

Does Source of Sulfur Fertilizer Matter for Alfalfa?

Dan Kaiser, University of Minnesota-Extension

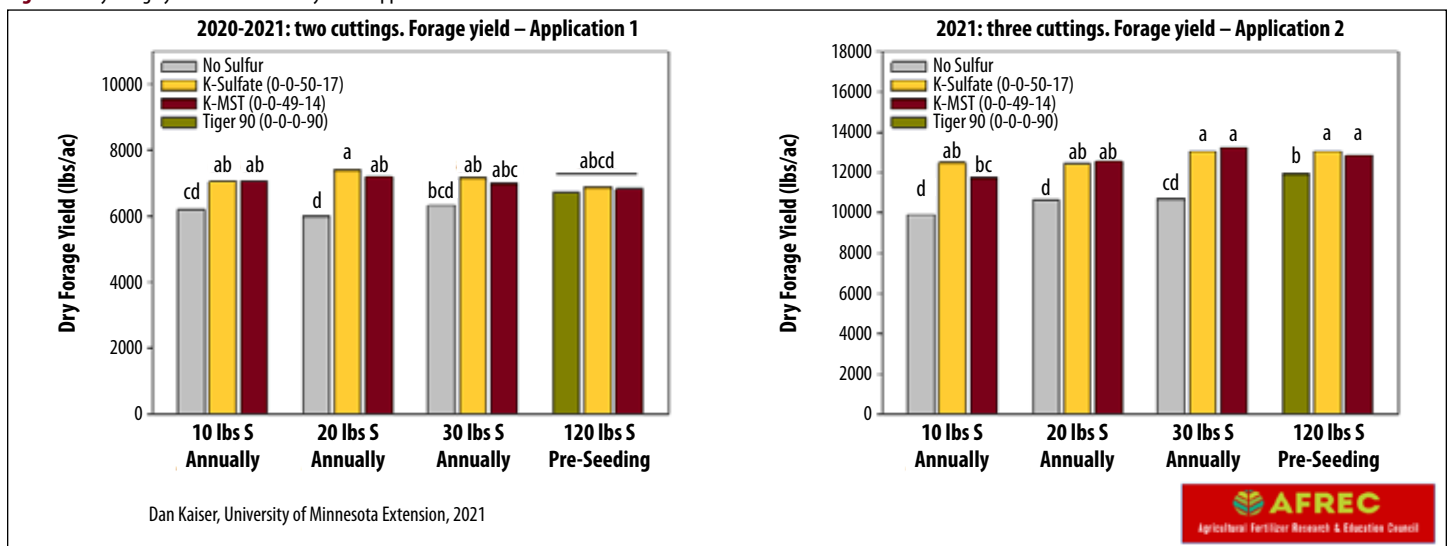
University of Minnesota research shows alfalfa benefits from sulfur (S) fertilizer application. Studies seem to confirm current UM alfalfa S fertilizer application guidelines, which suggest applying 10-25 lbs/ac S fertilizer, depending on production and soil organic matter concentration in the top 6" of soil. What S fertilizer is best? That's the focus of two studies funded by Minnesota's fertilizer check-off dollars through the Agricultural Fertilizer Research and Education Council (AFREC; mnsoilfertility.com).

Sulfur fertilizer sources. Can different elemental S sources oxidize enough S in a given year? The studies compared specific S fertilizer source classes at three rates. Two main options for applying it include elemental S mixed with bentonite (e.g., Tiger 90) and elemental S co-granulated with fertilizer at the manufacturer (e.g., MicroEssentials line of phosphate fertilizers, MAP MST – Macronutrient Phosphate + Micronized Sulfur Technology). Co-granulated S products are touted as being better since they have a lower S concentration in each fertilizer granule, distributing product more evenly across the field. Do these new products have an advantage over other S fertilizer sources? One study, established in spring 2020 in Rosemount on a deep loss soil, featured multiple S rates (0, 10, 20, and 30 lbs S/ac) applied annually to the same plots. Initial application was made spring 2020 and an additional one after the first cutting for each year of the study. The two S sources are potassium (K) sulfate and potash-MST. I have received some criticism in the past when using K-based products as they are not widely available. However, the release of sulfate from K sulfate is similar to ammonium sulfate (AMS), which is more commonly used. We use potash-MST since nearly all the S is elemental, differing from MicroEssentials (half elemental S and half AMS). Phosphate fertilizer sources, such as MAP or DAP, also contain S impurities as sulfate, which are not accounted for in the guaranteed analysis and could impact results. It is important to limit some unknowns to get clear results on the availability of elemental S.

