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Top-dressing Wheat with Nitrogen's Amigos: Chloride and Sulfur

The need for nitrogen in wheat is well known, but sulfur and chloride deficiencies are more common in than many farmers realize. Sulfur deficiency looks a lot like nitrogen deficiency and chloride deficiency looks just like a fungal disease, which is if either can be seen at all. While commonly associated with sandy soils, sulfur and chloride deficiency is possible in our heavy clay soils. No-till fields tend to have more trouble with sulfur as well.

Note nearly everything in this article is similarly true for fescue pastures as well. Fescue forage yields have been shown to increase 500 to 800 lbs in research fields top-dressed with sulfur in addition with nitrogen vs nitrogen alone.

Sulfur in Wheat

Sulfur requirements in wheat starts slow in the fall and early spring, but then takes off shortly after green-up. Deficiency looks just like nitrogen except the yellowing occurs in younger leaves rather than older leaves. The wheat will be stunted and spindly with slowed growth and fewer tillers. It can be difficult to measure sulfur in the soil in comparison to wheat needs, as sulfur deeper in soil might not be available to wheat roots, but a 6 inch soil sample also won't tell the full presence of sulfur in the profile.

There are all kinds of sulfur fertilizers, both liquid and dry, and too many to mention. Most are useful for topdressing wheat as long the sulfur is in a sulfate available form. Ideally top-dressed sulfur needs to go on before Feekes 5, which is green-up. Concern needs to be taken with leaf burn and sulfur liquid fertilizers combined with nitrogen fertilizers. Application rates are generally 10 to 15 lbs S per acre.



Sulfur Deficiency in Wheat.
Photo credit Dorivar Ruiz Diaz

Sulfur, specifically plant available sulfate, is mineralized from the organic matter in the soil and is therefore biologically tied to anything that slows down soil microbes. In early spring cold soil temperature is the main culprit for lack of biological sulfur. However saturated soil is another common microbial limiter due to the lack of oxygen that is required to breakdown organic matter. Saturated soil can also convert the sulfate to gaseous form much the same way as denitrification. In some extreme cases, excess nitrate can reduce the plant uptake of the sulfate that is available.

Besides organic matter breakdown, sulfur can also be found in subsoil accumulations. Being an anion like nitrates, it tends to leech down where it will hang out above an impermeable layer or combine with calcium as gypsum. Generally, sulfate leeches about half the speed of nitrates. While wheat roots can grow all winter long, wet winters and heavy clays means root growth occurs near the soil surface and won't reach down into the sulfur laden subsoil in time.

Chloride in Wheat

Chloride is an anion like sulfate and nitrate, and will therefore leech, and has a gaseous form. However, it is more elusive than the other two as deficiency is often hidden. The benefits and yield improvement from top-dressing chloride are hidden as well but can be important for suppression of fungal diseases and enzyme production. Chloride deficiency looks very similar to a fungal problem with yellow spotting on the upper and lower leaves.

In Southeast Kansas and Southwest Missouri chloride deficiency is less of a problem but only because of more likely potash (potassium chloride) or poultry litter applications. Fields without a frequent potash or poultry litter application can be easily susceptible to hidden chloride deficiency. Application rates are commonly 15 to 25 lbs Cl per acre.

Ammonium chloride is a liquid that can be applied top-dressed and mixed with the sulfur and nitrogen application. However, if a potash application of at least 50 lbs per acre or a litter application had been applied before planting wheat, chloride is unlikely to be an issue.

When top-dressing wheat this spring don't forget about all three of the mobile soil nutrient amigos; nitrogen, sulfur, and chloride. Each have their roles in wheat development and can improve grain yields. Usually sulfur and chloride are fairly affordable because they are needed in small quantities and because they can be parts of other fertilizers. My general fertilizer philosophy is to feed the grasses (wheat, corn, sorghum) and let the soybean ride. In other words, use the fact that phosphorus application means nitrogen, potash means chloride, and while fertilizing, throw in the sulfur and zinc if needed. Once the pH is balanced and the P, K and zinc



Chloride Deficiency in Wheat.

Photo credit: Dorivar Ruiz Diaz

are at the agronomic optimum, the soybeans likely won't need any of the "three amigos" as it gets most of those needs from organic matter turnover.

For extension information and publications on soil fertility, please give me a call at 620-724-8233 or email jcoover@ksu.edu.

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