CHANGING SULFUR TRENDS IN SOUTHERN AGRICULTURE

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In 1999, an Alabama extension agronomist reported sulfur deficiency in cotton grown in a silt loam and a clay loam in the northern region of the state[1]. In 2003, the North Carolina Department of Agriculture & Consumer Services (NCDA&CS) reported that 28% of corn tissue samples and 50% of soybean tissue samples submitted from the Piedmont region were low to deficient in sulfur[2]. In 2004, a Mississippi extension soil specialist reported early-season sulfur deficiency in a variety of soil types, including non-sandy soils[3].

Sulfur Fertilization Increases Yields

The above-mentioned reports on sulfur deficiency mirror a trend already occurring in the northern Corn Belt. From the mid-1990s to the present, researchers in Wisconsin, Minnesota and Kansas have documented yield increases from sulfur fertilization of forage and row crops grown in silt and clay loams with moderate to high organic matter levels.

Like nitrogen, sulfur is a mobile nutrient. Rainfall leaches sulfur out of the upper soil profile. More rainfall typically leads to more leaching and a greater need for sulfur replenishment. This was illustrated in a University of Florida study of cotton grown in a sandy soil. When rainfall was below normal (1996 and 1998), sulfur fertilization increased cotton yield by 21% and 16% respectively. When rainfall was above normal (1997), sulfur fertilization increased cotton yields by 72%[4].

Years ago, high levels of sulfur in acid rain helped to replenish the sulfur that was leached out of the root zone. Since 1991, anti-pollution regulations have significantly reduced sulfur emissions from industry, thus decreasing the amount of sulfur from the atmosphere. According to data from the National Atmospheric Deposition Program/ National Trends Network, most of the southern U.S. received only 3.5 to 4.5 pounds of sulfur from rainfall in 2003[5].

Improving Crop Yields

Agronomists are starting to better understand that in early spring, the upper portion of the root zone can be sub-optimal in available sulfur. Northern agronomists have pointed out that cooler soil temperatures resulting from more surface residue in no-till and reduced-till farming inhibit mineralization of sulfur from the organic matter and lead to early-season sulfur deficiencies. A 2003 bulletin issued by North Carolina State University (NCSU) points out that less tillage also promotes stratification of sulfur levels because there is little to no mixing of high sulfur subsoil with low-sulfur topsoil[6].

The NCSU bulletin further points out that corn is at particular risk of early-season sulfur deficiency during the transition period from radicle to seminal roots. Initially shallow and slow-growing, seminal roots concentrate in the upper two to four inches of soil, where sulfur is often lacking. Under no-till and reduced-till farming, it takes even longer for seminal roots to reach subsoil sulfur. In these cases, soil tests that reveal adequate to high levels of sulfur in the subsoil may not be accurate indicators of available sulfur levels during early-season growth.

Sulfur fertilization of heavy soils can increase crop yields, as demonstrated by recent research in the northern Corn Belt.

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- University of Minnesota has recorded corn yield increases of up to 29 bushels per acre on a silt loam soil with an organic matter level of approximately 2%[7].
- Kansas State University has recorded bromegrass yield increases of up to 30% on silt loams with 3% organic matter[8].
- The University of Wisconsin has recorded alfalfa yield increases of up to 20% on silt loam soils with organic matter levels of 2.8% to 4%[9].

In all three studies, these soil types had previously been considered unresponsive to sulfur.

Researchers in the southern geography have done extensive sulfur research on sandy soils.

- In a University of Florida study, sulfur increased bahiagrass yields by up to 25%[10].
- In a University of Arkansas study, sulfur increased Coastal bermudagrass yields by 11%[11].
- In an Auburn University study, sulfur increased cotton yields by 26%[12].
- In a Wheat Tech study in southern Missouri, sulfur increased winter wheat yields by 38%[13].
- On heavier soils, the University of Arkansas has reported a 13% yield increase from bermudagrass grown in a loam topsoil with a clay subsoil[14].

Improving Crop Quality

In addition to crop yield, research demonstrates that sulfur also improves crop quality. For example:

- On bahiagrass, sulfur raised crude protein from 10.5% to 11.5% in a University of Florida study[15].
- On bermudagrass, sulfur raised crude protein from 15.8% to 20.5% in a Louisiana State University study[16].
- On bromegrass, sulfur raised early-season crude protein from 19.8% to 23.3% in a Kansas State University study[17].
- On ryegrass, sulfur raised crude protein from 9.8% to 12.5% in a University of Florida study[18].
- Calves fed tall fescue fertilized with sulfur gained significantly more weight than those fed the no-sulfur check, in a Virgina Tech study[19].

Recent reports of sulfur deficiency and yield gains from sulfur fertilization in non-sandy soils indicate that the typical profile for sulfur deficiency is changing. This is chiefly due to reductions in atmospheric sulfur deposition and changing tillage practices. Rainfall also plays a role. As a result, sulfur deficiency may occur on heavier soil types as well as on lighter soil types.

Note:
Calves in the Virginia Tech Study were nursing as well as grazing.
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