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The Skinny on Sulfur

One of the more interesting stories of soil fertility and plant nutrition is that of the element sulfur (S). Yes, sulfur–even with its potentially putrid aroma from rotten-eggs (hydrogen sulfide), the element is essential for plant, animal, and human metabolic processes. Yet, it can often be overlooked in soil fertility decisions on the farm. In recent history, our understanding of sulfur in soils, plants, animals, and humans has blossomed; yet its story dates back a few centuries and was almost left untold but for some unintended consequences.

Sulfur can be considered “the forgotten macronutrient” as it is not commonly considered in soil fertility management decisions that tend to focus on nitrogen, phosphorus, and potassium. Yet, many plants uptake sulfur at a quantity similar to that of phosphorus.

Sulfur is uptaken by plant roots. Once inside the plant, sulfur is used to create a host of vital biochemical compounds that greatly affect crop quality and yield. These sulfur dependent molecules affect crop taste, protein content, and seed production. Additionally of interest, plants may also intake sulfur as sulfur dioxide gas through pore-like leaf tissue.

Sulfur, and the plant macronutrient nitrogen, are remarkably similar in plant chemistry and nutrient cycles. Both nutrients are commonly negatively charged, and can be found in soil organic matter, atmospheric gasses, as well as plant and animal residues. However, unlike nitrogen, sulfur can also exist in mineral deposits.

In the plant, sulfur ties the knots between amino acids to create chains of proteins; all of which are molecules containing large amounts of nitrogen in their structures. The ratio of nitrogen to sulfur in the plant is nearly perfectly correlated, meaning without the right amount of sulfur, excess nitrogen is nearly worthless to plant growth.

In the field, we agronomists regard crop sulfur deficiency as similar to nitrogen deficiency, as both produce a yellowing of leaf tissues. However, sulfur deficiency appears in the youngest leaves, while nitrogen deficiency appears in older leaves.

Yet, sulfur deficiency was once hardly observed. Previously, there were many passive sources of sulfur that could be deposited in soils and used for plant growth. For example, viticulturalists and orchardists used copper sulfate to control fungal diseases in fruit crops; phosphorus fertilizers were once made from dissolving phosphorus rocks with sulfuric acid, supplying both phosphorus and sulfur; and until relatively recently, it actually rained sulfur!

The Clean Air Act, passed in 1970 and amended in 1990, has drastically reduced atmospheric sulfur dioxide levels. We have since observed a reduction in the amount of sulfur deposited in Mid-Atlantic soils from acid rain, which contained dilute concentrations of sulfuric acid. This reduction has directly translated to a diminution of soil sulfur levels in the last 30 to 50 years.

The laudable environmental accomplishment of the Clean Air Act ought not be diminished, but it does speak to how no good deed goes unpunished.

Sulfur's outsized role in plant nutrition is clear. Yet, with fewer passive sources for soil sulfur fertility and high crop yields to draw upon soil sulfur reserves, it is imperative, as good managers, we consider the value of sulfur to our crop fertility program.

You can't manage what you don't measure: please consider paying the extra few dollars to include a sulfur analysis on your next soil test. This miniscule investment and thoughtful management could pay off big this growing season.

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