AGRONOMY

Potassium Reserves

Potassium is essential for plant growth and is used by more than 60 plant enzymes that are involved in various biochemical reactions including the production of sugars and starches. Potassium helps plants by increasing disease resistance, strengthening straw and stalks to reduce lodging, increasing winter hardiness, and improving drought resistance.

Potassium is the most abundant cation utilized in plant growth. Potassium is taken up by the plant roots from the soil and circulates throughout the plant in the form of K+. Unlike nitrogen and phosphorus, which take a number of different forms, potassium is only present in the soil in a single form and does not change. However, the amount of potassium present in the soil is complicated by geological and climatic conditions that are beyond our control and are essentially impossible to reverse.

Geological and Climatic Effects

Our current soils were developed from geological material with varying levels of potassium. As a result, levels vary widely throughout the United States.

Feldspars and micas are geological minerals that are rich in potassium with concentrations as high as 80-100,000 ppm. The potassium contained in feldspars and micas is held very tightly within these minerals and is generally unavailable to plants. However, the potassium that is imprisoned within these minerals can be released through climatic conditions. These conditions contribute to what is called weathering. Weathering is the decomposition of rocks into smaller and smaller minerals – a process that takes thousands of years. Precipitation is the key climatic condition that results in potassium being released during the weathering of potassium-containing minerals.

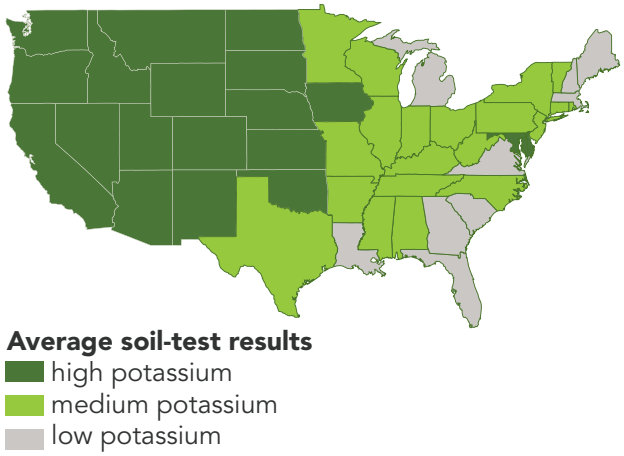
Precipitation also causes released potassium to leach through the soil over time. Normally, we do not consider potassium as a nutrient that can leach in medium- and fine-textured soils. In fact, if we were able to measure the movement of potassium through the soil in one season, there would appear to be no leaching whatsoever. After thousands and thousands of years of precipitation, the amount of potassium present in the soil has leached away, resulting in much lower concentrations of potassium today than at time zero.

Because most of the original minerals that contained potassium eons ago have slowly been weathered and washed away, potassium levels in areas of consistently high rainfall tend to be quite low. In the United States, for example, soils in the Southeast are more deficient in potassium than other regions of the US because this area receives more precipitation annually. In contrast, potassium soil-test levels consistently increase as you go farther west of the Mississippi River due to lower annual precipitation rates. Over time, this lower precipitation results in more of the potassium containing minerals remain in the soil and higher soil-test K levels.

Potassium Soil Test Levels in the Continental United States

The figure below shows the average potassium levels for the continental United States. The darker shades indicate higher levels of potassium. If we were to superimpose a map showing the average precipitation for the US, it would show a similar pattern that indicates the strong correlation between potassium levels and precipitation. Because these conditions cannot be controlled, and the loss of potassium-retaining minerals has occurred over a great deal of time, there is little that can be done to reverse the effects of this process.

Figure 1. Potassium Soil-Test Levels in the Continental U.S.



Conclusion

Potassium is essential for plant growth, but the amount of potassium available in the soil is determined by thousands of years of geological and climatic conditions. These conditions are inherited, and they are beyond a grower's control. In areas with higher precipitation, weathering and leaching will be more prominent, so potassium levels will be lower and need to be replenished by applying potash. However, it will never be possible to replenish the reserves that have been depleted through weathering over time.