

Wheat Nutrient Management Practices

Section 4: Sulfur and Other Micronutrient Management Practices

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Introduction

Sulfur is an essential nutrient for wheat production. This nutrient in the past has largely been supplied through atmospheric deposition, but with improved air quality over the past two decades, more S deficiency has been seen throughout the U.S. Crop management practices including tillage can influence S availability to crops. Further, soil type and organic matter can also influence S fertilizer needs of crops (Bly et al., 2015). This survey evaluated the use of the 4Rs of nutrient management—Right: source, rate, timing, and placement for S by South Dakota (SD) farmers. In this section we will evaluate the results from the 2019 nutrient management survey to help us better understand the local factors that influence the use of various S and other micronutrient management practices. The local factors evaluated include geographic location within SD, tillage type, and farm size. Understanding these factors on farmer's decisions regarding S and other micronutrient management practices can give guidance to government agencies, extension, and other professionals regarding needed research, educational resources, and trainings that are needed to help farmers adopt appropriate 4R nutrient management practices.

Sulfur and Other Micronutrient Sources

Sulfur Sources

Evaluating across S fertilizer application timings, ammonium sulfate was by far the most used S source (82%) followed by ammonium thiosulfate (11%). All other sources were used less than 3% of the time (Table 1). Within the fall, spring, and in-season application timings, S fertilizer applications were minimal (<9% use). When S was applied, ammonium sulfate was the most common S source and most likely to be applied in the spring (8%) compared to the fall (2%) or in-season (1%). All other fertilizer sources were used less than 2% of the time within each application timing. Sulfur fertilizer sources used by farmers were not affected by location, tillage type, or farm size.

Table 1. Percentage use of S fertilizer source by application timing along with percentage use across S fertilizer sources and application timings.

Sulfur Fertilizer Source	Application Timing			
	Fall (%)	Spring (%)	In-season (%)	Across Timings (%)
Ammonium sulfate (21-0-0-24S)	2	8	1	82
Ammonium thiosulfate (12-0-0-26S)	0.4	0.6	0.4	11
Elemental sulfur (0-0-0-88-98S)	0.2	0	0	2
Calcium sulfate (gypsum) (0-0-0-17S)	0.2	0	0	2
Magnesium sulfate, or Epsom salts (0-0-0-14S)	0	0	0	0
Potassium magnesium sulfate, or Sulpomag (0-0-22-23S)	0	0.2	0	2
Potassium sulfate (0-0-50-18S)	0	0.2	0	2
Potassium thiosulfate (0-0-25-17S)	0	0	0	0
Other sulfur products	0.2	0	0	2
Across Products	20	66	14	-
Note. Percentages may not add up to 100 as individuals could input data in multiple categories.				

Micronutrients

Zinc was the most applied micronutrient for wheat in SD (63%) (Table 2). The next most applied micronutrient was copper (24%) and then boron (13%). Overall, these micronutrients were not very commonly applied as < 2% of farmers surveyed applied one or more of these nutrients. This low use of micronutrients is likely due to their application not consistently increasing yields. To this point in research conducted in SD, fertilization with Zn has most often resulted in yield increases among the micronutrients needed by crops (Clark et al., 2019) and is reflected in these survey results as it is the most commonly applied micronutrient.

Table 2. Percentage use of various micronutrients by application timing along with percentage use across micronutrients and application timings.

Micronutrient	Application Timing			
	Fall (%)	Spring (%)	In-season (%)	Across Timings (%)
Zinc	0.4	6	0	63
Boron	0.2	0	0	13
Copper	0	0	0.4	24
Across products	38	38	24	-
Note. Percentages may not add up to 100 as individuals could input data in multiple categories.				

Sulfur and Micronutrient Rates

Sulfur Rates

Fertilizer-S rates used in wheat production were not influenced by location, tillage type, or farm size (Table 3). On average S was applied at 14 lbs S ac⁻¹ with a range of 2-32 lbs S ac⁻¹.

Zn Rates

Fertilizer-Zn rates used in wheat production were not influenced by location, tillage type, or farm size (Table 3). On average Zn rates were 0.25 lbs Zn ac⁻¹.

Table 3. Total fertilizer-S and Zn rate as affected by location, tillage system, and farm size.

Nutrient	Mean	Range	Standard Deviation
Sulfur, lbs S ac ⁻¹	14	2-32	7
Zinc, lbs Zn ac ⁻¹	.25	0.25	0

Micronutrient Rates

Other micronutrient rates besides Zn were not common among survey respondents. Therefore, they will not be discussed here. Information on rates of micronutrients applied with starter fertilizer can be found in the starter fertilizer section of this publication (Section 1).

Sulfur and Micronutrient Application Time

Sulfur Application Time

Evaluating across all S fertilizer sources, the spring application time was most used by farmers (66%) followed by fall (20%) and lastly in-season (14%) (Table 1). Farm location, tillage type, and farm size did not influence the decision of when to apply S fertilizer. These results demonstrate that the majority of S fertilizer is being applied in the spring and/or in-season is important as it shows farmers are normally applying it at times when it is less likely to be leached and more likely to be available to be utilized by the wheat crop.

Micronutrient Application Time

When micronutrients were applied, they were similarly likely to be applied in the fall and spring (38%) and then in-season (24%). Farm location, tillage type, and farm size were not related to this decision of when to apply micronutrients.

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References

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