8. SULFUR-Who needs it?

From the information on sulfur that has been disseminated in recent years, a fieldman could easily conclude that if the growers he worked with didn't already have sulfur deficiency problems they probably soon would.

Sulfur is needed by plants in about the same quantities as phosphorus. High protein crops such as alfalfa have a relatively high sulfur requirement because sulfur is a major constituent of protein. 10 tons of alfalfa contain about 50 Ibs of sulfur. Other crops can remove from 10 to 80 Ibs of sulfur per acre from the soil.

In spite of the known crop needs for sulfur in relatively large amounts, it is surprisingly difficult to get a good handle on this nutrient. Neither soil nor plant analysis values have been refined to the point where critical levels can be stated with confidence. Plants analysis for sulfate is felt by some to be superior to analysis for total sulfur but neither gives a precise index of S status. N:S ratios in plants can provide clues, with a high N:S ratio indicating a potential S deficiency problem.

The best and only definitive way to confirm a suspected sulfur deficiency is to see if a crop response can be obtained by the application of sulfur.

Those that are in the business of selling sulfur to agriculture continually hammer away at 2 points:

1. Increased use of high analysis, "purer" fertilizers has resulted in a great reduction in sulfur that was previously added to crops.

2. Increased pollution controls have resulted in a drastic reduction in the amount of sulfur contributed to the air (and subsequently to the soil) by industry.

The first point is valid, however it should also be brought out that sulfur used in pest and disease control programs can easily satisfy a crop's sulfur needs. For instance, vineyards on which sulfur is used to control mildew will never be sulfur deficient.

The second point is open to question as it does not square with the increased reports of acid rain (largely caused by SO_2) in many parts of the world. This apparent contradiction increased pollution control + increased reports of acid rain is due to the fact that much of the pollution control is directed at controlling pollution at and around the source. What industry has done is to build higher smoke stacks that spew SO_2 into the upper atmosphere. This SO_2 is carried many miles from the source; rain brings the SO_2 down in the form of sulfurous and sulfuric acid (acid rain). Pollution controls have affected the distribution of pollutants more than the actual amounts. If SO_2 is directed away from population centers, then that much more will fall on agricultural land.

How much sulfur does acid rain contribute to agriculture? Probably between 5 to 20 Ibs per acre in affected areas enough to satisfy crop needs. A good question is, where are the affected areas? It's not all that hard to monitor S in rain water and logging of S content of rain by pollution control agencies will likely become a standard practice before very long. Fieldmen can use such data when planning S fertilization programs.

Sulfur Contributions From Irrigation Water

When reading a report on an observed crop response from sulfur, the first thing the fieldman should look for in the report is the **sulfur** content of the **irrigation water.** One authority has calculated that "Responses to sulfur fertilization can be expected only where less than 5 Ibs per acre of the element is supplied with the irrigation waters." A detailed study in Washington state suggests that a response to sulfur can be expected only if the irrigation water source contains less than 5 Ibs of S per acre foot (a concentration of about 5.5 ppm sulfate). Most wells contain this amount of sulfur and many rivers do also. Relatively pure water from mountain streams (and snowmelt from the Sierras) can have a very low sulfur content. It is crops that are irrigated with **these** waters (or not irrigated at all) that are candidates for sulfur deficiency.

It is very surprising that in all the reports of sulfur deficiency, the influence of the sulfur content of the irrigation water is rarely mentioned. When one reads of thousands of acres responding to sulfur it often turns out that the crop is non-irrigated pasture. Sulfur responses on irrigated agricultural crops are not common; when they do occur, the water source pretty much has to be low in sulfur, but you usually wouldn't know this from reading about the response.

Correcting Sulfur Deficiencies

Gypsum (calcium sulfate) application is probably the best method of correcting a sulfur deficiency, esp. on irrigated crops. If a sulfur deficiency occurs on irrigated crops it will invariably be because the irrigation water is low in sulfate. Low sulfate irrigation water is usually low in total salts (and in calcium); infiltration problems can occur with such water, thus the gypsum can serve the dual purpose of adding sulfur and improving water penetration.

Elemental sulfur can be used to correct sulfur deficiency but since elemental sulfur is acidifying, soil pH control will be a concern on non-calcareous soils (most sulfur deficiencies occur on non-calcareous soils). Incorporating sulfur in an insect or disease control program is a good way to get sulfur to a crop. Responses from elemental sulfur will not be immediate as the biological conversion of sulfur to the usable sulfate form is a process that can take up to a year or more.

Using ammonium sulfate as the nitrogen source for a crop is a good method of adding sulfur. Since ammonium sulfate is an acidifying material, pH control will be important.

For row crops that require phosphorus, a sulfur-containing phosphorus fertilizer (e.g., 16-20-0) is a good choice.

Sulfur materials are not limited to the 4 materials mentioned above, but these 4 are the most widely used and most practical materials for correcting sulfur deficiency.

General Reference

The Sulphur Institute (1725 K St., N.W. Washington. D.C. 20006) started an annual publication, **Sulphur in Agriculture** in 1977. This publication gives annual summaries and write-ups of the significant work being done with sulfur in agriculture.