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Gypsum Fails to Improve Yield or Quality of Forage

Gypsum, applied to an alfalfa-bromegrass stand did not increase yield, percent crude protein and phosphorus concentration. Sulphur levels in both grass and legume were adequate without gypsum.

Sulphur has not been considered a limiting factor for plant growth in southern Ontario where the yearly atmospheric return in rainfall combined with soil sulphur fulfills the normal crop requirement. Furthermore, recent research in England and elsewhere indicates direct absorption of sulphur dioxide by moist plant and soil surfaces, a process known as "dry precipitation", may equal that obtained through rainfall. Greenhouse studies involving zero atmospheric return indicate that southern Ontario soils do not have a high capacity to supply plant available sulphur despite the continued return resulting from industrialization.

Recognizing that higher analysis fertilizers and reduced sulphur dioxide emissions combined with higher yielding crops may increase the potential for sulphur response we conducted an experiment in 1976 to measure the response of alfalfa grass mixture to surface applications of gypsum at the Elora Research Station. The gypsum treatments were evaluated on the basis of yield and total sulphur, crude protein and phosphorus concentrations in the harvested forage.

Harvesting at the late bud to first flower stage failed to show a yield response to sulphur at any of the three harvests (Table 1). Likewise the total yield for the season the stand comprising 73% or more alfalfa was not increased by the gypsum application.

Table 1: Dry matter yield obtained from increasing rates of sulphur applied to the soil surface of an alfalfa-grass stands.

Cut	Rate of sulphur				% Legume
	0	30*	60	90	
	(kg dry wt/ha)**				
1	4.29	4.63	4.54	4.58	73
2	3.02	2.85	2.70	2.77	88
3	2.11	1.82	1.73	1.99	83
Tot.	9.42	9.30	8.97	9.34	

* 30 kg S/ha is equivalent to 167 kg gypsum/ha.

** mean of six replications.

Increasing the rate of sulphur application resulted in a slight increase in the total sulphur concentration in the alfalfa component of the mixture but not in the grass (Table 2). The alfalfa growing without gypsum contained 0.24% sulphur or greater which is similar to the accepted sufficiency level of 0.23-0.25% sulphur in leaf tissue. With the exception of the first harvest the alfalfa and the grass generally contained similar amounts of sulphur.

Table 2: The total sulphur concentration in the alfalfa and grass components of a mixture forage fertilized with increasing rates of surface-applied gypsum.

Cut	Species	Rate of Sulphur (kg S/ha)			
		0	30	60	90
(% of dry wt)					
1	Alfalfa	.24	.24	.26	.26
	Grass	.21	.21	.20	.19
2	Alfalfa	.26	.28	.30	.29
	Grass	.31	.29	.32	.30
3	Alfalfa	.29	.32	.30	.31
	Grass	.31	.28	.30	.31

A deficiency of sulphur is often associated with reduced protein as a deficiency of the sulphur containing amino acids, cysteic acid and methionine, restrict protein synthesis. The crude protein percentage in the alfalfa and in the grass was not altered by increasing the rate of gypsum application (Table 3). The protein content of grass growing in association with the legume was three to four percentage points less than the legume at the first harvest but was similar at later cuts.

There are some reports that gypsum favours increased phosphorus uptake by plant species. Phosphorus analysis of the forage from this experiment failed to show any increase due to gypsum application (Table 4). In fact, there was a decrease in the phosphorus concentration in the grass growing in association with the alfalfa. However, both species were adequately supplied with phosphorus.

Table 3: The crude protein concentration in the alfalfa and grass components of a forage mixture fertilized with increasing rates of surface-applied gypsum.

Cut	Species	Rate of Sulphur (kg S/ha)			
		0	30	60	90
(% of dry wt)					
1	Alfalfa	18	18	18	18
	Grass	15	15	14	14
2	Alfalfa	21	20	20	20
	Grass	24	22	22	23
3	Alfalfa	21	20	21	20
	Grass	23	20	21	22

Table 4: The phosphorus concentration in the alfalfa and grass components of a forage mixture fertilized with increasing rates of surface-applied gypsum.

Cut	Species	Rate of Sulphur (kg S/ha)			
		0	30	60	90
(% P of dry wt)					
1	Alfalfa	.30	.28	.30	.29
	Grass	.38	.35	.36	.35
2	Alfalfa	.30	.30	.30	.30
	Grass	.46	.43	.43	.42
3	Alfalfa	.35	.32	.33	.31
	Grass	.48	.41	.44	.44