



# Current Report

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## The Oklahoma Cooperative Extension Service Bringing the University to You!

The Cooperative Extension Service is the largest, most successful informal educational organization in the world. It is a nationwide system funded and guided by a partnership of federal, state, and local governments that delivers information to help people help themselves through the land-grant university system.

Extension carries out programs in the broad categories of agriculture, natural resources and environment; family and consumer sciences; 4-H and other youth; and community resource development. Extension staff members live and work among the people they serve to help stimulate and educate Americans to plan ahead and cope with their problems.

Some characteristics of the Cooperative Extension system are:

- The federal, state, and local governments cooperatively share in its financial support and program direction.
- It is administered by the land-grant university as designated by the state legislature through an Extension director.
- Extension programs are nonpolitical, objective, and research-based information.

- It provides practical, problem-oriented education for people of all ages. It is designated to take the knowledge of the university to those persons who do not or cannot participate in the formal classroom instruction of the university.
- It utilizes research from university, government, and other sources to help people make their own decisions.
- More than a million volunteers help multiply the impact of the Extension professional staff.
- It dispenses no funds to the public.
- It is not a regulatory agency, but it does inform people of regulations and of their options in meeting them.
- Local programs are developed and carried out in full recognition of national problems and goals.
- The Extension staff educates people through personal contacts, meetings, demonstrations, and the mass media.
- Extension has the built-in flexibility to adjust its programs and subject matter to meet new needs. Activities shift from year to year as citizen groups and Extension workers close to the problems advise changes.

## Oklahoma Agricultural Soil Test Summary 2009-2013

Hailin Zhang  
Soil Fertility and Chemistry;  
Director, Soil, Water and Forage Analytical Lab

Barbara McCray  
Soil, Water and Forage Analytical Lab

Soil fertility information 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 (SWFAL) 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 2009 to 2013 consists of about 61,500 samples and is presented below in Tables 1 and 2. Similar summaries from 1994 to 1999, 2000 to 2003, and 2004 to 2008 were made and published in CR-2247, CR-2253, and CR-2259, respectively. 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<sub>3</sub>-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. Some unusually high values were also removed from the database (NO<sub>3</sub>-N > 1000, STP > 1000, and STK > 2000) because most of those samples were mislabeled compost or manure samples.

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 405-744-6630, [soiltesting@okstate.edu](mailto:soiltesting@okstate.edu) or [hailin.zhang@okstate.edu](mailto:hailin.zhang@okstate.edu).

**Table 1. Distributions of soil pH, NO<sub>3</sub>-N (lb/ac), Soil Test P Index\* and Soil Test K Index\* analyzed from 2009 to 2013.**

	<5.5	5.5-6.5	6.5-7.5	>7.5
Soil pH				
Count	14,619	26,292	13,183	7,411
Percent	23.8%	42.8%	21.4%	12.1%
NO <sub>3</sub> -N (lbs/A)	<10	10-20	20-40	>40
Count	26,957	15,225	10,486	8,910
Percent	43.8%	24.7%	17.0%	14.5%
STP Index	<40	65-120	65-120	>120
Count	27,628	14,967	8,810	10,084
Percent	44.9%	24.3%	14.3%	16.4%
STK Index	<120	120-250	250-350	>350
Count	6,216	19,316	12,250	23,732
Percent	10.1%	31.4%	19.9%	38.6%

\*The index values are equivalent to lb/ac, which is 2 times mg/kg (ppm).

