

# **Influence of Long-Term Application of N and S Fertilizers (1980-2002) and Liming in 1992 on Dry Matter Yield of Grass and Soil Properties in a Dark Gray Chernozem in North-Central Saskatchewan**

**S. S. Malhi<sup>1\*</sup>, M. Nyborg<sup>2</sup>, E. Solberg<sup>3</sup>, J. DeMulder<sup>3</sup>, Z. Zhang<sup>3</sup>, Z. H. Wang<sup>1</sup> and D. Leach<sup>1</sup>**

<sup>1</sup>Agriculture and Agri-Food Canada, Research Farm, P.O. Box 1240, Melfort, Saskatchewan, Canada S0E 1A0 <sup>2</sup>Department of Renewable Resources, University of Alberta, Edmonton, Alberta, Canada T6G 2E3; and

<sup>3</sup>Alberta Agriculture, food and Rural Development, Crop Diversification Centre North, R.R. 6, 17507 Fort Road, Edmonton, Alberta, Canada T5B 4K3

\*Phone: 306-752-2776 (Ext. 230); Fax: 306-752-4911; E-mail: malhis@agr.gc.ca

## **ABSTRACT**

The objective of this study was to determine the effects of long-term N, S and K fertilization (from 1980 to 2001) and liming in 1992 on forage dry matter yield (DMY) and soil properties in a Dark Gray Chernozem in north-central Saskatchewan. Long term experiments with N, S and lime application and forage removal (hay-off) and return (hay-on) showed that application of N or S alone had only a little effect on DMY, although the effect of S was slightly greater than N. But, application of N together with S substantially increased DMY. Decline of soil pH with annual applications of N and S fertilizers mainly happened in the 0-5 cm layer. In layers below 10 cm, soil pH tended to increase with N or NS fertilization, and this probably was due to downward movement of Ca or other bases. Surface application of granular lime increased soil pH mainly in the 0-5 cm layer, and maintained the high pH for at least 9 years. The total organic C (TOC) and total N (TN) in the 0-7.5 cm soil layer increased significantly with annual applications of N and S fertilizers, and the increase of was more with application of both N and S together compared to only N fertilizer. In the subsoil layers, the N alone treatment tended to decrease TOC and TN in the 7.5-30 cm layers, but the NS treatment increased TOC and TN in all layers of 15-37.5 cm soil depth. This suggests that application of N alone was not able to increase C and N sequestration in the soil profile as effectively as the application of N and S together. Annual applications of N and S fertilizers markedly increased light-fraction C (LFC) and light-fraction N (LFN) in the 0-7.5 cm soil layer, and the increase was substantially more when N and S fertilizers were applied together than when only N fertilizer was applied. In the subsoil layers, the NS treatment increased LFC and LFN in all layers in 7.5-37.5 cm soil depth. The LFC in the total of the five layers from 0 to 37.5 cm depth indicated that application of N and S fertilizer increased light fraction of C and N sequestered in soil, and the increase was more with application of N together with S than with N alone. Soil bulk density was substantially lowered (due to increase in organic C in soil) with annual applications of N and S fertilizers in the 0-7.5 cm soil layer. The decrease of soil bulk density was more when N and S fertilizer were applied together compared to N fertilizer alone. In the deeper subsoil layers, there was no effect of N fertilization on soil bulk density.