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G89-901 Understand Your Soil Test: Sulfur

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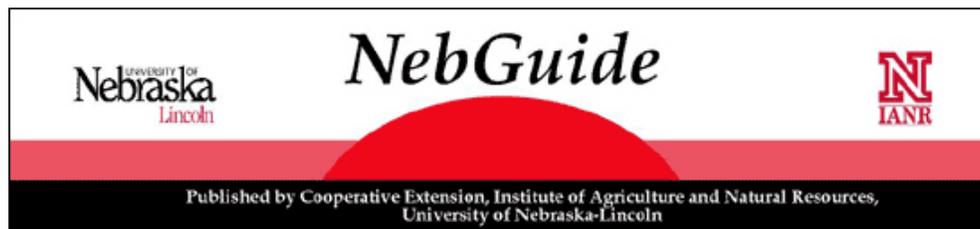


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Understand Your Soil Test: Sulfur

Factors leading to sulfur deficiency, soil and water tests, soil test interpretation and fertilizer materials that contain sulfur are covered here.

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Sulfur, one of the macro-nutrients, may be deficient in some sandy soils but usually is plentiful in other soils of the state. The amounts contained by healthy crops are on the same order as phosphorus, ranging from 0.2 percent to .5 percent sulfur. It is a component of certain amino acids, and so is part of several proteins essential for plants and animals.

Sources of Soil Sulfur

The primary source of sulfur in Nebraska soils is organic matter, accumulated gypsum (calcium sulfate), several other soil minerals and irrigation water. In the spring, until roots extend a few inches into the soil, seedlings depend on sulfate-sulfur released from organic materials by soil microorganisms.

Factors Leading to Sulfur Deficiency

Soils are most apt to be deficient in sulfur if the soil is 1) sand and 2) low in organic matter, moderately to strongly acid, and, if irrigated, with water low in sulfate.

Sulfate-sulfur is quite soluble and moves in the soil, but less readily than nitrate. A temporary deficiency may occur with corn in cold, wet springs when the sulfate is leached from the seed zone and microbial activity is slow. Sulfur chlorosis (yellowing) may occur until the soil warms up. This usually does not affect grain yield except on sandy soils where sulfate may remain low throughout much of the season.

Relation to Soil Tests

Soil tests are of value only if there is a research base that provides the necessary information to show whether and how a test method is related to fertilizer response; in this case, fertilizer sulfur.

The test that has worked the best in Nebraska and other states in the region uses a solution of calcium dihydrogen

phosphate (CDP), the 500 ppm-P test, to extract the sulfate which is then determined by one of several analytical chemistry methods. Other extraction methods have not worked as well. This method correlates with sulfur response of corn and alfalfa on sandy soils in Nebraska. Results are reported in ppm sulfate-sulfur (SO₄-S).

Correlations in the field on other soils of Nebraska have not been satisfactory. Often the top six to eight inches of a non-sandy soil will test low in sulfur, but enough sulfate is available below to meet crop needs. Consequently, subsoil samples to at least two feet, as well as topsoil samples, may be necessary for soil test evaluation of crop sulfur available in the soil.

Test Your Irrigation Water Also

Irrigation water is an important source of sulfate-sulfur. Most of the surface water used in the state and much of the groundwater contains enough sulfur to supply crop needs at normal irrigation rates. Exceptions are ground and surface water in sandy areas. As a part of your soil management, have your water tested for mineral nutrient content.

Soil Test Interpretation

Sulfur fertilization has increased yields of alfalfa and corn in field experiments on some sandy soils. Yield response from sulfur fertilization of non-sandy soils is rare in Nebraska. Sandy soils containing less than one percent organic matter (0.6 percent in the western third of the state) often do not supply enough sulfur for alfalfa and corn.

The most common soil test for sulfur involves extracting with a 500 ppm phosphorus solution (CaHPO₄). Since this is the procedure approved for use in Nebraska, the guidelines in *Table I*, resulting from field and greenhouse experiments, are suggested. Included are application rates of sulfur fertilizer for corn and alfalfa based on soil test. Sunflowers may respond to the same rates as corn. Note that sulfate content of irrigation water also should be considered.

Fertilizer Materials That Contain Sulfur

Sulfur fertilizer materials include gypsum (16 percent), 0-20-0 (13 percent sulfur), ammonium thiosulfate (24 percent sulfur), potassium-magnesium sulfate (22 percent sulfur) and agricultural sulfur (96 percent sulfur). **Do not apply ammonium thiosulfate with the seed.** It can be mixed with fertilizer solution such as 10-34-0 but **must not** be placed with the seed. It seriously can affect germination.

Table I. Sulfur recommendations for corn and alfalfa on sandy soils

Soil Test ^a Sulfate-Sulfur ppm	Less than 1.0% Organic Matter		Greater than 1.0% Organic Matter	
	Corn Pounds S/acre	Alfalfa Pounds S/acre	Corn Pounds S/acre	Alfalfa Pounds S/acre
0 to 5	10 row ^{bd} or 20 broadcast	40 ^c	5 row ^d	30 ^c
6 to 8	5 row ^d or 10 broadcast	none	none	
greater than 8	none	none	none	none

^aSoil test assumed is extraction with 500 ppm P as Ca(H₂PO₄)₂. If the acetic acid modification of this procedure is used, values of 6 and 9 should be used to separate the ranges rather than 5 and 8. (Based on University of Wisconsin data).

^bIf irrigation water contains more than 6 ppm SO₄-S. no broadcast sulfur fertilizer will be needed.

^cFor alfalfa seedlings, sulfur can be applied at rates to supply enough for three years. Use about 100 pounds of SO₄-S per acre.

^dApplied in a band next to the row but not with the seed.

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