**Table 2. Median, average and ranges of test results for all agricultural soil samples tested by SWFAL between 2009 and 2013.**

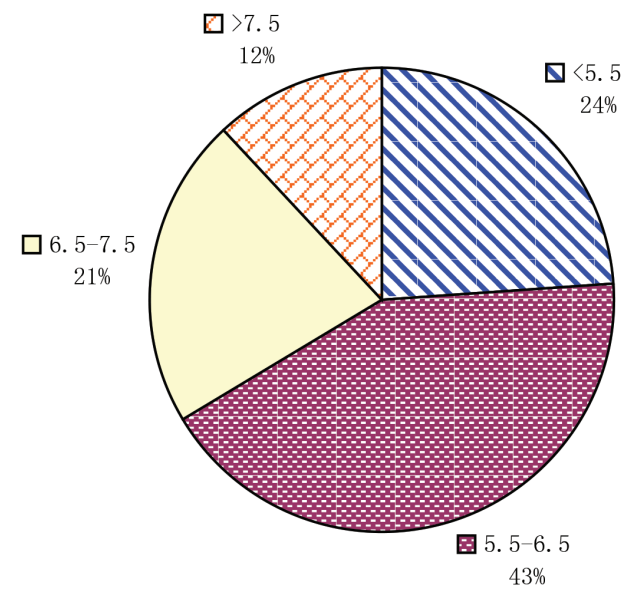
	pH	NO <sub>3</sub> -N (lbs/a)	STP Index	STK Index
Median	6.1	11	44	290
Average	6.2	22	73	349
Minimum	2.7	0	0	1
Maximum	11	950	999	1,994

### Soil pH and Lime Requirement

The pH of Oklahoma soils tends to be low, with a median of 6.1. This means 50 percent of the fields tested had a pH less

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**Figure 1. Soil pH distribution of Oklahoma agricultural soil samples tested between 2009 and 2013.**

than 6.1. Soil pH of all samples is divided into 4 groups and shown in Figure 1. Nearly 24 percent of the 61,500 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. This is especially true in some counties in the central wheat growing region, where as high as 40 percent 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, especially when winter wheat is rotated with other less acid tolerant crops.

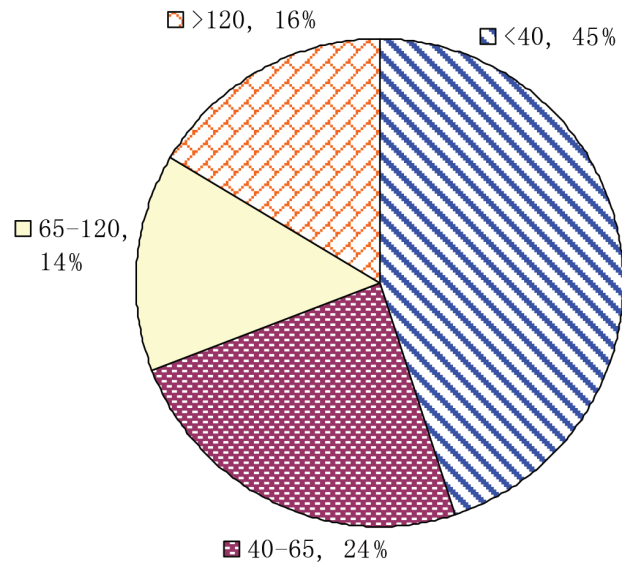
### Soil Nitrate-Nitrogen (NO<sub>3</sub>-N)

The distribution of NO<sub>3</sub>-N in all the surface soils is shown in Table 1. The majority of the surface soil samples had less than 20 lbs. residual NO<sub>3</sub>-N per acre (median 11 lbs./A). Only 14.5 percent of the fields sampled had NO<sub>3</sub>-N greater than 40 lbs./A. This indicates that most farmers would need to apply N fertilizer for the production of most crops based on surface soil tests alone. However, subsoil samples (6 inches and 18 inches deep) could contain significant amounts of nitrate nitrogen. Deep-rooted crops, such as winter wheat, cotton and bermudagrass, 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.

