MINNESOTA - Evaluation of Sulfur for Alfalfa/Grass Hay

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This study took place during the 2013 growing season near Fergus Falls, MN. This was a randomized complete block design with four replications. Treatments included: No N, P, K or S; NPK no S; NPK + S (40 lbs S as AMS) denoted as High S; NPK + Vitasul; NPK + Tiger 90; and NPK + Gypsum. Nutrients applied within treatments unless otherwise noted were: N:60 lbs N/ac; P:60 lbs P2O5/ac; K:140 lbs K_2O/ac; and S:10 lbs S/ac. Cuttings were taken on June 1; July 9; August 8; and October 10. Yield data was collected by harvesting all plants within a 20' section of the middle two rows from each plot. All data analysis was conducted and reported at the 0.10 probability level.

Table 1. Soil test summary of 0-6" soil samples taken from two locations for the alfalfa grass study.

Site	Phosphorus	Potassium	Organic Matter	pH	Nitrate - N 0-2'	Sulfate - S 0-6"
	------ppm------		%		lb N/ac	ppm
Fergus Falls	17	114	3.7	6.0	na	5.0

**Phosphorus, Bray-P1; potassium, ammonium acetate; organic matter, loss on ignition; pH, 1:1 soil to water; Nitrate-N KCl extractable nitrate from a 2' soil sample, Sulfate-S, mono-calcium phosphate extractable sulfate-S.*

Table 2. Statistical analysis of project data main effects of alfalfa cutting, sulfur treatment, and their interaction.

	Yield	%S	ADF	NDF	RFV	RFQ	Protein	TDN
	----------*P*>F----------							
Cutting	***	***	***	***	***	***	0.06	***
Treatment	0.97	*	0.73	0.54	0.51	0.79	0.71	0.81
Cut x TRT	0.83	*	0.90	0.57	0.60	0.61	0.26	0.59

*†Effect was significant at: ***, ≤0.001; **, ≤0.01; *, ≤0.05*

Table 3. Summary of effects of sulfur treatments on alfalfa dry matter yield and sulfur concentration in dry matter summarized by alfalfa cutting.

	Alfalfa Yield by Cut†				Alfalfa S Concentration by Cut†			
	1	2	3	4	1	2	3	4
	----------tons acre^{-1}----------				----------%DM----------			
Check	2.30	1.79	1.55	0.85	0.21c	0.23b	0.27b	0.25
NPK	2.46	1.85	1.60	0.77	0.25b	0.24b	0.27b	0.27
High S	2.25	1.74	1.59	0.94	0.27ab	0.27a	0.30ab	0.27
Vitasul	2.41	1.72	1.52	0.90	0.26b	0.23b	0.30ab	0.27
Tiger 90	2.37	1.72	1.44	0.76	0.25b	0.22b	0.33a	0.26
Gypsum	2.30	1.90	1.53	0.73	0.30a	0.27a	0.30ab	0.28
Average‡	2.35a	1.79b	1.54c	0.82d	0.25c	0.24b	0.30a	0.26c

†Numbers followed by same letters within column are not significantly different at P<0.10

‡For average by cutting, numbers followed by same letter within rows are not significantly different at P<0.10

Statistical analysis indicated no significant effects of sulfur treatments on alfalfa yield, ADF, NDF, RFV, RFQ, protein, and total dry matter. Analysis was conducted both by cutting and for the four cutting total/average. Data listed are by individual cutting. Significant differences were found between all cuttings for all variables. The lone significant variable was plant sulfur concentration which was found during the first three cuttings. For cut 1, the gypsum and high S treatments had the highest concentration of S in the dry matter followed by all other treatments that contained sulfur (which did not differ among Vitasul, Tiger 90, or the NPK treatment without S). For cut 2, the gypsum and high S treatments still exhibited higher concentrations of S while the remaining treatments did not differ from the control. For cut 3, all S containing treatments resulted in greater concentration of S with Tiger 90 having the highest of all S containing treatments.

For additional information, including quality analysis, please contact Doug Holen at holen09@umn.edu.