

GRASS FORAGE: FERTILITY MATTERS, N AND S Together Boost Timothy Yield in Central Canadian Research

By Paul Peterson, University of Minnesota and Sukhdev Mahli, Agriculture and Agri-Food Canada, Melfort, SK

Forage grasses often receive inadequate management attention to exhibit their true yield and quality potential. While most producers recognize that grasses need supplemental nitrogen, other nutrients are too-often neglected. The results of a recent Agriculture and Agri-Food Canada study in Saskatchewan demonstrate that attention to balanced fertilization with grass hay production pays. Results were published by S.S. Malhi, B. Coulman, and J.J. Schoenau in *Agronomy Journal* 101:1182-1189 (2009).

A 3-year field experiment was conducted on a loam soil in northeastern Saskatchewan to determine the influence of single- and combined-annual spring (mid- to late April) applications of N, P, and S fertilizers on 'Drummond' timothy yield and quality, as well as plant uptake and soil residual levels of these nutrients. Soil at the research site had pH 6.9 and 3% organic matter. Initial soil tests were considered low for S, marginal for N, near marginal for P, and optimum for K.

Eight fertilizer treatments were applied (lb/ac N-P-S): no-fertilizer control (0-0-0), P (0-20-0), S (0-0-13), PS (0-20-13), N (105-0-0), NP (105-20-0), NS (105-0-13), and NPS (105-20-13). Fertilizer sources were ammonium nitrate, triple superphosphate, and potassium sulfate. The target customers of timothy hay in this region want high fiber and low protein, so timothy was harvested only once annually at 10% flowering.

Greatest yield and nutrient uptake were obtained when N and S were applied together (Table 1). Over 3 years, N- and S-fertilization together boosted yields over N-fertilization alone by >50%, and over zero-fertilization by >150%. Sulfur fertilization increased yield considerably more with N fertilization than at the zero-N rate. The yield response was usually in the order NPS ≥ NS > NP > N ≥ PS ≥ S ≥ P ≥ control. Even though the soil was considered low to marginal in available P, a significant yield response to P was not observed.

Crude protein and P concentration in harvested forage increased with N application alone, but decreased when S was applied with N (Table 2). Fiber concentrations increased somewhat with N application. Forage S concentration increased with S application, but decreased with N application. Maximum N, P, and S uptake occurred with N and S co-fertilization. Residual soil N increased with N application, but decreased when S was applied with N. Residual soil P increased with P fertilizer, but decreased when N and/or S were applied with P. The researchers concluded that a combination of N and S fertilizer produced maximum yield and nutrient uptake of timothy, and reduced nitrate-N accumulation in this soil lacking in these nutrients.

Take-Home Messages for MFA-Region Producers:

- Don't assume that grass forage needs only N.
- There is growing evidence that perennial forages also often respond to S fertilization.
- Get soils tested, and experiment with different fertilizers on your farm. Soils and their available nutrient levels vary tremendously among and within farms.
- This research was conducted with an exceptionally winter-hardy forage grass (timothy) harvested only once per year in central Canada, where average growing-season precipitation is less than the MFA-core region. More stressful harvest regimes and less winter-hardy species may respond even more to balanced fertilization.
- The grass hay management regime in this trial may have particular relevance for dairy farmers looking for economic sources of grass fiber in their rations.

Table 1. Single-cut (10% flowering) timothy forage yields (ton DM/ac) with annual April N, P, and S fertilization in northeastern Saskatchewan.

Fertilizer Treatment Lb/ac N and S	Year			
	2005	2006	2007	Average
0 N and 0 S	1.47	1.45	1.07	1.33
0 N and 13 S	1.55	1.73	1.20	1.49
105 N and 0 S	2.12	2.39	2.14	2.22
105 N and 13 S	3.17	3.30	3.77	3.42

Table 2. Crude protein, NDF, and P concentrations; and N, P, and S uptake of timothy fertilized with N, P, and S and harvested at 10% flowering in northeastern Saskatchewan (3-yr averages).

Fertilizer Treatment Lb/ac N and S	CP	NDF	P	N	P	S
	----- % DM -----			----- Lb uptake/ac -----		
0 N and 0 S	4.3	56.8	0.155	18	4.2	1.9
0 N and 13 S	4.4	56.9	0.157	21	4.7	3.3
105 N and 0 S	6.9	58.6	0.188	47	8.2	2.1
105 N and 13 S	5.1	60.4	0.150	56	10.2	5.4