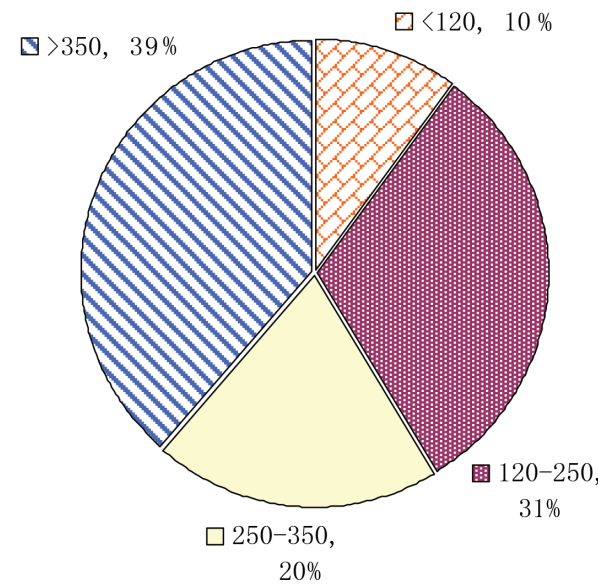
### Soil Test P Index

The phosphorus soil test estimates the availability of soil phosphorus during the whole growing season. The Mehlich

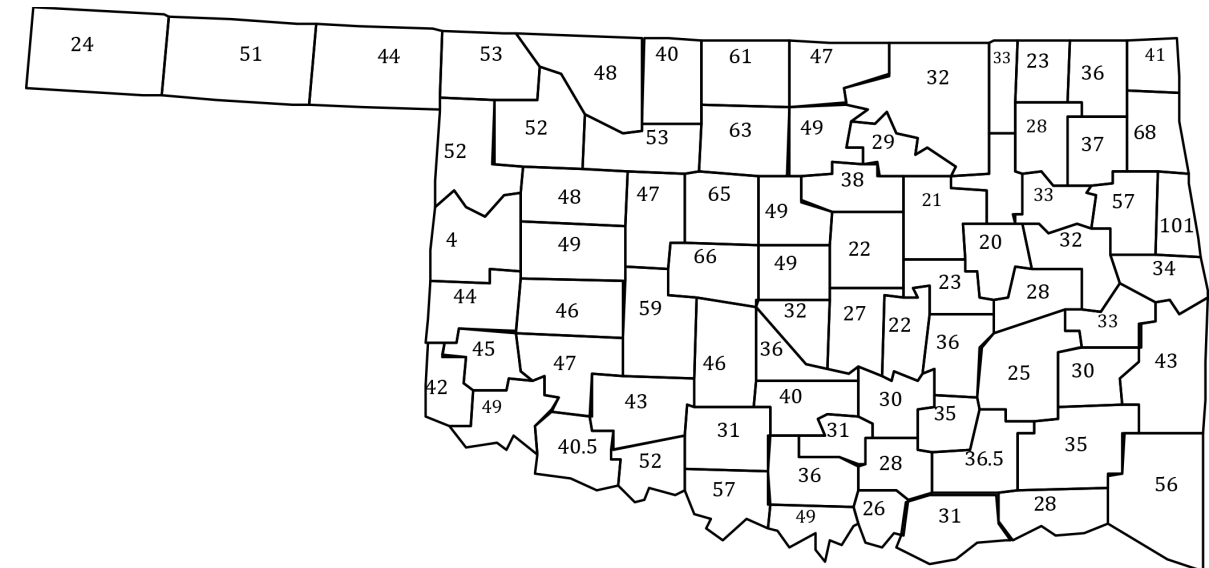
3 extraction method has been used in Oklahoma and many other central and eastern states for plant available P and K analysis. The estimated availability is reported as an index and percent sufficiency in the soil (See PSS-2225 for more details). Phosphorus fertilizer needs to be added if the soil test P index is less than 65 (100 percent sufficient level). The available P status is graphed in Figure 2. About 45 percent of the soil samples are considered low in P availability (STP index <40) and 24 percent were in the medium category (STP 40-65). Therefore, those fields need various amounts of commercial P or animal manure to achieve the potential crop yields. Fourteen percent of the samples had a STP index



