Purdue University Department of Agronomy
Soil Fertility Update

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Keep an eye open for sulfur deficiency in wheat

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Severe sulfur (S) deficiency in our wheat experiment (thankfully a S response trial) at the Southwest Purdue Ag. Center in Vincennes, IN has prompted us to alert farmers and their advisors to be aware of the potential for S deficiency in wheat as well as corn and alfalfa later in the season.

Sulfur deficiency of crops will become more common in the future

Atmospheric S deposition used to be substantial enough to satisfy crop needs. However because power plants have reduced S emissions, crops are reliant more on soil S supply. The incidence and severity of S deficiency is expected to increase as a result and applying fertilizer S will be necessary to provide sufficient S. Sulfur deficiency is most likely in sandy soil with low organic matter, but can also occur in silt loam soil with moderate organic matter levels. No-till systems and heavy residue are also thought to increase the chance of S deficiency.

Identifying sulfur deficiency

Sulfur deficient crops typically have an overall yellow appearance similar to N deficiency (Photo below). However S is not as mobile in the plant as N, so lower leaves do not show more severe deficiency symptoms than the upper leaves unlike N. In corn, S deficiency may also cause leaf striping in addition to an overall yellow color. Sulfur deficiency is more likely in corn, wheat, and alfalfa than in soybean. If S deficiency is misdiagnosed as a N deficiency the application of fertilizer N will make S deficiency worse, so tissue sampling is recommended to positively identify the limiting nutrient.

In the plant, S is a component of two amino acids and occurs in protein in a ratio of 1 part S to about 15 parts N. Therefore the N:S ratio of plant tissue as well as the S concentration are used to identify S deficiency. The lower the S concentration and the higher the N:S ratio the more likely S is deficient in the plant. Tissue S less than 0.12% and N:S ratio greater than 20:1 are most likely S deficient. Sulfur is most likely adequate when tissue S is greater than 0.20% and N:S ratio is less than 12:1. Tissue S and N:S values in between these levels can go either way – deficient or adequate.

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-Sulfur

Wheat with no sulfur fertilizer and 100 lb N/ac flanked by two 30 lb S/ac treatments.

+Sulfur

Wheat with 30 lb sulfur/ac and 100 lb N/ac flanked by two 0 S/ac treatments.

Photos courtesy of Dennis Nowaskie

Soil sulfur may not be enough

Most soil S is in the organic form, however plants accumulate only sulfate-S. Organic-S is mineralized to sulfate by bacteria in much the same way as organic-N is ultimately converted to nitrate-N. Warm moist soils promote mineralization so S deficiencies are more likely to occur when soils are cold in the spring than during the remainder of the growing season. No-tillage and heavy residue may also decrease S mineralization. Sulfate, similar to nitrate, is highly mobile in soil, leaching below the root zone with excess rainfall. Soil testing for sulfate-S has not been considered reliable because of this mobility.

Correcting sulfur deficiency

Sulfur fertilizer should be applied as close to crop need as possible to reduce the chance it will be lost from the root zone by leaching. Often including S in a fertilizer program to avoid S deficiency is more efficient and less costly than correcting a S deficiency once it occurs. Typically soil applications of 15-40 pounds of sulfate-S per acre are sufficient to prevent S deficiency.

Adding ammonium thiosulfate (12-0-0 26%S) to urea-ammonium nitrate solutions (like 28-0-0) or blending ammonium sulfate (21-0-0 24%S) with urea (46-0-0) are convenient and cost effective ways to provide S. Potassium-magnesium sulfate (0-0-22 21%S 11%Mg) can be blended with muriate of potash (0-0-60) to provide S and K. Gypsum (about 20%S) if pelletized can be blended with other fertilizers or if ground, applied with a lime spreader.