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## Critical Plant and Leaf N Concentrations of an Ageing Timothy Sward

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## Critical plant and leaf N concentrations of an ageing timothy sward

G. Bélanger and G. F. Tremblay

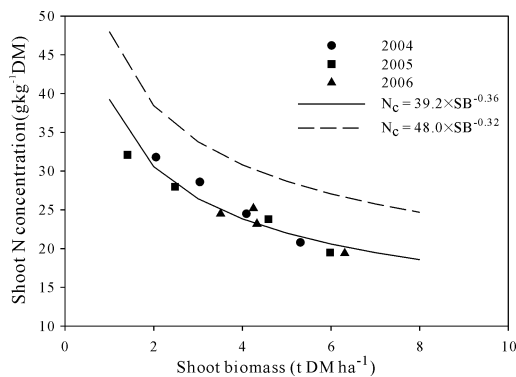
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**Key words :** *Phleum pratense*, nitrogen, N nutrition index, model

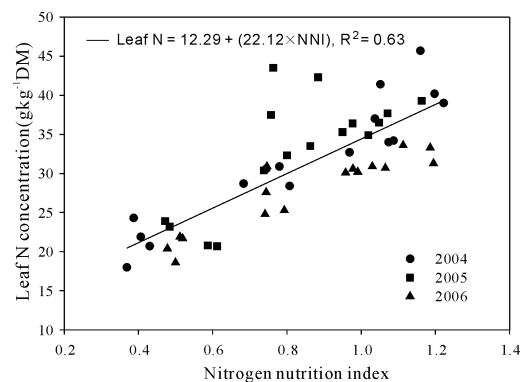
**Introduction** Quantifying the level of N nutrition of grass swards requires the definition of a critical concentration, that is the minimum N concentration required to achieve maximum shoot growth. The critical plant N concentration [ $N_c$ ;  $g\ kg^{-1}$  dry matter (DM)] of a tall fescue sward was first defined as a function of shoot biomass (SB;  $t\ DM\ ha^{-1}$ ) ( $N_c = 48.0 \times SB^{-0.32}$ ) by Lemaire and Salette (1984); this was later validated for timothy by Bélanger and Richards (1997). The N nutrition index (NNI) is calculated by dividing the observed N concentration by  $N_c$ . The NNI was then successfully related to the leaf N concentration of the upper sward layer [Leaf N =  $4.0 + (37.9 \times NNI)$ ; Gastal et al., 2001], hence making it possible to establish the N nutrition index by simply analyzing leaf N concentration. These models of critical plant and leaf N concentrations were determined on young swards (< 3 years). Our objective was to determine the critical plant and leaf N concentrations of older timothy (*Phleum pratense* L.) swards.

**Materials and methods** Timothy (cv. Champ) was sown in 1998 at Lévis, QC, Canada ( $46^{\circ}47'N$ ,  $71^{\circ}07'W$ ). The experiment included four rates of N fertilizer (0, 60, 120, and 180  $kg\ N\ ha^{-1}$ ) applied each year prior to the start of growth in the first week of May from 1999 to 2006. Timothy was harvested at four developmental stages (stem elongation, early heading, late heading, and early flowering) during spring growth. In the last three years (2004, 2005, and 2006), DM yield was measured and 20 last fully emerged leaf blades were taken in each plot of this replicated experiment. Dried and ground samples of whole plants and leaves were used for the determination of N concentration.

**Results** Data points for which there was no significant yield increase with a higher rate of N fertilization were below the critical N curve previously validated for young timothy swards (Figure 1). This critical N curve could not describe non limiting N conditions of this ageing (6-8 years old) timothy sward. A new critical N curve ( $N_c = 39.2 \times SB^{-0.36}$ ) was then developed for older swards (Figure 1). The N concentration of the last fully emerged leaf blades was strongly related to NNI derived from the new critical N curve [Leaf N =  $12.29 + (22.12 \times NNI)$ ; Figure 2]. This confirms previously reported results on ryegrass and tall fescue (Gastal et al., 2001).



**Figure 1** Shoot N concentration as a function of shoot biomass of a 6-8 years old timothy sward. Dash line represents the critical N curve of Lemaire and Salette (1984).



**Figure 2** Nitrogen concentration of the last fully emerged leaf blades as a function of the N nutrition index (NNI) of a 6-8 year old timothy sward.

**Conclusions** A new critical N curve was developed for older (6-8 years old) timothy swards and the N concentration of the last fully emerged timothy leaf was a good indicator of the level of N nutrition of timothy.

### References

- Bélanger, G., Richards, J.E. (1997). Growth analysis of timothy grown with varying N nutrition. Can. [J]. Plant Sci. 77, 373-380.
- Gastal, F., Farrugia, A., Hacquet, J. (2001). The nitrogen nutrition index of grass can be evaluated through determination of N concentration of upper leaves. Proc. of the 11<sup>th</sup> Nitrogen Workshop, Reims, France, pp. 449-450.
- Lemaire, G., Salette, J. (1984). Relation entre dynamique de croissance et dynamique de prélèvement d'azote pour un peuplement de graminées fourragères. I. Étude de l'effet du milieu. Agronomie 4, 423-430.