"A Report to Wilson Industrials"

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Influence of Sulfur Source and Rate on Yield of Soft Red Winter Wheat in Arkansas

Arkansas wheat acres vary widely from year to year but have been steadily increasing since 2008 and an estimated acreage during the 2012-2013 growing season of 600,000 acres. Soft red winter wheat is primarily grown and is most often doubled-cropped with soybean. The majority of Arkansas wheat acres are planted on silt loam soils and a portion of this area is located on sandier textured alluvial soils with low organic matter that require S additions in order to maximize wheat yield. Although most soils in Arkansas cropped to wheat have sufficient S and organic matter to produce maximal yields almost all of the acreage receives 15-21 lbs S/A annually in the form of granular ammonium sulfate blended with urea. Typically wheat producers apply 90-120 lbs N/A in a split application with ½ applied near "green up" (around February 14) and the other ½ applied 3-4 weeks later (early March). The addition of granular ammonium sulfate is generally included in the first split application. More emphasis is being placed on S nutrition as areas of the country are seeing S deficiency more often due to increased regulations and lack of atmospheric S deposition. This study was established to determine if liquid ammonium sulfate (8-0-0-9) was a viable source of S for wheat production in Arkansas and was compared to ammonium thiosulfate (12-0-0-26).

Plots were established at the Ralston Farm near Atkins, AR, in February of 2013. These locations were selected because they are on well-drained soils in the Arkansas River Valley and occur in an area where previous S deficiency has been reported. Selected soils data from a 4 inch soil sample is presented in Table 1. The current University of Arkansas recommendations suggest to add S when a history of S deficiency has been noted. The combination of low soil test S and low soil organic matter at Ralston 1, would indicate a high probability of response to S fertilizer. The producer drill-seeded these fields in late October 2012 at a seeding rate of 120 lbs/A. Initial fertilizer treatments were applied on March 6, 2013. Treatments consisted of the S rates 0, 15, 30 and 45 lb S/A applied using a standard spray boom and a carrier rate of 10 GPA. These rates were applied using both liquid ammonium sulfate and ammonium thiosulfate. In addition to the S treatments each plot received adequate N additions in the form of urea to bring the total N rate in each plot to 120 lb N/A. Plots were monitored throughout the growing season and when the wheat reached ~50% heading (May 8, 2013) a 3 ft. section of the first bordered row was taken for plant tissue analysis. Plant samples were dried at 60˚ C until a consistent mass was reached and then ground to pass through a 2 mm sieve and submitted to the University of Arkansas Agricultural Diagnostics Lab, Fayetteville, AR for total N and elemental analysis. Wheat plots were harvested on June 13, 2013 and yields were adjusted to 12.5% moisture. Statistical analysis was conducted on the grain yield data by location and was analyzed as a full factorial in a randomized complete block design, with 4 S rates x 2 S sources and 4 replications. The analysis of variance for each site is presented in Table 2.

Wheat plots were monitored regularly and notes were taken concerning the effects of S addition. One week after S application there was a noticeable difference in the "leaf burn" from the S applications, the treatments receiving 30 and 45 lb S/A as ammonium thiosulfate being much more yellowed. The liquid ammonium sulfate showed no significant signs of burn regardless of the rate applied. During plant sampling at Ralston 1 it was obvious that the wheat that did not receive S was severely deficient and was stunted, had yellowing of uppermost leaves

and severe streaking. All plots that received S were visibly greener and never exhibited signs of S deficiency. At the Ralston 2 location all plots appeared to be healthy and there was never any indication of S deficiency even in the plots that did not receive S. Statistical analysis of the yield data indicated that there were no significant main effects or interactions at the Ralston 2 location indicating that S was not limiting. As for the Ralston 1 location, there was a significant rate effect. The effect of S rate on wheat yield for Ralston 1 is located in Table 3. As S rate increased from 0 to 15 lb S/A there was a significant yield increase, but subsequent additions of S above 15 lb S/A did not influence wheat yield. At Ralston 1 where there was significant and positive response to S additions of 15 lb S/A there was also no significant source effect indicating that both liquid ammonium sulfate and ammonium thiosulfate are equally efficient at supplying S to wheat at the early tillering stage. Since both of these products are liquid, they would most likely be mixed with UAN 32% and applied using streamer bars. This data indicates that 15 lb S/A appears to be sufficient for correcting moderate to severe S deficiency and that liquid ammonium sulfate and ammonium thiosulfate are both viable options for early season S application to wheat in Arkansas.

Table 1. Selected physical and chemical properties for the two soils utilized in this experiment.

Soil Series	pH	P	K	S	LOI
		----------mg/kg----------			-----%-----
Roxana silt loam	5.9	85	145	7.78	1.45
Dardanelle silt loam	5.7	55	136	9.68	2.06

Table 2. Analysis of Variance for wheat yield at the Ralston Farm near Atkins, AR as influenced by S source, S rate and their interaction.

Source of variation	Ralston 1	Ralston 2
S Source (SS)	0.8658	0.1181
S Rate (SR)	0.0121	0.2249
SS x SR	0.3802	0.1586

Table 3. Influence of S rate on wheat yield on a Roxanna silt loam at the Ralston Farm Location 1 near Atkins, AR.

S Rate	Wheat Yield
lb S/acre	bu/acre
0	33.4 b
15	43.4 a
30	42.8 a
45	42.3 a

Table 4. Influence of S rate on wheat yield on a Dardanelle silt loam at the Ralston Farm Location 2 near Atkins, AR.

S Rate	Wheat Yield
lb S/acre	bu/acre
0	34.0 a
15	28.8 a
30	28.8 a
45	29.9 a

Table 5. Influence of S source and S rate on wheat yield across the Ralston Farm Location 1.

S Rate	LAS	ATS
lb S/acre	----------bu/acre----------	
0	33.4	
15	44.1	42.9
30	43.0	42.7
45	41.8	42.7

LAS- Liquid Ammonium Sulfate (8-0-0-9)
ATS- Ammonium Thiosulfate (12-0-0-26)