AGRONOMY

Potassium Analysis: Wet K Soil Method

The most common way to test for soil potassium levels is to take a "standard" dry sample, which involves drying and grinding the sample before the analysis can begin. This process of heating and drying the soil is known to affect the measurable potassium level to some extent. There is another potassium test option: a field moist or "Wet K" test conducted on samples as they are received to the lab, without drying.

Observations on Soil Potassium

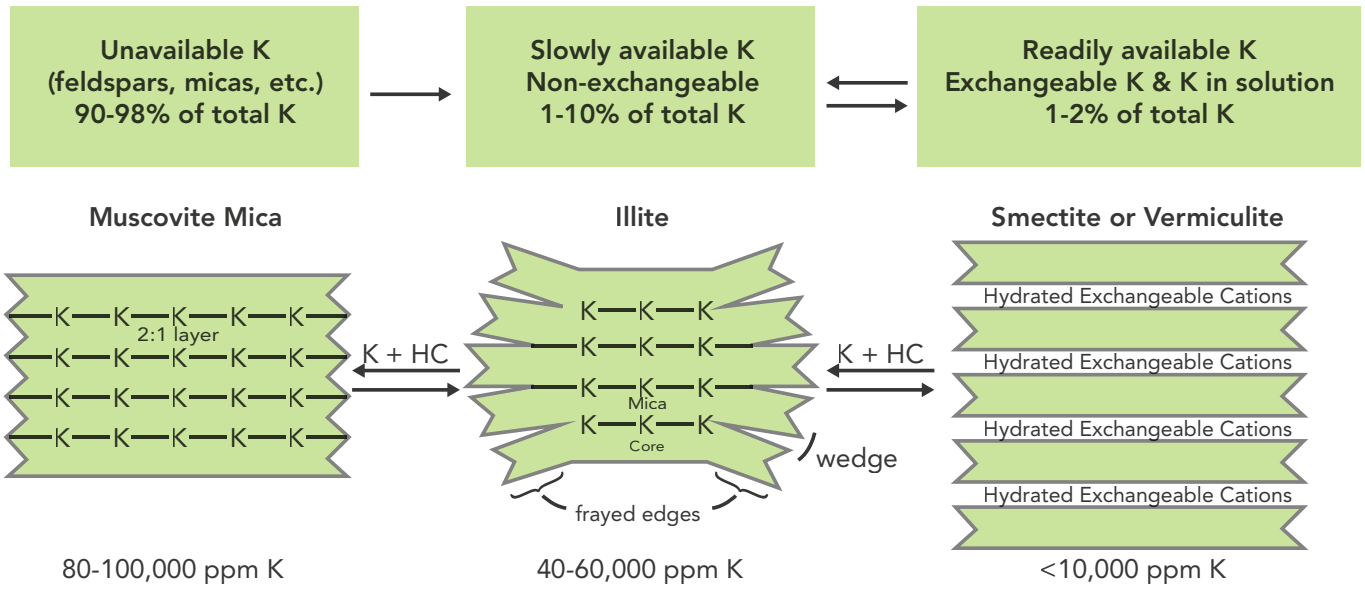
Moist soil testing is not a new idea. University research going back as far as the 1920s measured the effect of the drying process on soil test potassium. These studies have produced some common observations that will be discussed below.

It's important to remember that the differences noted between moist and dried soil analysis methods and the resulting potassium test results are not uniform across all soil types or geographic regions. As clay mineral types change, so do the comparison statistics. Native potassium levels have an effect as well. When native potassium levels are high, the difference between a moist soil K and a dry soil K test is minimal. When native potassium levels are low, the difference can be more noticeable. Native potassium levels in the soils of the Midwest range from very low to high K content.

Types of Potassium in Soil

- Kex = Exchangeable (and solution K) = 1-2% of total K
- Knex = Non-exchangeable (slowly exchangeable) = 1-10% of total K
- Kfixed = Unavailable and physically part of the soil composition = 90-98% of total K

Figure 1. Forms of Potassium in the Soil



HC: Hydrated Exchangeable Cations

Potassium Movement in Soil

The mechanism for potassium movement in the soil is diffusion (moving from high concentration to a lower concentration). When soil has low levels of exchangeable K (Kex), nonexchangeable (Knex) will diffuse from the soil clay layers and add to Kex levels. This is often understood as 'releasing' potassium for plant uptake. When soil has high levels of exchangeable Kex, the Kex will diffuse into the layers to add to Knex. This results in a reduced standard K test value and is often described as 'fixation' of potassium by the soil. See Figure 1.

