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# VARIABILITY IN SOIL TEST POTASSIUM

**Many fertilizer recommendations are made based on a composite soil sample representing the average fertility of the entire field.** This approach fails to address the spatial variability of nutrients in the field resulting from changes in soil type, topography, previous cropping history, and many other factors. Even precision farming strategies such as management zones fail to account for all of the spatial variability found in agricultural fields.

**A study conducted on Oklahoma demonstrated that the field element size, or the shortest distance where a significant change in soil nutrient availability occurs, was 9ft$^2$.** Soil samples were collected from an established bermudagrass pasture on a 1x1-ft grid from a 490-ft$^2$ area. Samples consisted of eight 6-in cores/ft$^2$. The mean soil test potassium (K) value for the entire area was 131 ppm, which would be considered 100% sufficient for bermudagrass production and no K fertilizer would be recommended. However, the soil test values ranged from 12 to 301 ppm K, resulting in several zones within the test area needing as much as 140 lb $K_2O$/A. A similar study was conducted in Kentucky cornfields and found 2 to 3-fold differences in soil test K (STK) values within a 0.22-A area sampled on a 0.01-A grid.

**Considering the high degree of micro-variability in agricultural fields, how can we ensure an accurate estimate of STK?** An analysis of data collected by Dr. Bob Miller, Colorado State University, suggests that a minimum of 10 soil cores should be collected from a grid-point sampled area to minimize relative standard deviation about the mean fertility level within a management zone. This minimum number applies to any grid size and becomes even more important in fields with lower average STK levels.

**Soil test K can also be highly variable for a field depending on the timing of sample collection.** Patterns in STK exist in many regions that show a decline during the growing season due to crop uptake, increasing values over winter as crop residues release K, and a subsequent decline during the next growing season. However, this cycle is often disrupted due to rainfall patterns. For example, dry conditions following harvest and throughout the winter will result in less K being released from plant residue and lower estimates of STK than will likely be available for the next crop.

**The amount and type of clay in the soil can also affect STK measurements.** This is especially relevant when sampling dry soils with high 2:1 clay content. On low K-testing soils, sampling 2:1 clays when dry will generally result in an over-estimation of STK. Conversely, STK will generally be under-estimated on high K-testing soils. This variability can also be introduced by drying samples in the laboratory prior to analyses. However, the variation due to clay content and soil moisture can be managed by using a field-moist test for K. Results from more than 300 corn and soybean trials conducted by Iowa State University show that the relationship between STK and crop response to K fertilizer in Iowa is much better when using a field-moist soil test.

**To minimize variation in STK, consider the following:**

- Collect an adequate number of soil samples to accurately represent the field or management zone.
- Establish consistency in the timing of sample collection.
  - Avoid unusually wet or dry periods.
  - Be aware of the effect of residue decomposition on STK.
- Rely more on soil test trends rather than a single year for STK.
- Consider supplementing the soil test report with nutrient removal estimates from the previous crop (https://www.ipni.net/app/calculator/home) when determining K requirements for the current crop.

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