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

Gilles Bélanger
*Agriculture and Agri-Food Canada, Canada*

Gaëtan F. Tremblay
*Agriculture and Agri-Food Canada, Canada*



The 21st International Grassland Congress / 8th International Rangeland Congress took place in Hohhot, China from June 29 through July 5, 2008.

Proceedings edited by Organizing Committee of 2008 IGC/IRC Conference

Published by Guangdong People's Publishing House

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

*G . Bélanger and G . F . Tremblay*
*Agriculture and Agri-Food Canada , 2560 Hochelaga Blvd . , Quebec , Canada G1V 2J3 ; E-mail : belangergf@agr .gc .ca*

**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 B langer 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 × 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 L vis , QC , Canada (46°47′N , 71°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 experiement . 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 + (21 .12 × NNI) ; Figure 2] . This confirms previously reported results on ryegrass and tall fescue ( Gastal et al . , 2001) .

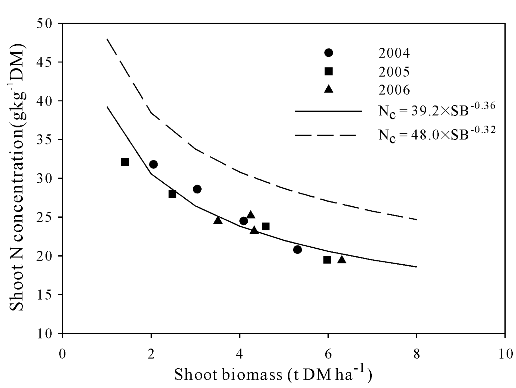


**Figure 1** *Shoot N concentration as a function of shoot biomass of a 6-8 years old timothy sward . Dash line represents the critical N curve of Lemaire and Salette(1984) .*

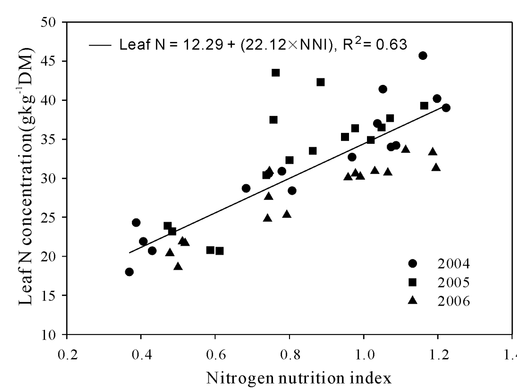


**Figure 2** *Nitrogen concentration of the lastly fully emerged leaf blades as a function of the N nutrition index ( NNI ) of a 6-8 year old timothy sward .*

**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 11th 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 .