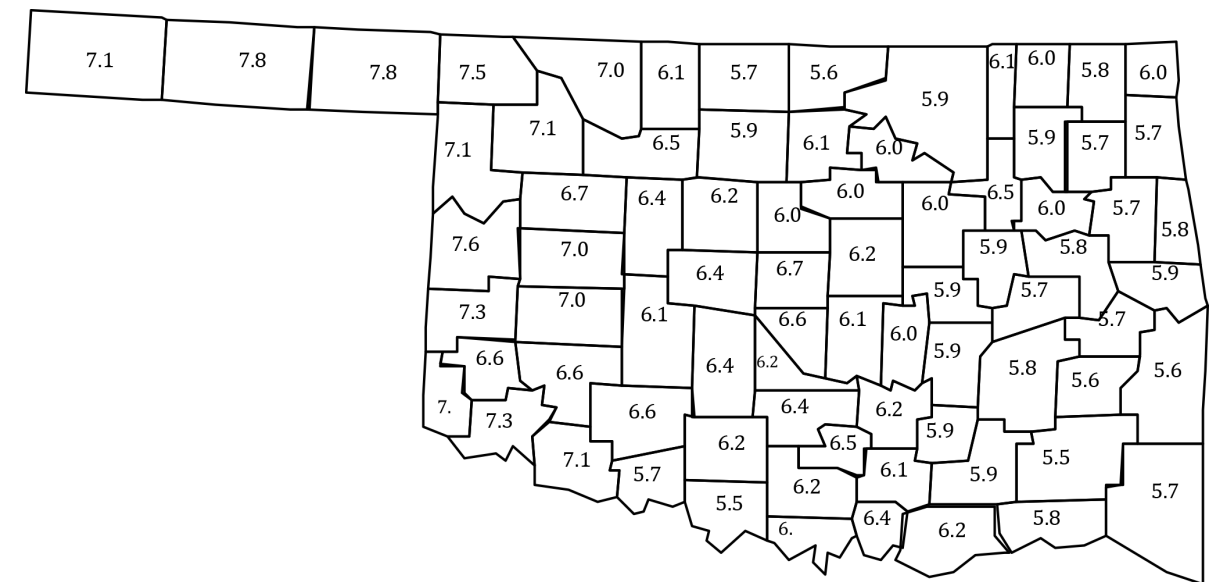
**Figure 2. Distribution of soil test P index in Oklahoma agricultural soils tested between 2009 and 2013.**



**Figure 3. Distribution of soil test K index in Oklahoma agricultural soils tested between 2009 and 2013.**



**Figure 4. Median Soil Test P index values of soil samples tested between 2009 and 2013 for Oklahoma Counties.**



**Figure 5. Median Soil pH values of soil samples tested between 2009 and 2013 for Oklahoma Counties.**

between 65 and 120. In this range, some crops may benefit from additional P fertilizer but it may not be cost effective. About 16 percent of the fields had STP more than 120, although some parts of the state had much higher percentages due to repeated application of animal manure. Knowing areas in which P is deficient will assist with manure utilization efforts through which nutrients are redistributed thereby reducing the impact on water quality.

### Soil Test K Index

Most Oklahoma soils are high in potassium. This can probably be attributed to the parent materials and low rainfall conditions with which our soils are developed. Data in Figure 3 confirms this tendency. About 44 percent of the fields had a STK index less than 250, or sufficiency less than 100 percent,

for all crops except for alfalfa, which would need additional K to meet crop requirements. The 100 percent sufficiency STK for alfalfa is 350. In general, the STK levels decrease from western to eastern Oklahoma along the precipitation gradient.

### Median STP and Soil pH Values by Counties

The median soil test P index and soil pH are presented on the Oklahoma County maps (Figures 4 and 5). In general, soil pH values are neutral to calcareous in the western and southwestern parts of the state, but acidic in the eastern and north central portions. There is no obvious pattern of STP distribution. Little changes were observed between this summary and the previous summary.