Rosemount results. Only two cuttings were taken after the initial 2020 fertilizer application and before the next application in 2021. In that time, there was a significant forage yield increase when 10 lbs S/ac was applied, averaging a little over 1,000 lbs dry weight over the two cuttings regardless of S source. Similar results were found for the remaining three 2021 cuttings, but yield increase due to S was close to 2,300 lbs dry weight for cuts two through four in 2021. There was no evidence >10 lbs S was required. Discounting quality and assuming a forage value of \$150/ton and a S cost of \$0.50/lb, total return from S fertilizer application was close to \$230/ac. Even if the S fertilizer price is doubled, there would be a significant economic return.

How long does S stay in soil profiles? When sites were established, 120 lbs of S was applied as K sulfate, potash-MST, and Tiger 90. Annual applications will not be made to see how long sulfate stays in soil profiles and how

Figure 1. Dry forage yield broken down by sulfur application. Rosemount LTS alfalfa trial.




higher rates of elemental S oxidize over time. Initial results indicate higher rates yielded slightly less for the initial two cuttings. However, the K sulfate and potash-MST S sources yielded similar to the maximum yield achieved at the site. Tiger 90 yielded less when applied at 120 lbs than the 10-lb annual rate, but increased yield over the control. When incorporated before seeding, the material does oxidize, but the potential for oxidation seems to be less than with the MST products, which also contain elemental S.

What does this mean? Data indicates application of as little as 10 lbs S/ac can be highly profitable, and there is some flexibility in the S fertilizer source used. A Morris site has been established to study S impacts on higher organic matter soils. We will see if the 10-lb rate is sufficient over time or whether differences will be found as the stand ages, warranting higher fertilizer rates. Data also confirms other results showing less availability of the S and bentonite mixture (in this case, Tiger 90). New research is looking at Tiger 90 surface application in the fall without incorporation to see if that provides a better opportunity for the elemental S in the material to oxidize to available sulfate. Since S plus bentonite products are sold, we need to research whether management should be altered to ensure these products have the best chance to supply S to crops that need it.

Figure 2. Forage yield response to S; 2020-2021 two cuttings. Rosemount LTS alfalfa trial.

Sulfur					Source of Sulfur				
Rate lbs/ac	Control	K ₂ SO ₄	K-MST	Rate AVG	Rate lbs/ac	Control	K ₂ SO ₄	K-MST	Rate AVG
10	Alfalfa forage yield - lbs/ac				10	Alfalfa forage yield - lbs/ac			
20	5944	6859	6624	6476	20	9061	11684	10725	10490
30	5710	7518	7076	6768	30	6499	11542	11662	10901
Source Avg ¹	5981	6817	6752	6517	Source Avg ¹	9180	11575	11985	10913
+1064 lbs Forage with S					+2283 lbs Forage with S				
@ \$150/ton returns ~\$80/ac					@ \$150/ton returns ~\$170/ac				
@ \$0.50/lb S and assuming \$6/ac spreading					@ \$0.50/lb S and assuming \$6/ac spreading				
10 lbs S returned ~\$69/ac					10 lbs S returned ~\$159/ac				
10 lbs S returned ~\$228/ac over 2 years									



Dan Kaiser, University of Minnesota Extension, 2021

