Influence of Balanced Application of N, P and S Fertilizers on Forage Yield and Quality of Timothy in Northeastern Saskatchewan

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Background

- Timothy (*Phleum pratense* L.) hay provides another opportunity for crop diversification in the Parkland region of Canadian prairies.
- There are approximately 40,000 ha of timothy grown in the three Prairie Provinces of Canada for the compressed hay market, mainly to Japan.
- Research has shown forage yield responses of perennial forage grasses to N, P or S application and the responses were related to available soil nutrients.
- Information is lacking on the forage yield response of timothy to balanced fertilization.

Objective

To determine the influence of balanced application of N, P and S fertilizers on forage dry matter yield (DMY), protein content (PC) and nutrient uptake of timothy grown for hay under dryland (rainfed) conditions.

Materials and Methods

- Field experiment was conducted from 2005 to 2007 on a Dark Gray Luvisol (Typic Cryoboralf) loam soil at Star City in the Parkland region of Saskatchewan, Canada.
- For this area, mean annual precipitation is 425 mm, and growing season (May to August) precipitation is 244 mm. The growing season precipitation (May to August) was 372 mm in 2005, 220 mm in 2006 and 297 mm in 2007.
- Mean annual temperature is 0.3ºC and mean temperature in the growing season is 11.5ºC (with a mean of 2.2ºC in May and 17.6ºC in August).
- There were 8 treatments in a randomized complete block design with four replications: No fertilizer (Nil); 22 kg P ha^{-1} (P); 15 kg S ha^{-1} (S); 50 kg P_2O_5 + 15 kg S ha^{-1} (PS); 120 kg N ha^{-1} (N); 120 kg N + 50 kg P_2O_5 ha^{-1} (NP); 120 kg N + 15 kg S ha^{-1} (NS); and 120 kg N + 50 kg P_2O_5 + 15 kg S ha^{-1} (NPS).
- All fertilizers were broadcast on the surface in mid to late April every year.
- Representative soil samples (0-15 and 15-30 cm depths) from the experimental site were collected in spring prior to seeding timothy in summer 2004.
- The air-dried and ground (2-mm sieve) soil samples were analyzed for texture (manual), pH (1:2 soil:water ratio with a pH meter), NO_3-N, extractable P and SO_4-S.

- Harvesting was done at 10% flowering stage, because the target customers are interested in high fibre content, not in high protein content.
- Hence only one cut was done each year. A self-propelled mechanical forage harvester (Haldrup model) set at a 5 cm cut height was used to harvest 1.5 m wide strip along the length in the centre of each plot.
- Dried and finely-ground forage samples were analysed for protein content.
- The data were subjected analysis of variance (ANOVA) and least significant difference (LSD) was used for mean separation between treatments.

Summary of Results

- In all 3 years, there was little increase in DMY with P, S or PS application compared to unfertilized control (***Figures 1, 3 and 5***).
- The DMY increased moderately when N was applied alone.
- There was substantial further increase in DMY when N was applied in combination with P or S, but the highest DMY was attained when all three nutrients were applied together.
- Uptake of nutrients N, P and S in forage showed trends usually similar to DMY in most cases (***Figures 2 and 4***).
- Compared to unfertilized control, forage PC increased only when N was applied alone, but it decreased when N was applied in combination with P and S due to dilution effect from increased DMY (***Figure 6***).

Conclusion

- The findings suggest that balanced application of N, P and S is essential for optimum forage yield of timothy.

