



# Current Report

**EXTENSION**

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## Oklahoma Agricultural Soil Test Summary: 2018-2022

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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 fertilizer and manure application. The Oklahoma 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 four to five years. The summary from 2018 to 2022 consists of about 51,000 samples and is presented below in Tables 1 and 2. Similar summaries from 1994 to 1999, 2000 to 2003, 2004 to 2008, 2009 to 2013 and 2014 to 2017 were made and published in CR-2247, CR-2253, CR-2259, CR-2074 and CR-2283. All the identifiable lawn, garden and research samples were excluded in the summary since most of them do not represent the real condition in production agricultural fields. Soil samples were analyzed for pH, buffer index (BI) pH less than 6.3 for lime recommendations, nitrate-nitrogen (NO<sub>3</sub>-N, lbs/acre), soil test phosphorus

(STP) index and soil test potassium (STK) index. The recommended soil sampling depth in Oklahoma is 6 inches, and STP and STK indexes are equivalent to lbs/acre (lbs/acre = 2xppm). 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 assessment 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. Both spatial and temporal variabilities exist in all fields. Similar summaries for each county are also available. To request a copy for a specific county, please contact the authors at 405-744-6630, or [soiltesting@okstate.edu](mailto:soiltesting@okstate.edu).

Soil Routine Test Summary					
					Total
<b>pH</b>	<5.5	5.5~6.5	6.6~7.5	>7.5	
<b>Count</b>	8630	24200	11312	6391	<b>50533</b>
<b>Percent</b>	17.1%	47.9%	22.4%	12.7%	
<b>NO<sub>3</sub>-N</b>	<10	10~20	20~40	>40	
<b>Count</b>	27780	11700	6735	4641	<b>50856</b>
<b>Percent</b>	54.6%	23.0%	13.2%	9.13%	
<b>STP index</b>	<40	40~65	65~120	>120	
<b>Count</b>	29151	9063	5066	7255	<b>50535</b>
<b>Percent</b>	57.7%	17.9%	10.0%	14.4%	
<b>STK index</b>	<120	120~250	250~350	>350	
<b>Count</b>	8589	18796	9567	13583	<b>50535</b>
<b>Percent</b>	17.0%	37.2%	18.9%	26.9%	

Table 1. Distributions of soil pH, NO<sub>3</sub>-N (lb/ac), Soil Test P Index and Soil Test K Index analyzed from 2018—2022.

	pH	NO <sub>3</sub> -N (lbs/a)	STP Index	STK Index
Median	6.2	8	32	233
Average	6.3	17	63	288
Minimum	2.8	0	0	0
Maximum	12.5	999	999	1999

Table 2. Median, average and ranges of routine soil test results for all agricultural samples tested between 2018–2022.

### Soil pH and Lime Requirement

The median pH of Oklahoma soils was 6.2, which is 0.1 unit lower than that of the previous four years. That means 50% of the fields tested had a pH less than 6.2. Soil pH of all samples is divided into four groups and shown in Figure 1. Nearly 17% of the 51,000 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 30% 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 to 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 8 lbs/acre). Only 9.1% of the fields sampled had NO<sub>3</sub>-N greater than 40 lbs/acre. 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 to 18 inches deep) could contain significant amounts of nitrate-nitrogen. Deep-rooted

crops, such as winter wheat, cotton and bermudagrass, can penetrate and use the nitrate-nitrogen 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 since the 1980s for plant available P and K analysis. The estimated availability is reported as an index and percent sufficiency in the soil (See fact sheet PSS-2225 for more 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 Figure 2. About 58% of the soil samples are considered low in P availability (STP index <40), and 18% 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. Ten 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. About 14% of the fields had STP over 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, which re-distributes nutrients, thereby reducing the impact on water quality.

