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Oklahoma Agriculture Soil Test Summary 2002-2003

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An accurate evaluation of soil fertility levels for an individual county or a whole state is necessary for estimating nutrient needs, tracking changes in soil pH and nutrient levels, and serving as a guideline for manure application. The Oklahoma Cooperative Extension Service's Soil, Water and Forage Analytical Laboratory analyzes soil samples and archives testing results for all 77 Oklahoma counties. A statewide and county summary of all agricultural soil samples is made every 4 to 5 years. The summary from 2000 to 2003 consists of 40,200 samples and is presented in Table 1 and Table 2. A similar summary from 1994 to 1999 was made and published in CR-2247. All the identifiable lawn, garden and research samples were excluded in the summary since most of them do not represent the real situation in agricultural fields. Soil samples were analyzed for pH, buffer index (BI) if pH was less than 6.3, nitrate-nitrogen (NO_3-N, lbs/A), soil test phosphorus (STP) index, and soil test potassium (STK) index. Medians are given along with the average because most of the data do not have normal distributions, and sometimes averages give a false impression on where the center of the distribution lies for non-normal distributions.

This summary may provide a valuable index of the soil fertility status of Oklahoma farmland, but soil samples need to be collected and analyzed for an individual field to better manage soil fertility and to correct soil acidity problems. Similar summaries for each county are also available. To request a copy for a specific county, please contact the authors at 405-744-9566 or zhailin@okstate.edu.

Soil pH and Lime Requirement

The pH of Oklahoma soils tends to be low with a median of 5.9. Soil pH of all samples is divided into 4 groups and shown in Figure 1. Twenty-five percent of the 40,200 samples had a pH less than 5.5 and indicated a potential production loss due to soil acidity. Low soil pH has become a crop production problem of increasing concern in many parts of Oklahoma, especially in the central wheat growing region where over 40% of the fields had a pH less than 5.5. Strong soil acidity not only lowers the availability of phosphorus but also increases the level of toxic elements present such as aluminum and manganese. Banding phosphate fertilizer and using aluminum tolerant wheat varieties have shown some benefits on acid soils, but eventually lime must be used to neutralize the acidity and sustain crop production.

Soil Nitrate-Nitrogen (NO_3-N)

The distribution of NO_3-N of all the surface soils is shown in Table 1. The majority of the surface soil samples had less

Table 1. Distributions of soil pH, NO_3-N (lb/ac), Soil Test P Index and Soil Test K Index analyzed from 2000 to 2003.

Soil pH	<5.5	5.5-6.5	6.5-7.5	>7.5
Count	9924	19431	7541	3272
Percent	24.7%	48.4%	18.8%	8.1%
NO_3-N (lbs/A)	<10	10-19	20-39	>40
Count	16548	11327	6790	4041
Percent	42.8%	29.3%	17.5%	10.4%
STP Index	<65	65-120	120-300	>300
Count	28526	6450	3719	1474
Percent	71.0%	16.1%	9.3%	3.7%
STK Index	<120	120-250	250-350	>350
Count	3324	14293	7868	14689
Percent	8.3%	35.6%	19.6%	36.6%

Table 2. Median, average and ranges of test results for all agricultural soil samples between 2000 and 2003.

	pH	*NO_3-N (lbs/a)*	*STP Index*	*STK Index*
Median	**5.9**	**11**	**39**	**278**
Average	6.1	19	72	335
Minimum	2.1	0	0	21
Maximum	9.8	979	2832	2700

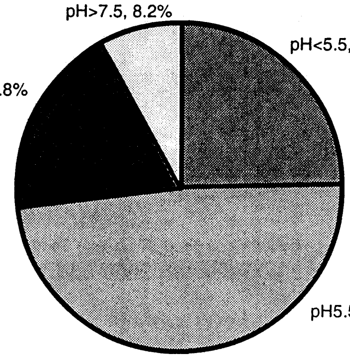

Figure 1. Soil pH distribution of Oklahoma agricultural soil samples tested between 2000 and 2003.

than 20 lbs. residual NO_3-N per acre (median 11 lbs./acre). Only 10.4% of the fields sampled had NO_3-N greater than 40lb/acre. This indicates most farmers would need to apply N fertilizer for crop production based on surface soil tests alone. However, subsoil samples (6 and 24 inches) could contain significant amounts of nitrate nitrogen. Deep-rooted crops, such as winter wheat, can penetrate and utilize the nitrate from the subsoil during growth. Since very few farmers submitted subsoil samples, subsoil nitrate results were not included in the summary.

