The Oklahoma Cooperative Extension Service
Bringing the University to You!

The Cooperative Extension Service is the largest, most successful informal educational organization in the world. It is a nationwide system funded and guided by a partnership of federal, state, and local governments that delivers information to help people help themselves through the land-grant university system.

Extension carries out programs in the broad categories of agriculture, natural resources and environment; family and consumer sciences; 4-H and other youth; and community resource development. Extension staff members live and work among the people they serve to help stimulate and educate Americans to plan ahead and cope with their problems.

Some characteristics of the Cooperative Extension system are:

- The federal, state, and local governments cooperatively share in its financial support and program direction.
- It is administered by the land-grant university as designated by the state legislature through an Extension director.
- Extension programs are nonpolitical, objective, and research-based information.
- It provides practical, problem-oriented education for people of all ages. It is designated to take the knowledge of the university to those persons who do not or cannot participate in the formal classroom instruction of the university.
- It utilizes research from university, government, and other sources to help people make their own decisions.
- More than a million volunteers help multiply the impact of the Extension professional staff.
- It dispenses no funds to the public.
- It is not a regulatory agency, but it does inform people of regulations and of their options in meeting them.
- Local programs are developed and carried out in full recognition of national problems and goals.
- The Extension staff educates people through personal contacts, meetings, demonstrations, and the mass media.
- Extension has the built-in flexibility to adjust its programs and subject matter to meet new needs. Activities shift from year to year as citizen groups and Extension workers close to the problems advise changes.

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Sulfur Requirements of Oklahoma Crops

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http://osufacts.okstate.edu

There are 13 chemical elements that come from the soil which all plants need. Only three are commonly deficient in Oklahoma: nitrogen, phosphorus, and potassium. They are sometimes referred to as primary or macronutrients because plants require large amounts of each. Since plants use such large amounts of these three elements, it is natural for soils to "run out" of these nutrients first. We are acquainted with the need to replenish these nutrients by fertilizing in order to maintain productive soils and profitable yield levels.

Of the remaining 10 nutrients, seven are collectively referred to as micronutrients because they are needed in only trace amounts, and the others are called secondary nutrients. Secondary nutrients are calcium, magnesium, and sulfur.

Researchers at Oklahoma State University have recognized that sulfur would likely be the next nutrient to become deficient in Oklahoma soils. For this reason, and because sulfur fertilizers are often promoted nationally without regard to actual state or local needs, much sulfur research has been done in Oklahoma. Experiments have shown responses to sufur fertilizer only in certain areas.

Available Soil Sulfur

Sulfur is taken up by crops primarily as the sulfate anion (SO_4^{2-}). Like nitrogen, sulfur is a relatively mobile nutrient in soils and is stored in the soil organic matter. Unlike nitrogen, sulfur does form slightly soluble inorganic compounds, like gypsum, which are common stored forms of sulfur in arid and semiarid soils. The supply of native sulfur from soils is influenced greatly by organic matter content and annual rainfall. Figure 1 shows the relative tendency for free sulfates, like gypsum, to contribute to crop needs in relation to rainfall.

Soil texture has a strong influence on the amount of sulfur available in soils because of its relationship to leaching. Deficiency has been reported in the deep sandy soils along the north Canadian River even though annual rainfall is too small to promote excessive leaching. On the other hand, because many eastern Oklahoma soils tend to be shallow and poorly drained, sulfur is not readily leached out of them. An exception is the sandy, coastal plains soils in southeastern Oklahoma where sulfur deficiency has been reported.

Sulfur Additions

Significant amounts of sulfur may be added to Oklahoma soils each year from sulfur contained in rainfall, fertilizers, and pesticides, and irrigation water. Conservative estimates from a research indicate 20 pounds per acre of sulfur are added to soils each year by rainfall in central Oklahoma. The larger amounts are for eastern Oklahoma.

Phosphate fertilizers may contain sufficient sulfur to add another pound or more of sulfur to soils each year. Every 12 inches of irrigation water that contains 5 ppm sulfur, will add 13 pounds per acre of sulfur to the soil. Sulfur concentrations in most Oklahoma irrigation water are several times greater than 5 ppm.

For most production systems in Oklahoma there are at least 10 pounds per acre of sulfur added to the soil each year without specifically using a sulfur fertilizer.

