Crop Sulfur Fertilization This Spring

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Abstract
Significant sulfur (S) deficiency in Iowa crops was first documented about 15 years ago. First identified in alfalfa and then corn and soybean. Since then about 150 trials with corn (along with trials with alfalfa and soybean) have been conducted across the state, with approximately 50% of trials having a statistically significant yield increase. A main reason for the yield response to S in recent years, as compared to many years prior, has been reduction in atmospheric deposition as a result of the Clean Air Act. Other factors for increased S responses include fields with no manure applications, increased crop yields, refinement of phosphate fertilizers, and decreases in soil organic matter levels.

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Suggested sulfur fertilization

Research has indicated corn yield response to approximately 15 lb S/acre in fine textured soils and 25 lb S/acre in coarse (sandy) textured soils. These are suggested S rates for corn (and soybean). If in a corn-soybean rotation, apply these rates before corn as corn has been more responsive than soybean, and then no application needed before soybean. If in a corn-corn rotation, apply every-other-year. For alfalfa, apply 20-30 lb S/acre, with application not needed every year.

Accurately determining S deficiencies has been difficult. No S soil test has been calibrated (reliable) for Iowa crops (similar across the U.S. Midwest). In Iowa, there is no calibrated plant S test for corn or soybean. For alfalfa, sample the top six inches of the plant at early bloom. If the S concentration is less than 0.22-0.25% S, then S application is suggested. Strip trials, conducted with and without S across multiple years, is a good method to confirm fertilization need.

Plant deficiency symptoms
Sulfur deficiency symptoms are easily confused with nitrogen deficiency. In corn, at early growth stages S deficiency shows as yellowing of the younger upper leaves with the older leaves remaining green. Because S is not easily translocated in plants, deficiency appears in the newer leaves. Interveinal chlorosis of the younger leaves may occur, however, interveinal chlorosis is not always an indication of S deficiency. With severe deficiency, the entire plant can show yellowing. In soybean, the plant may have an overall yellow appearance. In alfalfa, deficiency shows as a general yellowing of foliage, plant stunting, and spindly stems. In all crops, yield loss can occur without plant deficiency symptoms being present.
Products

Since the plant available S form is sulfate (SO$_4^{2-}$), for an immediate crop response need apply a fertilizer containing sulfate. This would be the case for spring or early sidedress application in corn or soybean, and before any cutting in alfalfa. Because elemental S must be microbially oxidized to sulfate, it should be applied well in advance of crop need. For example, early fall before corn or soybean, or at the time of alfalfa establishment for multiple years.

Many S fertilizer products are available, including all animal manures and several byproducts. The first three fertilizers in the list are the most commonly used sulfate materials. Elemental S is also commonly used. There is sulfate in the common phosphate fertilizers. The S content is not guaranteed, with a range of 1.3-3.3% S (based on recent analysis of 118 samples by the Office of the Indiana State Chemist). Enough S that a significant amount can be applied with phosphorus fertilization, especially for multi-year applications.

- Ammonium Sulfate (21-0-0-24S)
- Ammonium Thiosulfate (12-0-0-26S)
- Calcium Sulfate (Gypsum) (0-0-0-17S)
- N-P-S products (ex. 13-33-0-15S)
- Polysulfate (0-0-14-19S)
- Magnesium Sulfate (0-0-0-14S)
- Potassium Magnesium Sulfate (0-0-22-23S)
- Potassium Sulfate (0-0-50-18S)
- Elemental S (0-0-90S)
- Sulfur in MAP, DAP, TSP
- By-Products (analysis varies)
  - Lysine manufacturing
  - Soybean soapstock processing
  - Wallboard (gypsum)
  - Flue-gas desulfurization

Application timing

When S is applied in the sulfate form, application can be anytime in the spring through early crop stages. For elemental S, it should be applied well in advance of crop need, or in combination with a sulfate containing fertilizer. Sulfur can be applied broadcast, banded, and in combination with nitrogen, phosphate, and potash fertilizers, or mixed with liquid fertilizer (check compatibility). Ammonium thiosulfate should not be placed in the seed furrow as significant seedling damage can occur.

Summary

- Sulfur deficiency has been common in Iowa.
- Many products are available to correct deficiencies.
- Sulfate containing products should be used when application is close to crop demand.
- Manure is a good source of S.

For additional information, see ISU Extension and Outreach publications CROP 3072, Sulfur Management for Iowa Crop Production.
IPM 42, Nutrient Deficiencies and Application Injuries in Field Crops

Category:  Soils  Soil Fertility

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