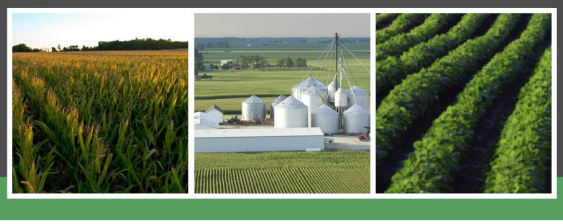

Agronomic Spotlight

Sulfur in Corn and Soybean Production

Sulfur is an essential nutrient that is required for plant growth. If S is deficient, plant growth and development can be reduced and maturity delayed. Sulfur deficiency appears as an overall yellowing of the plant, or striped leaves in corn. Tissue sampling should be done to identify sulfur needs.

WHAT TO CONSIDER

Sulfur (S) is an essential nutrient required for plant growth, and is needed for different plant functions, including photosynthesis, chlorophyll formation, and nitrogen fixation. Deficiency can occur when S is limited, resulting in light green coloration, reduced plant growth, and delayed maturity in corn and soybeans.

The reduction of sulfur dioxide (SO_2) in the atmosphere resulting from anti-pollution laws, combined with higher yields and lower use of S containing pesticides, has increased the need for additional S in recent years. In fact, reports have shown that the amount of S in rainfall throughout the Midwest has decreased by about 10 lb per acre in the past 30 years (Figure 1).[1] Since we can no longer rely on atmospheric deposition, crops must get their S through the mineralization of organic matter and supplemental fertilizer. The addition of S in some areas can produce dramatic results, helping to increase yield and profits in corn and soybean production.[4]

Sulfur Mineralization- About 95% of the total S in soils is found in organic matter, which remains unavailable to the plant until it is converted, or mineralized, to sulfate-sulfur (So_4-S). Only 3 to 5 lb of S are mineralized each year per percent of organic matter in the top 6 inches of soil. The rate of mineralization is dependent on soil moisture, temperature, and the carbon to sulfur (C:S) ratio. Conservation tillage systems can further slow the rate of mineralization due to a higher C:S ratio and lower soil temperatures.[4]

Crop Removal and Leaching- Crop removal and leaching are the two main ways that S leaves the soil. A 200-bu corn crop harvested for grain removes about 16 lb of S per acre (25 to 30-lbs for silage), half of which is taken up after tasseling.[4] Roughly 10 lb of S per acre is removed from a 65-bu soybean crop, or, 0.16 lb of S per bushel of soybean.[3] Like nitrate, So_4-S is mobile in the soil and is subject to leaching out of the root zone. Excessive rainfall can accelerate leaching of sulfate through the soil, especially in sandy soils.[4] The addition of S is particularly beneficial on soils with under 2% organic matter and in course-textured soils. S typically does not need to be added in fine textured soils or fields with manure history.

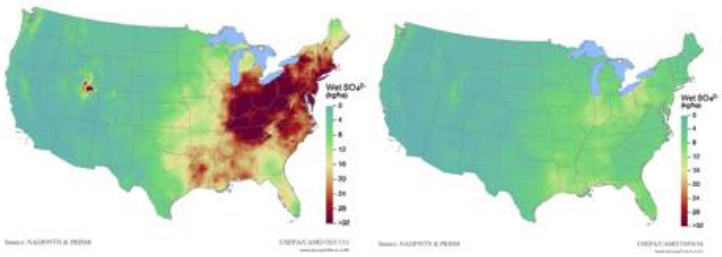

Figure 1. Map of wet sulfur deposition 1989 (left), 2012 (right). EPA Progress Report, Acid Deposition Figures.

Figure 2. Sulfur deficiency in corn.

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YIELD IMPACT

S deficiency is more likely to occur on sandy soils and areas with low organic matter. S deficiency in corn is displayed as an overall yellow appearance, similar to nitrogen (N) deficiency. However, because S is immobile in the plant, symptoms will first appear on younger leaves; whereas N deficiency will first show on older leaves. Striped leaves in corn is also a symptom of S deficiency, and may be confused with magnesium, manganese, or zinc deficiency. In soybeans, look for yellowing of the plant, starting in the upper canopy.[1,3] Crops that are deficient in S will have slow plant growth and delayed maturity. Early season deficiency symptoms may occur under cool soil conditions before young plants have a fully developed root system; however, plants are likely to overcome this as soils warm and root mass and S mineralization increases.[3] If a S deficiency is misdiagnosed as a N deficiency, the application of fertilizer N will make the S deficiency worse; therefore, tissue sampling is recommended to positively identify which nutrient is deficient.

MANAGEMENT OPTIONS

Tissue Sampling- Soil tests are generally considered unreliable for predicting sulfur availability. Instead, tissue tests should be used to identify sulfur needs. It is important to collect tissue samples from both healthy areas of the field and areas of suspected deficiency for comparison. Contact your local testing laboratory for sampling instructions.[1]

Fertilizer- When determining the need for additional S, soil texture, organic matter, crop rotation, and manure history are all important factors to consider. Remember, sandy and low organic matter soils are at higher risk for sulfur deficiency than fine textured soils and fields with manure history, and may require annual applications of S. S is used by the crop throughout the entire growing season, so applications should be made as close to the crop need as possible. Research across the Midwest show that 25 lb of S per acre broadcast, or 10 to 12 lb per acre applied in a starter fertilizer is sufficient in sandy soils for corn production. 10 to 15 lb of S per acre broadcast is the suggested rate for medium to fine textured soils.[1,4] In general, soybeans require less S than corn. The University of Minnesota recommends 10 to 15 lb of S broadcast per acre for soybeans in at-risk fields.[6] There are several fertilizer options available for the addition of S. Liquid fertilizer containing S can be damaging to emerging crops and should not be applied directly on the seed.[4]

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