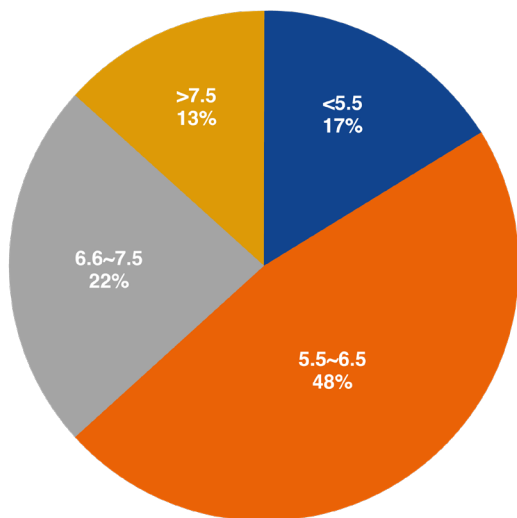


Figure 1. Soil pH distribution of Oklahoma agricultural soil samples tested between 2018–2022.

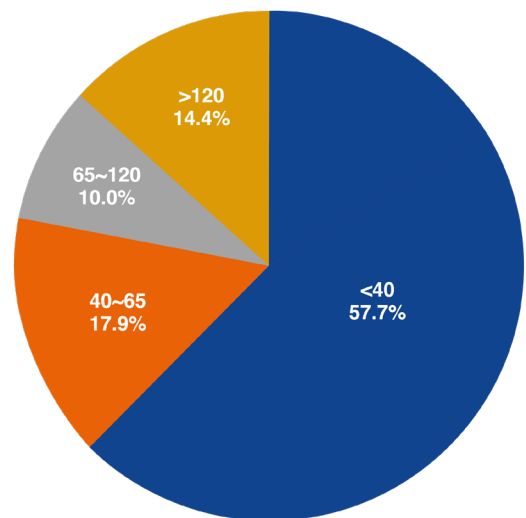


Figure 2. Distribution of soil test P index in Oklahoma agricultural soils tested 2018–2022. STP of 65 or higher is considered adequate for all crops.