Acknowledgements

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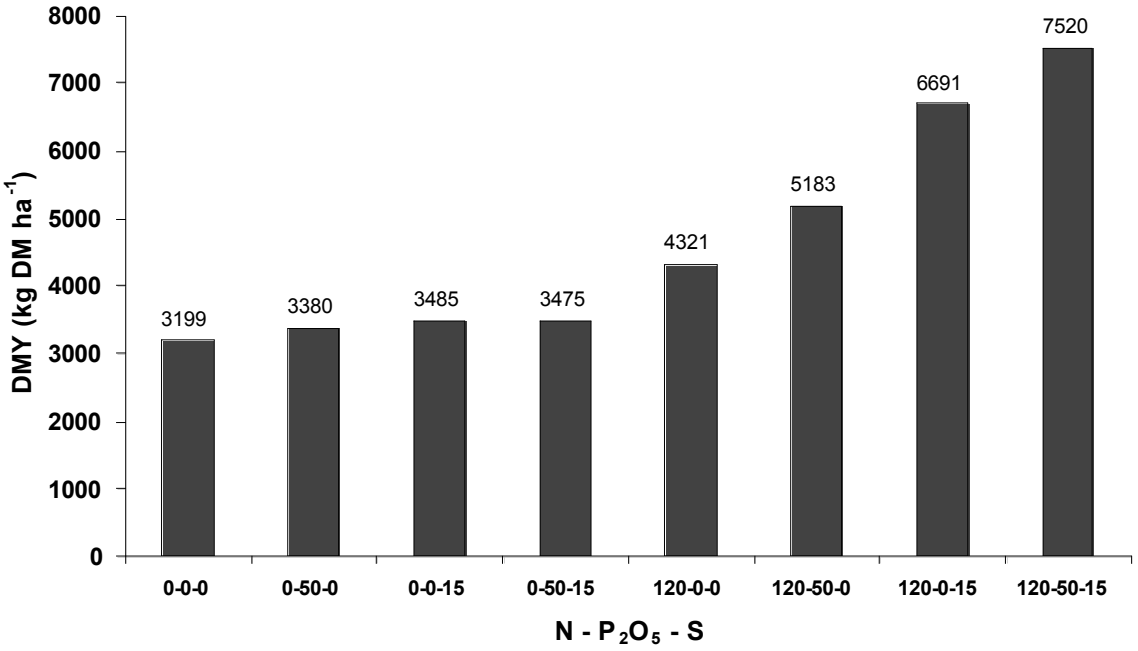

Figure 1. Effect of application of N, P and S fertilizer, broadcasted annually, on total dry matter yield of timothy at Star City, Saskatchewan in **2005**.

