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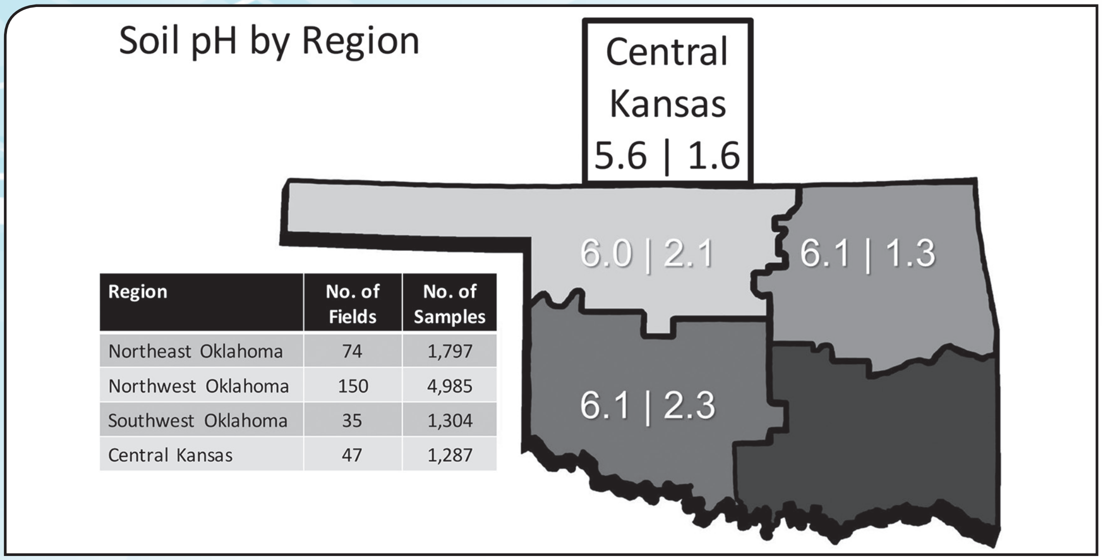
DECISION SUPPORT TOOLS FOR VARIABLE RATE NUTRIENT APPLICATIONS

in the Southern Great Plains

Dr. Brian Arnall
Associate Professor, Oklahoma State University
b.arnall@okstate.edu

Dr. Steve Phillips
Director, North American Program
sphillips@ipni.net



Region	No. of Fields	No. of Samples
Northeast Oklahoma	74	1,797
Northwest Oklahoma	150	4,985
Southwest Oklahoma	35	1,304
Central Kansas	47	1,287

Figure 1. A visual representation of the variability of soil pH in Oklahoma and central Kansas. The first value in each quadrant is the average soil pH for all the fields within the region. The second value is the average per field range of soil pH.

Soil sampling (composite or grid) is not a common practice in the southern Great Plains. In fact, it is estimated that only 15% of crop production fields in Oklahoma are managed using any type of soil sampling. Recently the region has seen an increase in cropping system diversity and yield potentials. Because of this and an influx of crop consultants, the interest in intensive soil sampling (i.e., grid soil sampling) has increased.

Do the region's agricultural soils have the inherent variability necessary to justify intensive sampling? Soil analysis data were compiled from 9,373 individual soil samples collected using a 2.5-acre grid sampling strategy, at a resolution of 1 to 6 acres, in 313 fields located in 21 Oklahoma counties and four counties in central Kansas. The data collected included macro- and micronutrient concentrations as well as soil pH, organic matter content, and cation exchange capacity. Soil analysis was performed by multiple soil testing labs. The data were from soil samples collected primarily at the 0-6 in. depth. The number of samples per location ranged from 5 to 128 depending on location size with an average of 30 samples per field. This data set (summarized in **Table 1**) provides an opportunity to analyze trends (i.e., pH, organic matter content, nutrient concentrations) across soil types at a regional scale.

Data indicate that soils in Kansas and Oklahoma tend to be slightly acidic (**Figure 1**) with 247 out of 306 fields being below pH 7.0, and 142 fields below pH 6.0. The majority of the soils collected had average phosphorus (P) concentrations that would be considered near sufficient, 28 ppm Bray P-1 and 29 ppm Mehlich P-3 (32.5 ppm Mehlich P-3 is 100% sufficient) and

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TABLE 1. Average, minimum, and maximum soil test values for each field along with the average range for each parameter within a field.

	Soil pH (306 fields)		Buffer pH (303 fields)		Phosphorus (Melich 3 and Bray 1), ppm (294 fields)		Potassium, ppm (313 fields)	
	Average	Range	Average	Range	Average	Range	Average	Range
Average	6.0	1.9	6.8	0.5	28	54	185	192
Min	4.6		5.9		4		28	
Max	8.1		12.5		93		544	
	Organic matter, % (203 fields)		**Calcium, ppm (199 fields)**		**Magnesium, ppm (233 fields)**		**Sulfur, ppm (116 fields)**	
	Average	Range	Average	Range	Average	Range	Average	Range
Average	1.8	1.2	1,546	1,877	314	351	13.9	26
Min	0.5		396		46		5.9	
Max	3.5		5,099		1,208		87	

average potassium (K) of 185 ppm, which would be considered well above sufficient (125 ppm K is considered 100% sufficient). However, average P concentrations from all locations ranged from 5 to 93 ppm and 4 to 89 ppm for Bray P-1 and Mehlich 3, respectively. Average K concentrations ranged from 28 to 544 ppm.

With limited resources and marginal yields does intensive sampling have value? While crop yields in the southern Great Plains have increased, they are still below the national average. Therefore, profit margins are often tight resulting in producers being hesitant about investing in intensive sampling. This data set suggests that the spatial variability in nutrient content and pH can be significant and the economic impact of variable rate lime and nutrient applications should be evaluated. As more data is collected, the probability of positive economic return could be defined by specific soil series.

How does a farmer decide to invest in intensive sampling? This research is leading to the development of decision aid tools for the web and smart phone devices. Producers will be able to input field location and composite soil sample test results, and the probability of a positive economic return for the implementation of intensive sampling and variable rate application will be provided.

For more information on these tools contact Dr. Brian Arnall, Associate Professor Oklahoma State University, E-mail: b.arnall@okstate.edu.