Crop Needs

Crops need sulfur in relation to crop yield because sulfur, like nitrogen, is a mobile element in the soil. The tables located on page 3 show sulfur requirements associated with yield goals for common Oklahoma crops.

Sulfur Fertilizer Requirement

The amount of sulfur fertilizer required is determined by first identifying the yield goal and sulfur requirement. Sulfur requirement for non-legume crops is about 1/10 of the nitrogen requirement. From the sulfur requirement can be subtracted the available sulfur as measured by a recent soil test of both the surface and subsoil. The difference resulting from this subtraction is the sulfur fertilizer requirement. Consider the following example for bermudagrass production:

The yield goal is	**The S requirement is**
6 ton/A	**30 lbs/A**

Soil test sulfur = 5 lbs surface
= 12 lbs sub-soil
Total Soil S 17 lbs/ac

Requirement 30 lbs - 17 lbs available = 13 lbs fertilizer requirement.

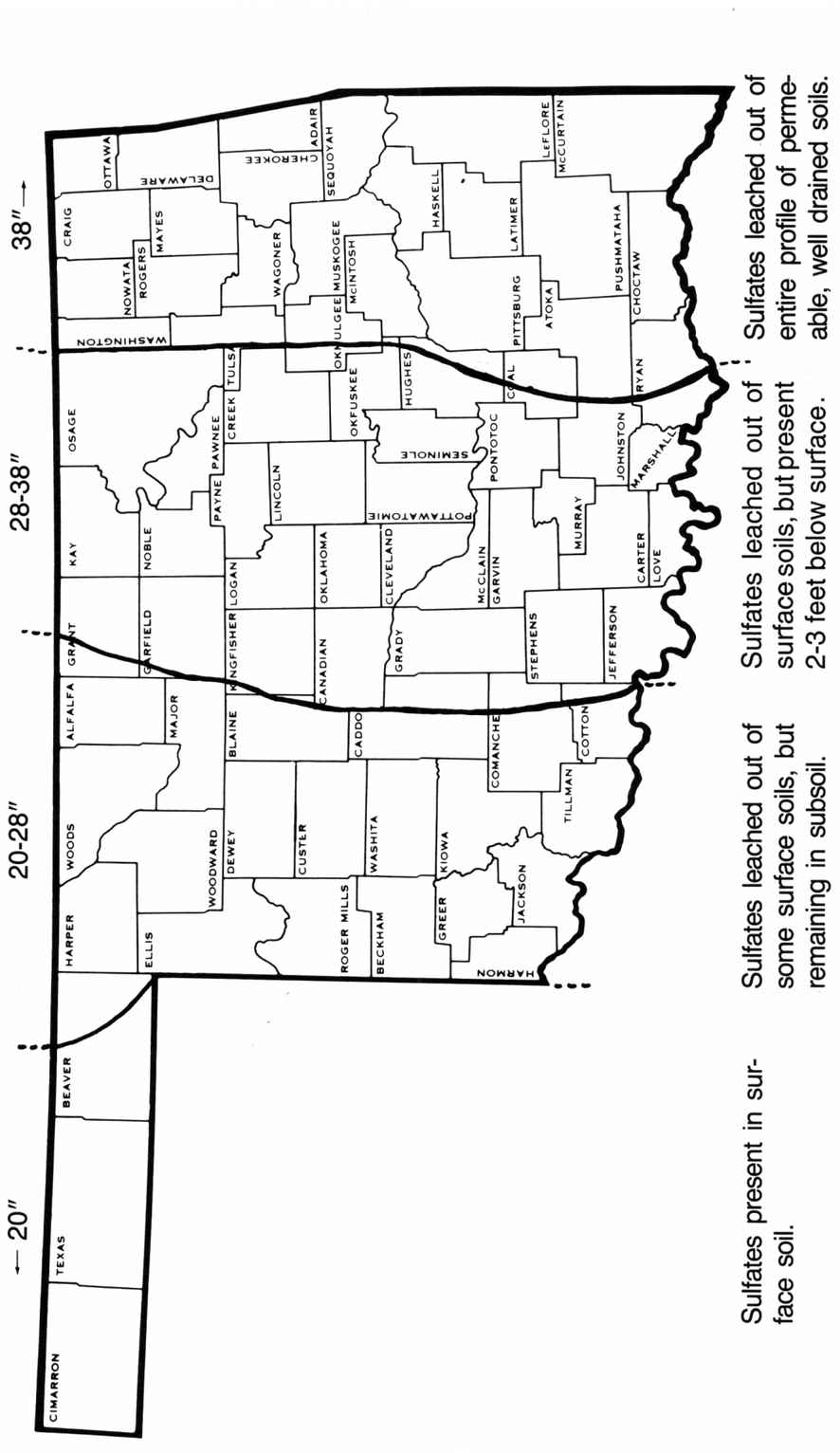

Figure 1. Presence of sulfates in soils in relation to annual rainfall. Although the majority of sulfur compounds have been leached out of surface soils in eastern and central Oklahoma, soluble sulfate anions (SO_4^{2-}) are present in significant amounts. Soil test for sulfur will indicate if sulfur is deficient.

This fertilizer requirement may be reduced by an additional 10 lbs due to the sulfur supplied by rainfall and other incidental soil additions. The final fertilizer requirement is 13-10 or about 3 pounds.

Sulfur Fertilizers

Some of the common sulfur fertilizers and their sulfur content are provided in the following table.

