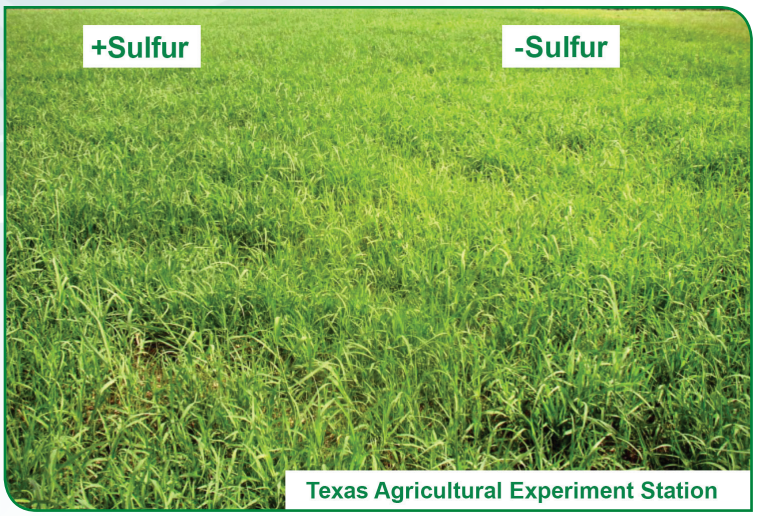
PLANT NUTRITION TODAY

2017 ISSUE 2, NO. 2

PAY ATTENTION TO SULFUR

Sulfur (S) is an essential nutrient in crop production. Although it's classified as a secondary element along with magnesium and calcium, it is sometimes called "the fourth major nutrient" because some crops can take up as much S as phosphorus. Sulfur nutrition has gained a lot of attention in recent years for several reasons. These include higher crop yields that require more S, less S impurities in modern fertilizers, and less use of S-containing pesticides. Furthermore, reduced industrial S emissions to the atmosphere has contributed to increased S shortages. The maps shown at the end of this article illustrate how sulfate ion (SO_4^{-2}) wet deposition in the US has fallen over a recent 20-year period.



Sulfur deficiency in Tifton 85 bermudagrass was visually evident from the outset of a study on the effect of K and S rate and source. Haby et al. 2007.

Sulfur serves many functions in plants. It is used in the formation of amino acids, proteins, and oils. It is necessary for chlorophyll formation, promotes nodulation in legumes, helps develop and activate certain enzymes and vitamins, and is a structural component of two of the 21 amino acids that form protein.

The crop's need for S is closely associated with nitrogen (N). The relationship between S and N is not surprising since both are components of protein and are involved in chlorophyll formation. They are also linked by the role of S in the conversion of nitrate to amino acids. Crops having high N need will usually also have high S needs.

The majority of S in most soils is contained in organic matter. Organic S must be mineralized to the inorganic sulfate anion before it can be taken up by crops. Organic matter decomposition and the resulting S release is affected by temperature and moisture, and generally conditions that favor crop growth also favor mineralization and release of S, although this may be less likely with cool season crops. Sulfate, like most anions, is mobile in soils and therefore subject to leaching. Conditions where S is most likely to be deficient are low soil organic matter levels, coarse (sandy) soil texture with good drainage, and high rainfall. But, these are generalizations, and S can be deficient under other conditions as well.

Several factors should be taken into account when making S fertilization decisions. Among these are cropping and yield goals, soil and plant analysis, organic matter content, soil texture, and contribution from other sources such as irrigation water and manure. High yielding forage crops such as alfalfa

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PLANT NUTRITION TODAY is a quarterly publication of compiled scientific information developed by the International Plant Nutrition Institute (IPNI). Website: http://www.ipni.net/pnt

