Cleaner air creating sulfur deficiencies

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Cleaner air in southern Wisconsin is having an impact on some alfalfa crops, but the impact may not be what most people would expect. At an area fertilizer dealer meeting held here recently, University of Wisconsin Extension soil scientist Keith Kelling noted researchers would be working over the next year to adjust the fertilizer recommendations of the Wisconsin soil test to account for alfalfa crops getting less sulfur than previously from polluted air.

Cleaner air is the apparent culprit in sulfur deficiencies in some older stands of alfalfa in southern Wisconsin.

Since the late 1960s, agronomists, farmers and others in northern and western Wisconsin – stretching from Prairie du Chien to Green Bay – have recognized the potential significant responses to applied sulfur fertilizer. This occurs on lighter textured, low organic-matter soils that have not had manure applied to them in recent years.

In southern Wisconsin, however, researchers determined little or no response to applied sulfur fertilizer and concluded the reason was the amount of sulfur in polluted air in that more-industrialized part of the state. Sulfur in the air

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is delivered to the soil when it rains.

According to Kelling, from 1969 to 1987, precipitation S (sulfur) decreased an average of 42 percent across Wisconsin. The Wisconsin Department of Natural Resources estimates Wisconsin's sulfur emissions have declined another 40 percent from the mid-1980s to the mid-1990s, and a recent National Oceanographic and Air Administration survey showed Wisconsin's precipitation S levels may only range from 7 pounds to 15 pounds per acre per year.

In southern Wisconsin at least, the Wisconsin soil test recommendations were calculated to credit soils with 20 pounds of precipitation S based on what was known in the early 1990s.

"We need to make some adjustment to this ... credit," Kelling said.

Historically, due to lack of clear guidance provided by a sulfur (SO4-S) soil-test study in 1991, the Wisconsin soil test recommendation program switched its procedures in order to account for plant-available sulfur from other sources. The system to which the program switched was the sulfur availability index (SAI), which Kelling describes as a "somewhat crude 'expert' system." At that time, because of larger amounts of sulfur in the more-polluted air of southern Wisconsin, the soil test recommendations allowed a credit of 20 pounds of sulfur per acre.

The SAI, however, was never completely field tested, Kelling noted.

Within a few years after the SAI was incorporated into the recommendation program, UW soil scientists started receiving reports of sulfur deficiencies in southern and eastern Wisconsin on older alfalfa stands.

UW researchers have been looking at measured responses to sulfur at the Arlington Agricultural Research Station – where soils have high organic matter and are the medium-textured soils frequently found in southern Wisconsin – since at least 1996, plus at the Lancaster research farm and on farms in Manitowoc, Fond du Lac and Dodge counties.

In addition, a number of agronomists and crop consultants cooperated in 2000 and 2001 by sending in plant tissue for analysis. Samples were received from 28 counties. The analysis showed tissue-sulfur levels ranged from 0.09 percent to 0.58 percent. Thirty-six of the 126 samples tested for tissue-sulfur levels below 0.23 percent sulfur, and 14 of them tested at either 0.23 percent or 0.24 percent. The remainder tested at 0.25 percent or above.

Kelling stressed the use of plant analysis does an excellent job of distinguishing when an alfalfa crop has adequate sulfur and when it does not. In general, when the tissue-sulfur level is below 0.23 percent, the addition of applied sulfur will provide a yield response, while tissue-sulfur levels over 0.25 percent typically do not produce a response.

"There are locations where we are seeing responses to sulfur in southern Wisconsin," Kelling said.