

eFields

Ohio State University Extension Sulfur Trial Protocol

Study Overview

The goal of this study is to determine the yield impact of sulfur on crops in Ohio. Information from this trial will be used to improve management recommendations for growers throughout the state. To maximize learning, 3 sulfur rates should be compared (control, 10lb, 20lb). If adequate space is available, consider adding a sulfur source or placement component to the trial. When possible if a nitrogen/sulfur source is used the nitrogen portion should be balanced in a separate treatment than the control. This will allow us to be certain the treatments effects are from sulfur and not the nitrogen portion of the treatment.

Proper experimental design is important to ensure the validity of yield results at the season end. Plot replication and randomization make it possible for statistical analysis to account for the natural field variation that occurs. For this study, a minimum of three replications should be used and four replications recommended. Plots should be randomized within each replication to eliminate bias due to plot order.

Selecting Sulfur Source

There are many forms of sulfur available, plants take sulfur up in the sulfate form. Elemental sulfur is generally not recommended for this trial, unless it was fall applied (to ensure sufficient sulfate conversion and therefore plant available). Dry ammonium sulfate can easily be applied prior to planting or ammonium thiosulfate can be blended through liquid fertilizer system. This trial should not be conducted on a field that received manure in the past year, due to manure containing high rates of sulfur. If it is conducted on a field that received manure that needs to be noted and a manure sample taken to determine base rates of sulfur applied to the field.

Fertilizer	%N	%K ₂ O	%S	%Mg	%Ca
Ammonium sulfate	21	0	24	0	0
Ammonium thiosulfate	12	0	26	0	0
Elemental sulfur	0	0	>90	0	0
Gypsum (calcium sulfate)	0	0	19	0	23
Potassium magnesium sulfate	0	22	23	11	0
Potassium sulfate	0	50	18	0	0

Selecting Sulfur Rates

Current recommendations for sulfur in Ohio are that most soils provide enough sulfur, but wheat and alfalfa that grow rapidly at cool temperatures when mineralization of S is low are most likely to be S deficient. Current work from Purdue over the last few years from have shown yield

responses to sulfur in early planted soybeans when sulfur is applied at planting. The Purdue trials would recommendation applying 15-25 lb of Sulfur before planting soybeans. It is recommended that all other field treatments be constant such as seeding rate and nitrogen rate.

Sulfur Crop removal rates

- Corn 0.05 lbs/bu 10lb/200 bu
- Soybeans 0.18lbs/bu 10lb/55 bu
- Alfalfa 5-7lbs/ton 30-42lb/6 ton
- Wheat 0.07lbs/bu 5.6lb/80 bu

These recommendations can be used as a midpoint for determining treatment rates. There is more sulfur in the plant than that removed in the grain. Current atmospheric deposition is between 2-7 pounds across Ohio.

All trials need to have an untreated control, a treatment balancing for nitrogen will improve the validity of the trial.

Corn recommended treatment rates

- A-Control 0 sulfur
- B-10 lb sulfur
- C-20 lb sulfur

Soybean recommended treatment rates

- A-Control 0 sulfur
- B-10 lb sulfur
- C-20 lb sulfur

Wheat recommended treatment rates

- A-Control 0 sulfur
- B-10 lb sulfur
- C-20 lb sulfur

Alfalfa recommended treatment rates

- A-Control 0 sulfur
- B-25 lb sulfur
- C-50 lb sulfur

Field Dimensions

The field size will determine the total number of plots that can be installed. Remember, at least 3 replications per rate. Plot length is typically determined by the length of the field. All plots should be at least 500 feet long. Plot width will be determined by equipment size. It is important to take into account the size of both the applicator/planter and the combine/harvest equipment, as well as any application equipment that might impact the trial.

- Estimate the field width then divide by the selected width (application equipment) to determine the number of passes / plots available and if you can meet the 5 treatments by 3 replications (15 plots).

- Passes / plots no less than 500-feet (not counting headland rows) are recommended.
- Plots widths consist of two or more combine header widths.

Suggestions

- To maximize learnings, at least 2 fields per county is recommended.
- Evaluate applicator and combine width to make sure the selected plot dimensions align properly. Correct alignment of the applicator and combine widths will ensure project success.
- Using the application tracking option using an in-cab display can help manage the project. One can setup the 5 treatments by using the rate name then adding A, B, C, D or E (or similar nomenclature) at the end of each name.
 - Before starting each pass, select the treatment corresponding to the plot.
- For alfalfa trials yield may need to be calculated using subsamples with a 28"X28" sample square at least 4 subsamples should be averaged for each treatment.
 - Take subsamples on the day hay is mowed
 - When possible use bale counts and harvest weight instead of subsampling.
 - Forage test from each treatment area should be taken by sampling bales from the treatment area. Crude protein will be the most interesting factor.

Data Collection

5 primary data needs for this project

1. Complete worksheet
2. Field boundary (lat/long of field will work at minimum)
3. As-applied data (if available)
4. Plant tissue test at R1(for forage use a forage test at harvest instead)
5. Yield Monitor Data (calibrated); If a yield monitor is not available, a weight wagon can be used to weight the total amount harvested from each plot. Accurate plot dimensions are needed (e.g. width and length of each plot)

Example Layouts

Full-width applicator layout with 5 replications.

Planter		Plot ID	Description	TRT Code
Pass	Replication			
1	1	101		A
2		102		C
3		103		B
4	2	201		C
5		202		B
6		203		A
7	3	301		B
8		302		A
9		303		C
10	4	401		A
11		402		C
12		403		B