Common Sulfur Fertilizers

Material	*% S*
Elemental Sulfur	90
Calcium Sulfate (Gypsum)	17
Potassium Sulfate	17
Potassium-Magnesium Sulfate (Sul-Po-Mag, K-Mag)	22
Ammonium Sulfate	24
Ammonium Thiosulfate	26-43

SULFUR (S) REQUIREMENTS FOR NON-LEGUMES

SMALL GRAINS

Yield Goal Bu/A Wheat	Barley	Oats	*S lbs/A*
15	20	25	2
15	20	25	2
20	25	35	4
30	35	55	6
40	50	70	8
50	60	90	10
60	75	105	12
70	90	125	14
80	100	140	18
100	125	175	22

GRAIN SORGHUM

Yield Goal lbs/A (Bu/A)	*S lbs/A*
2000 (36)	2
2000 (36)	2
2500 (45)	4
3000 (54)	4
4000 (71)	6
4500 (80)	8
5000 (89)	10
7000 (125)	14
8000 (143)	18
9000 (161)	22

CORN

Yield Goal Bu/A	*S lbs/A*
40	4
40	4
50	6
60	6
85	10
100	14
120	16
160	24
180	28
200	32

COTTON

Yield Goal Bales/A	*S lbs/A*
1	5
1.5	8
2	10
2.5	13
3	15
3.5	18

COOL SEASON GRASSES FESCUE, ORCHARD, RYE

Yield Goal tons/A	*S lbs/A*
1	6
2	12
3	18
4	24
5	30

WEEPING LOVEGRASS

Yield Goal tons/A	*S lbs/A*
1	4
2	6
3	10
4	16
5	20

BERMUDAGRASS

Yield Goal tons/A	*S lbs/A*
1	4
2	10
3	14
4	20
5	24
6	30
7	38

FORAGE SORGHUM

Yield Goal-Tons/A Ensilage	Hay	*S lbs/A*
5	2.5	4
10	5.0	8
15	7.5	12
20	10.0	18
25	12.5	22
30	15.0	28

SMALL GRAINS FOR GRAZING

Yield Goal tons/A	*S lbs/A*
0.5	2
1	6
1.5	8
2.	12
2.5	14
3.0	18

Sulphur Requirements for Legumes

Alfalfa		**Peanuts**		**Soybeans**	
Yield Goal tons/A	*S lbs/A*	*Yield Goal tons/A*	*S lbs/A*	*Yield Goal tons/A*	*S lbs/A*
2	12	6	4	10	6
4	12	12	6	20	12
6	34	18	10	30	18
8	44	24	14	40	24
10	56	30	18	50	30
		36	22	60	36

Mungbeans		**Cowpeas**		**Guar**	
Yield Goal Cwt/A	*S lbs/A*	*Yield Goal Cwt/A*	*S lbs/A*	*Yield Goal Bu./A*	*S lbs/A*
5	3	5	3	6	4
10	6	10	5	12	6
15	9	15	8	18	10
20	12	20	11	24	14