nutrient stewardship

The Highs and Lows of Soil Test Potassium Variability

THIS ARTICLE IS ABOUT…

RIGHT SOURCE | RIGHT RATE | RIGHT TIME | RIGHT PLACE

Highlights

- Factors that contribute to swings in K test results.
- Why it is better to take fewer soil samples with more cores than more samples with fewer cores when testing for K.
- Tips on how you can minimize variability.

Soil test potassium levels tend to have some noticeable, and at times dramatic, variability over time. So, if you've ever gotten a soil test result for potassium that looked a little odd, you're not alone. There are a number of possibilities as to why that occurs, and here are a few:

Time of year. Studies in the Midwest have shown that levels are typically lowest in November, rise during the winter, and peak in March. During the cropping season, K levels decline, again reaching their minimum. In some areas of the Corn Belt, crop advisers report that growers are requesting a shift to spring, rather than fall, soil sampling. This shift could cause soil test levels to increase above expectations when compared to samples from previous years' fall samples.

Freezing and thawing. Freeze cycles produce effects akin to wetting-drying cycles. In northern soils, some of the observed increases in potassium levels in the spring may be attributable to this factor.

Nutrient uptake and removal by crops. Comparing the amount of K removed to the amount applied is often used as a way to predict the direction of soil test changes in the future. If more K is applied than removed, then a positive budget exists and levels are expected to increase. If application rates are less than removal rates, then soil test levels are expected to decline. How quickly and how much soil test levels will respond to budgets depends on the mineralogical properties of the soil, environmental conditions, and the magnitude of the K budget surplus or deficit.

Release of K from crop residues. Potassium is not tied up in organic forms in the plant. Therefore, it is easily leached from plant residue with moisture. Consequently, the timing and quantity of precipitation relative to harvest and sampling can affect the K levels measured by a soil test. Soil samples taken immediately after harvest would not detect much of the K contributions from the recently harvested crop's residue. How- ever, later sampling after more precipitation would be expected to capture more of the leached K, leading to higher soil test readings.

Microbial activity. Some microbes in soils are capable of reducing the positive charge in the iron present in some clay minerals during wet, warm periods. This causes the layers of some minerals to collapse, trapping potassium inside. Microbial activity may be partly responsible for the decreases in soil test levels through the cropping season.

Soil moisture. Many advisers have noticed that soil moisture at the time of sampling can greatly affect soil test K results. The reasons behind these changes are not clear, but have been linked to the release of K from interlayer positions of certain clay minerals. This mechanism is likely largely responsible for seasonal variations.

Nutrient stratification. Nutrient stratification is a gradient of soil test levels with depth. In reduced tillage systems, levels of K can be several hundred ppm greater at the surface than just a few inches down. An important aspect of stratification is the shift in soil test levels not only at the soil surface but throughout the soil profile. Some studies have shown that, relative to more aggressive tillage systems such as moldboard plowing, reduced tillage systems have relatively higher levels near the surface but relatively lower levels deeper in the soil profile.

Depth control during soil sampling. Controlling sampling depth becomes more important as nutrient stratification increases. If samples are taken shallower than recommended, inaccurately high soil test K levels may result. If samples are taken too deeply, the opposite may occur.

Number of cores in a soil sample. A representative sample is critical for assessing soil nutrient status. Soil test K levels can be highly variable within a field. Causes of variability include differences in landscape position, erosion, and management history. Taking a small number of cores results in reduced chances that the sample represents the average fertility of the area. In addition, smaller core numbers lead to greater variability among samples taken from the same area. Consequently, taking too few cores per sample can contribute significantly to the observed year-to-year variability in soil test results, producing random increases or decreases. So in short, it is better to take fewer samples with more cores than more samples with fewer cores

Laboratory to laboratory variability. A single sample sent to multiple laboratories will give you scattered results. In a recent study, variability in ammonium acetate-extractable potassium from lab to lab ranged from 6 to 22% across a range of soils used as standards. Variability across labs is about 40% higher than variability within a lab. The bottom line: Find a reputable lab with good quality control and stick with it.

Variability is natural, but it is also influenced by what we do along the way. Do your best to minimize the adverse effects you may have on variability: plan for sampling the same time every year, stay with a quality laboratory, control probe depth, and take plenty of cores per sample. It takes extra time, but the results will be much more meaningful.

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