Soil Test P Index

The phosphorus soil test estimates the availability of soil phosphorus during the whole growing season. The Mehlich 3 extraction method has been used in Oklahoma and many other central and eastern states for plant available P and K analysis. The estimated availability is reported as an index and percent sufficiency in the soil (See F-2225 for details). Phosphorus fertilizer needs to be added if the soil test P index is less than 65 (100% sufficient level). The available P status is graphed in Fig. 2. About 71% of the soil samples had index values less than 65, or less than 100% sufficiency, therefore, those soils need various amounts of commercial P to achieve the potential crop yields. Sixteen percent of the samples had a STP index between 65 and 120. In this range, some crops may benefit from additional P fertilizer but it may not be cost effective. Only 13% of the fields had STP over 120, although some parts of the state had a much higher percentages of this category due to heavy application of animal manure. Knowing where P is deficient will help any manure marketing effort to redistribute nutrients and reduce the impact to water quality.

Soil Test K Index

Most of Oklahoma soils are high in potassium, probably, attributed to the parent materials and low rainfall under which our soils are developed. Data in Fig. 3 confirms this tendency. About 44% of the fields had a STK index less than 250, or sufficiency less than 100%, for all crops except for alfalfa, which would need additional K to meet crop requirements. The 100% sufficiency STK for alfalfa is 350.

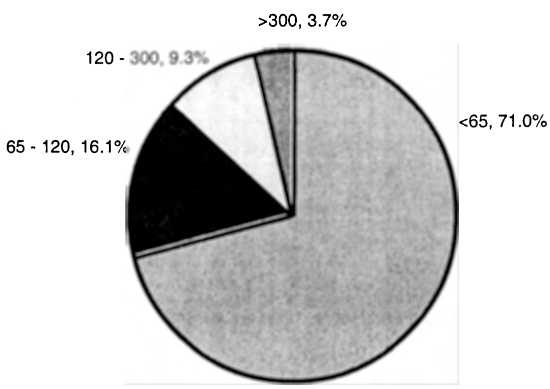

Figure 2. Distribution of soil test P index in Oklahoma agricultural soils tested between 2000 and 2003.

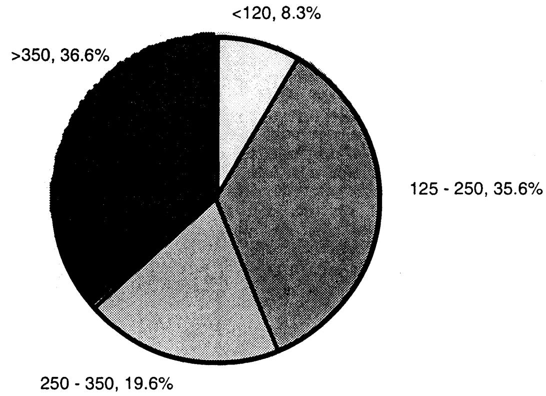

Figure 3. Distribution of soil test K index in Oklahoma agricultural soils tested between 2000 and 2003.

Median STP and Soil pH by Counties

The median soil test P index and soil pH are presented on Oklahoma County maps (Figure 4 and 5). In general, soil pH values are neutral to calcareous in the west and southwest part of the state, but acidic in the east and north central Oklahoma. There is no obvious pattern of STP distribution.

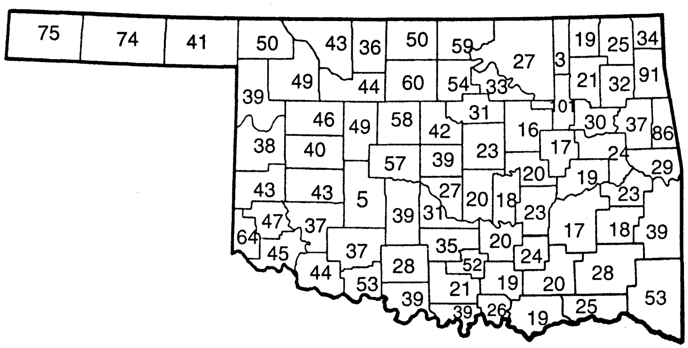

Figure 4. Median value of Soil Test P index for Oklahoma Counties.

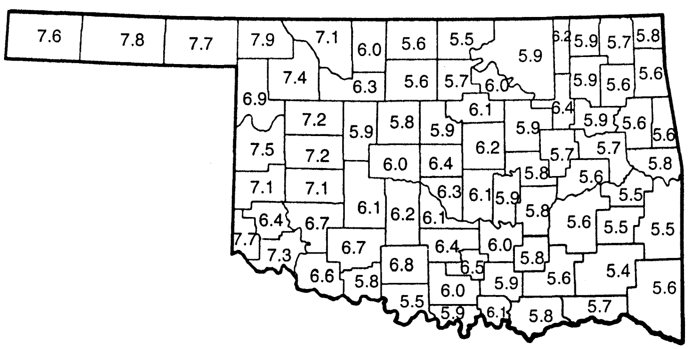

Figure 5. Median value of Soil pH for Oklahoma Counties.

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