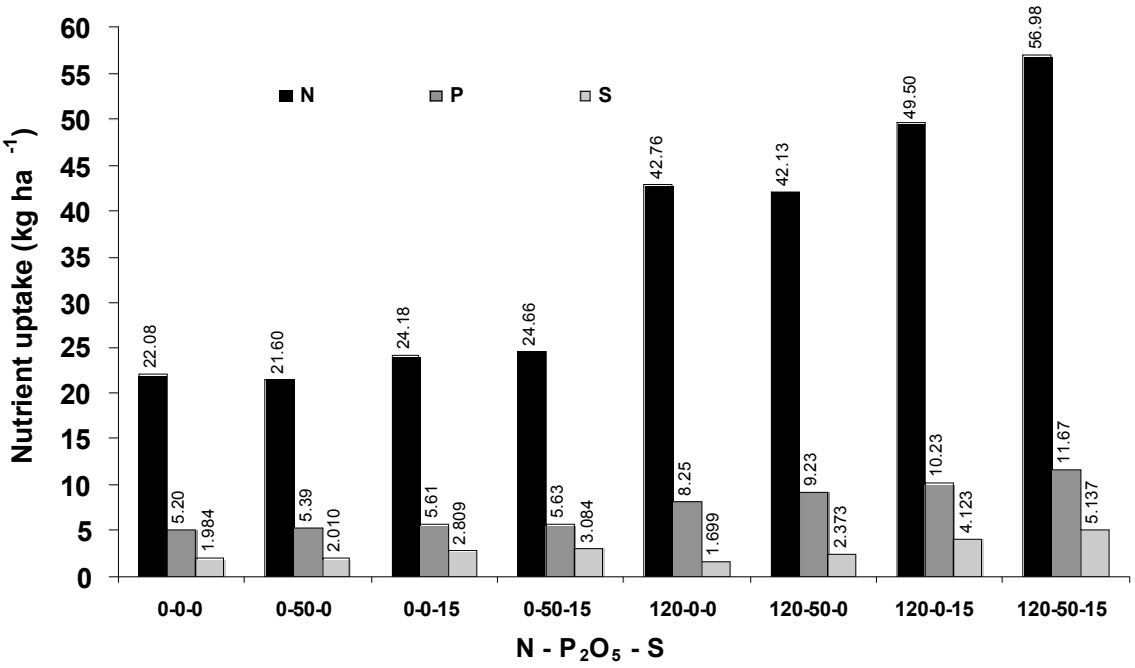

Figure 2. Effect of application of N, P and S fertilizer, broadcasted annually, on plant uptake of N, P and S of timothy at Star City, Saskatchewan in **2005**.

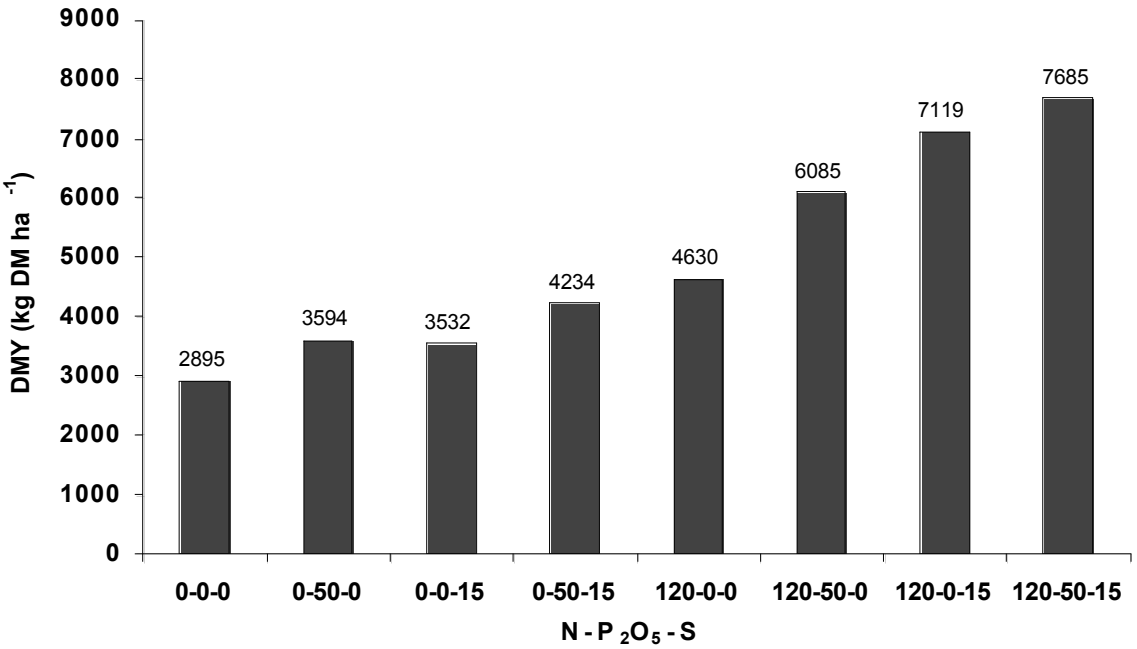

Figure 3. Effect of application of N, P and S fertilizer, broadcasted annually, on total dry matter yield of timothy at Star City, Saskatchewan in **2006**.