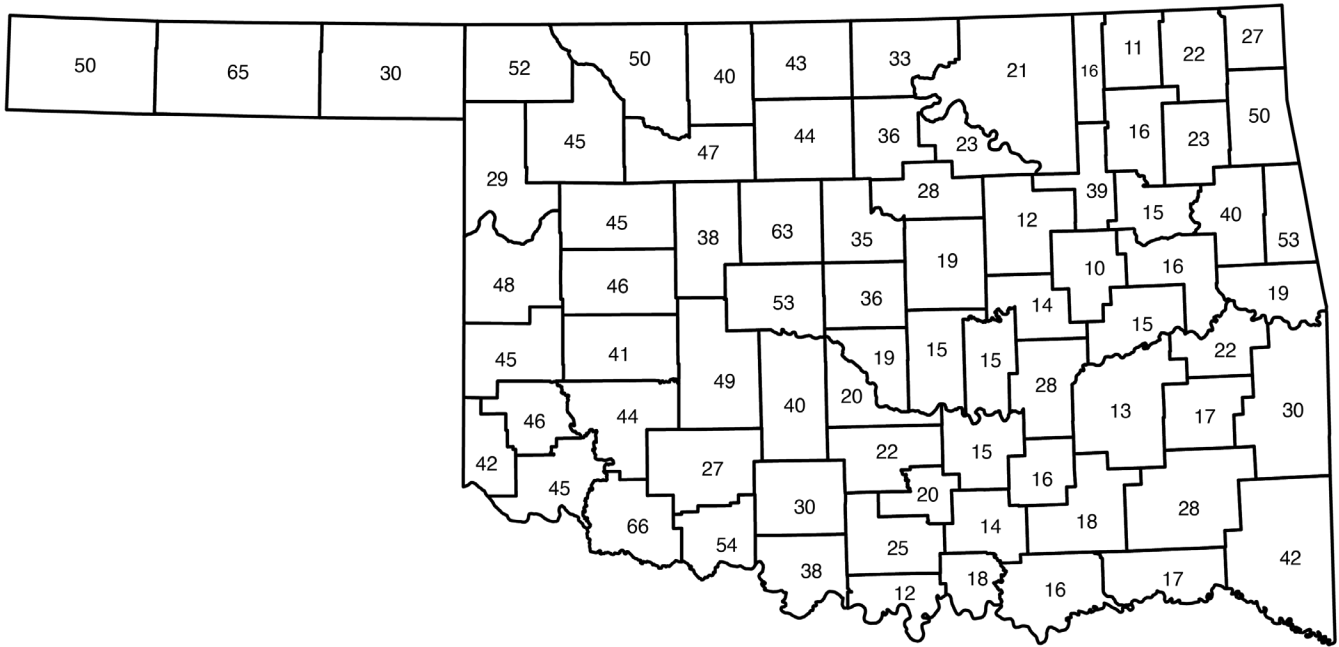


Figure 5. Median Soil Test P index values of soil samples tested between 2018–2022 for Oklahoma counties.

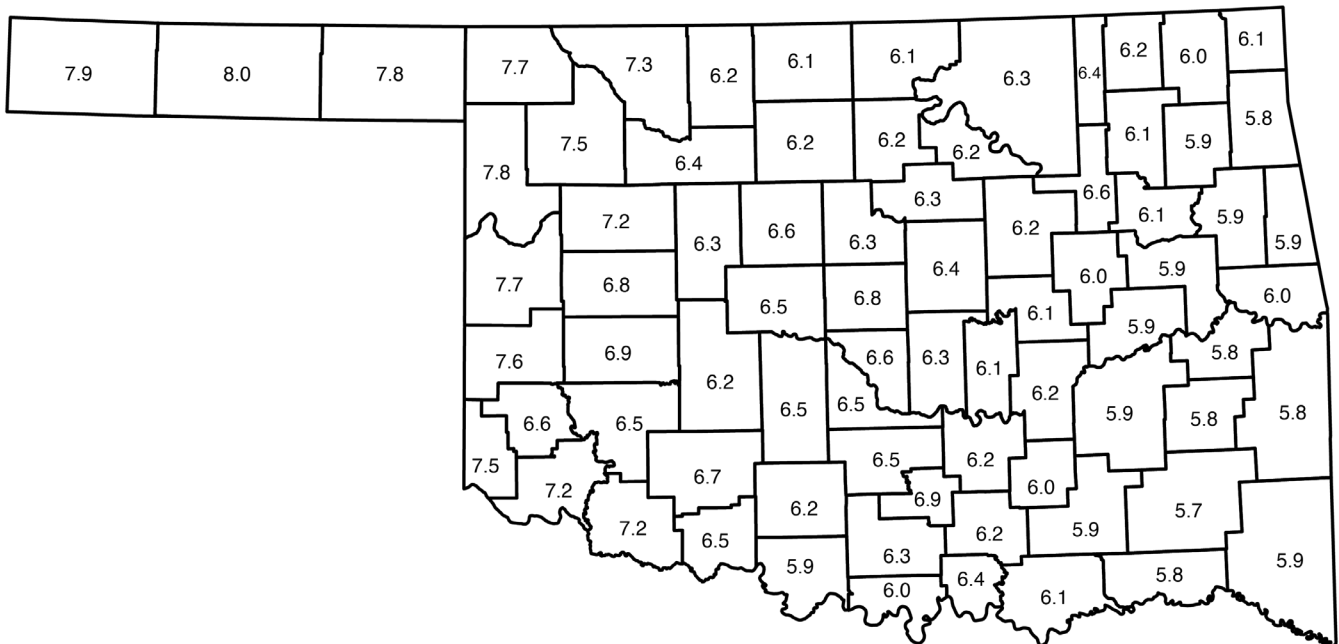


Figure 6. Median Soil pH values of soil samples tested between 2018–2022 for Oklahoma counties.

# The Oklahoma Extension Service

## Education Everywhere for Everyone

The OSU 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 programs; 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 non-political, 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 uses research from university, government and other sources to help people make their own decisions.
- More than 1 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 advise changes.

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