Recent articles in the popular farm press have brought potassium soil testing, recommendations and the use of potassium chloride (KCl) as a fertilizer into question. This is a result of the article, “The potassium paradox: Implications for soil fertility, crop production and human health,” in the peer-reviewed journal, Renewable Agriculture and Food Systems.

In this study, basic scientists at the University of Illinois drew the conclusion from their extensive works that long term applications of Potassium Chloride (KCl) did not maintain or increase soil solution potassium or increase yields more than the control. This revelation was a shock to most of the farming public and the fertilizer industry as a whole. This controversy is likely to remain in the news for quite some time as long-time traditions are not easily displaced.

Assuring sufficiency of potassium in the tissue of growing crops is an important consideration if the goal is optimum yields. Understanding that the uptake of this primary essential nutrient is from the soil, it would be natural to develop a soil test that correlates to plant tissue content and enables farmers or agronomists to declare whether the system is likely to deliver the potassium. This is much easier said than done, since there are numerous ways to measure soil potassium and there are various pools of potassium in soils.

The total content of potassium in Midwestern soils ranges from just over 2,600 lbs. per plow acre to over 40,000 lbs. per plow acre, depending on the type and amount of clay in the soil. These numbers do not represent the portion of potassium that is available to the plant, but it does help to understand why researchers found little correlation to soil test or applied KCl.

One of the keys to understanding potassium nutrition is that the plant takes most of the potassium from the soluble pool of potassium in the soil water. This pool is most often lower in concentration than that of the plant, so the potassium has to be pushed against the concentration gradient. This push comes from the soil, it would be natural to develop a soil test that correlates to plant tissue content and enables farmers or agronomists to declare whether the system is likely to deliver the potassium. This is much easier said than done, since there are numerous ways to measure soil potassium and there are various pools of potassium in soils.

To Be, or Not To Be?

Basic Scientists Refute Potassium Practices Long Held by the Industry

By: Cliff Ramsier

Three ingredients: solution potassium, dissolved oxygen, and plant sugars, at the root interface, must come together at that right time and in the right place for the plant to successfully acquire the nutrition it needs.
root respiration of plant sugars, in the presence of oxygen, that is found in the soil solution.

These three ingredients (solution potassium, dissolved oxygen, and plant sugars at the root interface) must come together at that right time and in the right place for the plant to successfully acquire the nutrition it needs. If just one of these ingredients is missing, potassium deficiency results. Obviously, it is very difficult to predict whether these three circumstances will exist at the same time with a simple potassium test.

Based on these findings, the industry may be forced to recognize the complexity of managing potassium. Soil scientists have been searching for a better potassium test for decades. Prospective tests on the horizon today show promise, but until then we must rely on other parts of the soil test to predict the likelihood of good potassium nutrition. Some of the pieces of information from a soil test that help to more accurately predict proper potassium nutrition include those that deal with potential potassium supply, the likelihood of soil moisture that contains dissolved oxygen, lack of toxins, and the relationship to other minerals that may compete with potassium for uptake.

If a soil test reports only P, K and pH, then there isn’t enough information to infer the likelihood of good potassium nutrition. On the other hand, if the soil test reports CEC, pH, and percent base saturations of all the base nutrients, in addition to organic matter, then the potassium uptake driving parameters can be quantified within reason. It is important to note that extremes in total water content such as drought or excessive rainfall override the system.

Due to soil variability across the field, especially when characterizing the water interactions in the soil, it is beneficial to soil sample by soil type to improve the quality of the input information especially because most of this variability is recognized by soil type.

**Ag Spectrum’s Systems Approach**

Ag Spectrum Company has employed these methods of soil sampling for decades and in the process, has been able to minimize the total application amounts of potassium while optimizing yields for clients. Ag Spectrum’s recommendations are based on numerous factors and implementation is complex. First, considerations must be given to the plant’s needs and priorities.

1. Identify the plant’s developmental phase/stage.
2. Determine the specific nutrient requirements at each stage of development.
3. Evaluate the nutrient impact on plant signaling and hormones.
4. Deliver specific needs so that each function is optimized within the plant.
5. Ensure precise applications are applied (not too much, not too little).

6. Provide all of the above while giving consideration to the nutrients and soil environment.

Next, create an optimum soil environment that maximizes air, water and nutrient availability for plant uptake.

1. Select a preferred method to optimize air and water such as gypsum, tillage practices, or tiling.
2. Ensure the absence of toxins with a soil test and subsequent herbicide and pesticide applications.
3. Ease nutrient acquisition for the crop by generating microbial activity, increasing root mass, or applying proper nutrients to reduce the energy required to acquire nutrients.

Finally, select the most efficient and effective nutrient delivery method and timing. Depending upon the situation, there are five primary methods that should be considered.

1. Apply in bulk soil.
2. Apply in the seed trench for timing early nutrients while the crop root is limited and nutrients are potentially unavailable.
3. Band the nutrients with the planter in a form that suits the vegetative crop.
4. Sidedress nutrients to be available during the reproductive phases.
5. Foliar feed to improve soil nutrient use and efficiency.

It isn’t an exact science, nor is it easy to implement, but it does represent the basic science requirements for nutrient uptake and sufficiency where conventional systems fall short of these concepts. If growing crops efficiently is your goal, then consider the long-term benefits the Maximum Farming System provides.