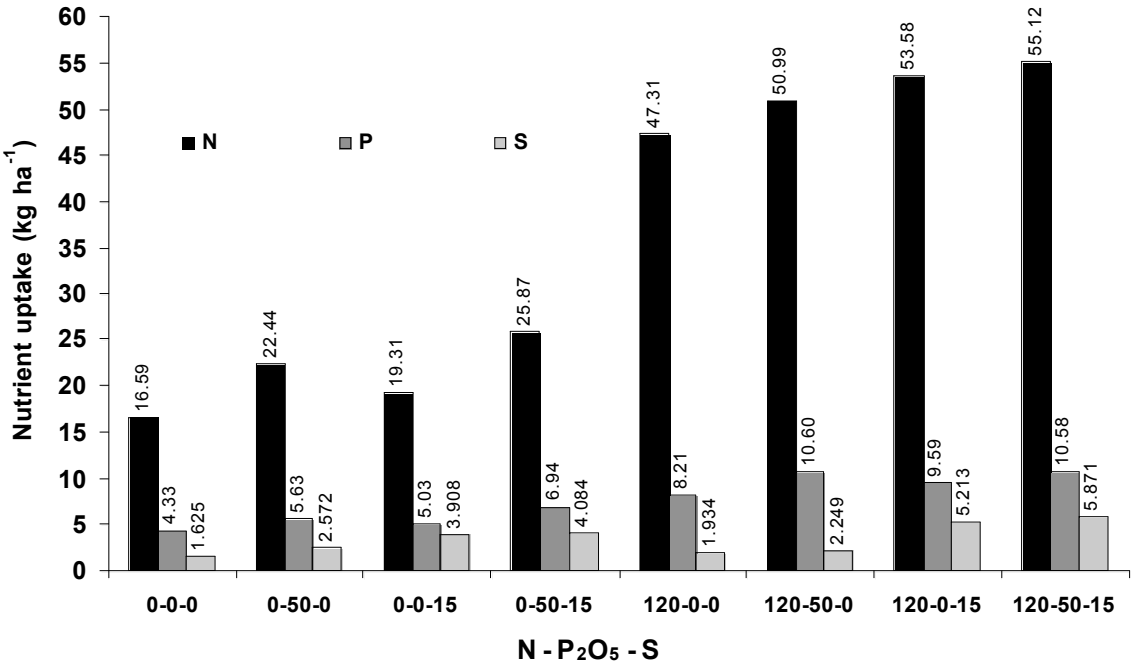

Figure 4. Effect of application of N, P and S fertilizer, broadcasted annually, on plant uptake of N, P and S of timothy at Star City, Saskatchewan in **2006**.

