels. The change in RF distribution between summaries and the median value declines suggest that the luxury of naturally high K levels is being slowly eroded, and provides further evidence that the historic negative K budgets for the states in the region are not sustainable over the long-term. BC

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