Resources Use Efficiency in Tall Fescue and Annual Ryegrass Pastures with Different Nitrogen Nutrition (Humid Pampa, Argentina)

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Introduction The Humid Pampa pastures frequently grow under suboptimal N nutrition. The series of experiments presented here were designed to better understand the agronomical impact and the efficiency of N fertilization practices that are expected to have an increasing demand because of the eminent agriculture area expansion in the region. Results on radiation and N use efficiency for two conspicuous temperate forage grasses-*Festuca arundinacea* Schreb. (FA) or *Lolium multiflorum* Lam. (LM) -under different N fertilization levels applied in late autumn (AUT) or in early spring (SPR) are reported.

Materials and methods Experiments were conducted in the EEA INTA Balcarce (37°45′.S lat. 58°18′ W long.) on Typic Argiudol soils in 1994, 1995, 1997, 2003 and 2005 (LM) and in 1996 and 2006 (FA). Data on nine experiments with N application in AUT (four) or in SPR (five) were used. N treatments covered the range 0-250 kg N ha^{-1} (applied as urea under non limiting P). Independent plots (5.5 m^2) were used. For each regrowth period forage accumulation (kg DM. ha^{-1}), photosynthetically active radiation intercepted (PARint, Mj m^{-2} s^{-1}), radiation use efficiency (RUE, origin = 0), N absorption efficiency (NAE, kg N uptake/kg N applied) and N use efficiency (NUE, kg DM ha^{-1}/kg N uptake) were measured. Plant N concentrations (%) were determined, except in 2005 and 2006. Briefly, nitrogen nutrition index (NNI) were calculated as proposed by the reference N dilution curve (Nref) (Gastal and Lemaire, 1997) and critical N dilution curve (Ncr) (Justes *et al*., 1994). Data were analyzed using ANOVA (P = 5%) and regressions were fitted.

Results Forage accumulations were significantly incremented by N. Responses varied between seasons and species (Figure 1a). N uptake increased linearly in relation to increments in N applied (Figure 1b), however, NAE was higher in SPR than in AUT (on average 63% and 25%, respectively). NUE was higher for LM than for FA (on average 49 and 34 kg DM ha^{-1}/kg N uptake), no differences being detected between seasons. On other hand, N application increased PARint and RUE but, while higher PARint were observed for LM than for FA, principally in AUT (on average 280 and 166 Mj m^2, respectively), the estimated RUE for SPR doubled those estimated for AUT, independently of the species (Figure 1c). Finally, for both seasons and species, N rates compatible with optimum N nutrition (NNI=1) were approximately 135 (Ncr) or 195 (Nref) kg applied N ha^{-1}, and 106 (Ncr) or 147 (Nref) kg N uptake ha^{-1}.

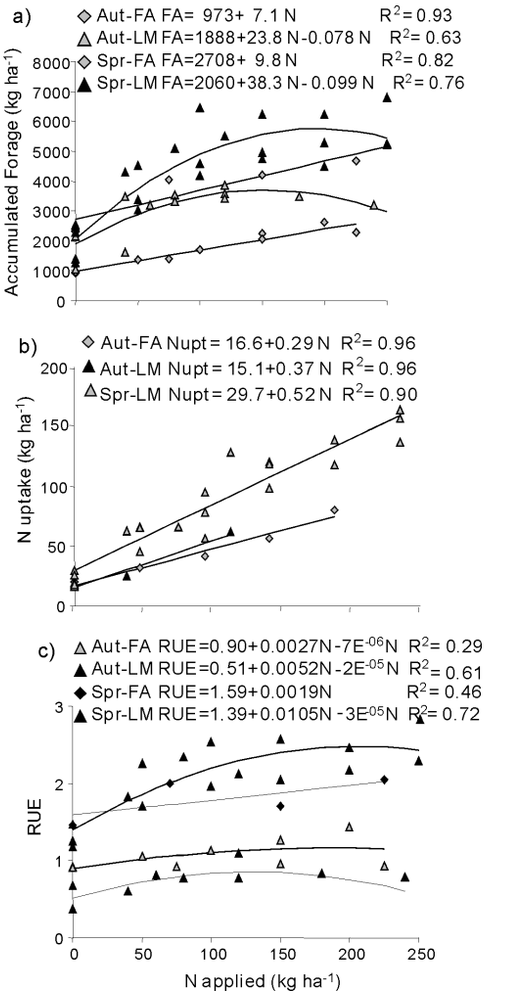

Figure 1 *Forage accumulation (a), N uptake (b) and radiation use efficiency (RUE) with applied N applied in late autumn (AUT) or in early spring (SPR). LM, annual ryegrass. FA, tall fescue.*

Conclusion A higher use efficiency of resources was mainly associated to season (spring greater than autumn) and, to a lesser extent, to genotype (annual ryegrass greater than tall fescue).

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