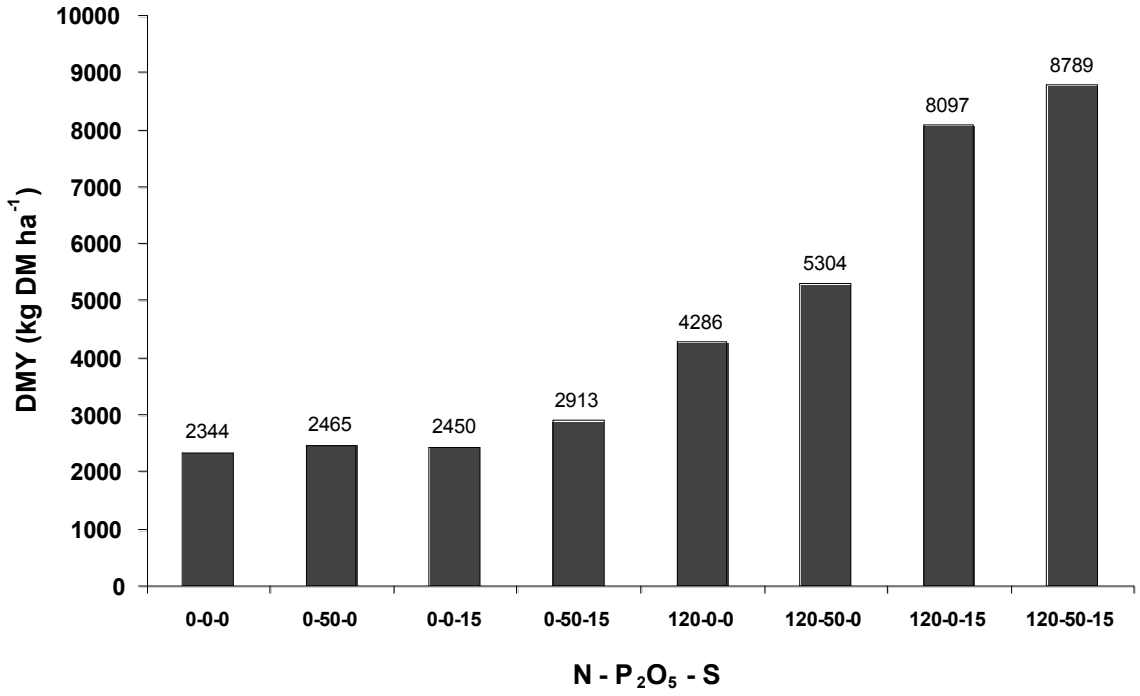

Figure 5. Effect of application of N , P and S fertilizer, broadcasted annually, on total dry matter yield of timothy at Star City, Saskatchewan in **2007**.

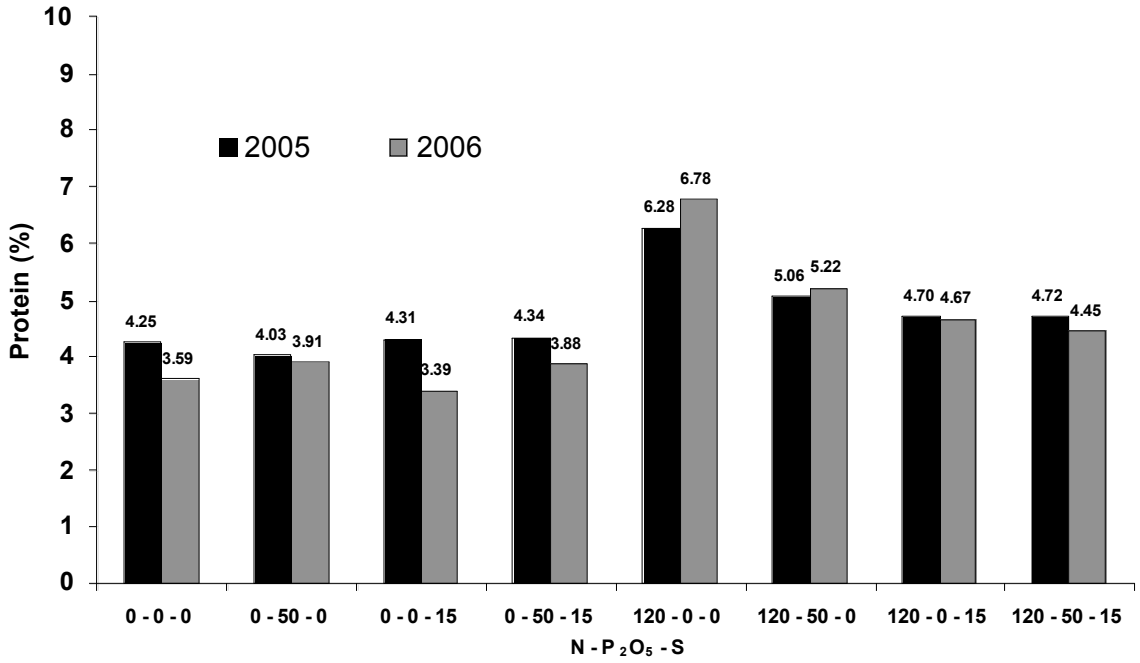

Figure 6. Effect of application of N, P and S fertilizer, broadcasted annually, on protein content of timothy at Star City, Saskatchewan in **2005 and 2006**.