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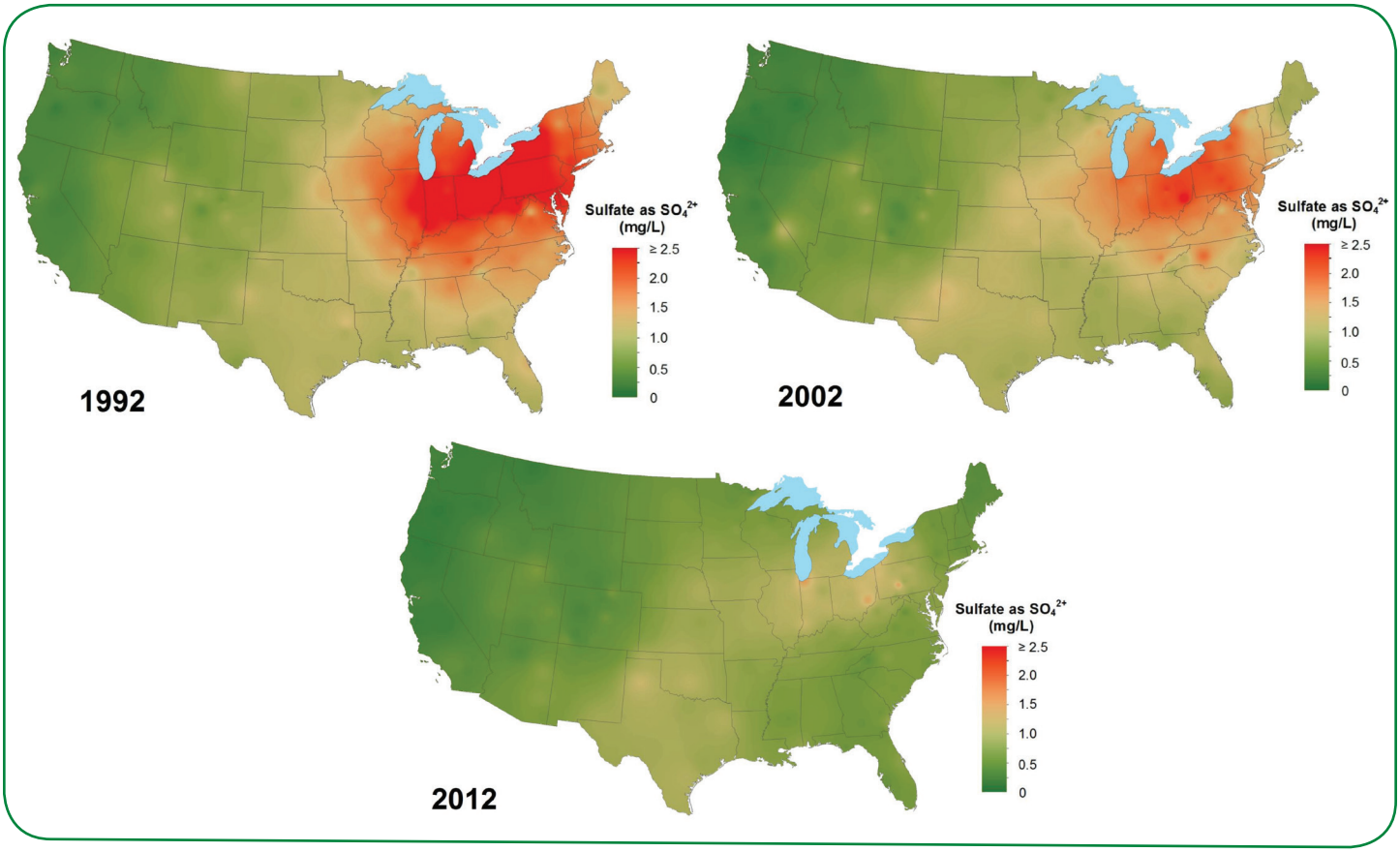
and hybrid bermudagrass remove more S than most grain crops and tend to be relatively responsive. Soil test S is usually a measure of sulfate-S, and as with nitrate-N (NO_3^--N) samples should be taken deeper than normal (0 to 2 ft.) because of sulfate mobility in the soil. Soils containing less than 2% organic matter are most commonly S deficient, and coarse-textured soils are more likely to need S than fine. Sulfur content of irrigation water should be determined since in some cases it can deliver significant amounts of S.

There are several S fertilizer sources available. Most soluble S fertilizer contains sulfate, but others such as bisulfites, thiosulfates, and polysulfides are also available. The most common insoluble S fertilizer is elemental S, which must be oxidized to sulfate before plants can use it. This is a biological process and is affected by temperature, moisture, aeration, and particle size. This process also produces acidity, and elemental S can be used in some instances specifically to acidify soils. For more information on fertilizer sources see IPNI's *Nutrient Source Specifics* series.

Sulfur is an important component of a complete and balanced crop nutrition program, and has justifiably gained more attention in recent years. Crop consultants and decision-makers are well advised to pay attention to S nutrition and the various factors that influence its availability and level of need.

References

Haby, V.A., W.M. Stewart and A.T. Leonard. 2007. *Better Crops* 91(2): 3-5. Available online:



Sulfate ion wet deposition maps *produced by the National Atmospheric Deposition Program are available for each year between 1985 and 2012 at: http://nadp.sws.uiuc.edu/data/animaps.aspx*

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