Temperature Impacts on Potassium

As temperatures increase during sample drying, the lattice of the clay mineral expands, and some of the slowly exchangeable potassium is released to diffuse into the soil solution and into the 'exchangeable' extraction form. That is the most common effect, but the reverse can also be true. If there is a high concentration of potassium in the solution and exchangeable form, diffusion can carry that potassium out of the solution, back into the clay lattice structure and back into the slowly available phase. With heat and drying it is also possible that some clays can collapse and trap the K in the unavailable form, giving a lower test value.

It is important to note that this effect of expanding clay mineralogy is only related to potassium. The other exchangeable soil cations (Calcium and Magnesium) display a different behavior and very little dependence on methodology.

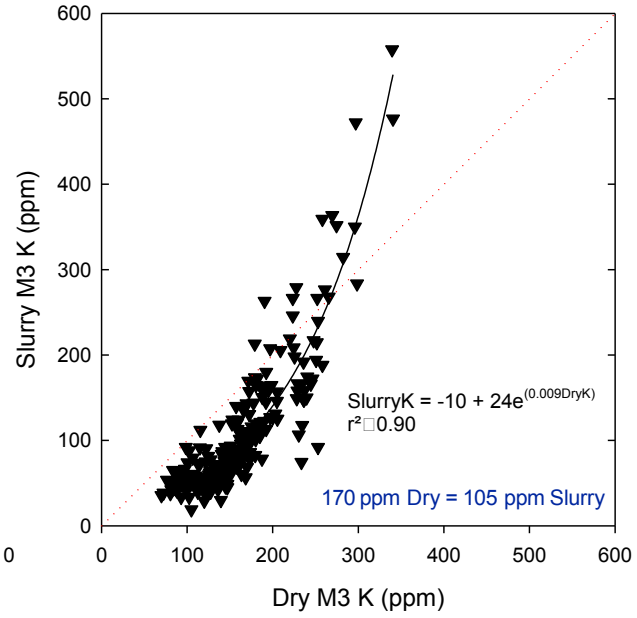
Moist Soil Testing Method

A moist soil K test focuses on the more readily exchangeable potassium in the soil. The method was developed by Iowa State University in the 1960s. In this method a large portion of the sample is taken as it was collected in the field, without drying, and placed in water. This mixture is stirred to create a slurry and a subsample of this suspended soil is collected for analysis.

Accuracy

The goal of a soil test is to take a representative sample from a highly complex system and use the results to make the best possible management decision. Neither the traditional dry nor the moist soil testing method is "correct" in an absolute sense, but both are valuable tools. Each method presents its own useful potassium assessment, and both data sets offer useful agronomic information. Looking at only the wet K test result minimizes the portion of the potassium that is slowly available and that which can be released through the normal biological and chemical processes. Utilizing only a dry K test masks the fact that potassium moves between the two phases of available K and slowly available K. This 'fixation and release' process is what causes potassium soil test levels to vary from one year to the next. Taken together, the moist and dry test data can act as a double-check of soil potassium fertility levels. If both the wet K and dry K test results are low, then the need for additional potassium fertilizer is the greatest. Graph 1 shows how moist soil testing gives lower K results at low concentrations but tests higher as the soil's K supply increases.

Graph 1. Dry and Moist Method Correlations.



Mallarino, Oitmans, Thompson, 2011

Interpreting Wet K

What is a high, medium or low soil test? See the Table 1. developed by Iowa State University. It is important to note that the wet K (Moist Soil) test has its own interpretation table. The familiar ranges from the 'Standard' chart cannot be used for evaluating Wet K results.

Table 1. Potassium Soil Test Ranges

	Standard K (ppm)	Moist Soil K (ppm)
Very Low	1–120	1–50
Low	121–160	51–85
Adequate	161–200	86–120
High	201–240	121–155
Very High	241+	156+