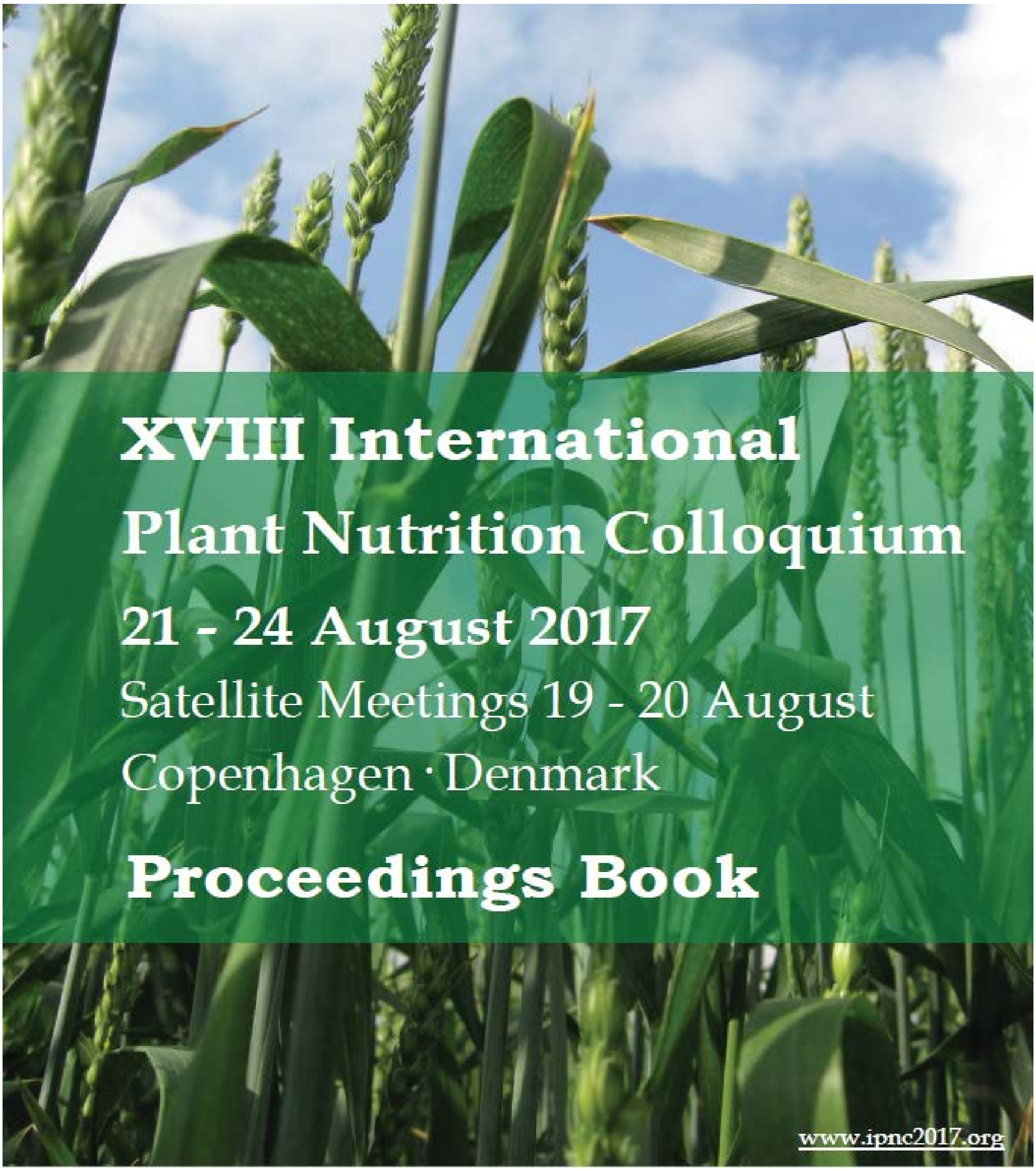

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^{15}N uptake and distribution in grasses growing under *Nothofagus antarctica* vs. grasses in an open site

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INTRODUCTION

In Argentinean Patagonia, there is an extensive area from 36º 30´ to 56º 00´SL where *Nothofagus antarctica* (ñire) native forests are distributed in a narrow strip being the main use as silvopastoral system. In these systems, understory vegetation (composed mainly by grasses) is grazed mainly for cattle and sheep (Peri & Ormaechea 2013). Next to the *N. antarctica* forest, in the ecotone zone, there are grasslands also used for extensive sheep or cattle production with many grass species in common with understory forest species. Likewise, as nitrogen is usually a limiting nutrient in most of the ecosystems, we aimed to know how grasses utilize and distribute available N when they are growing in open areas or close to trees. It is known that trees may compete for resources, but they may also increase soil fertility, microbialactivity orimprove water availabilityby reducing water loss from evapotranspiration inshade (i.e.Mordeletand Le Roux 2006; Simmons et al. 2008). The aim of this work was to study ^{15}N uptake and distribution in grasses growing in undertory *N. antarctica* trees compared with grasses growing in an open grassland. We hipotethized that in these austral ecosystems, when water may be limiting owing to strong summer winds, grasses under trees could better absorb and assimilate the available N than grasses growing in open landscapes.

METHODS

The study was carried out in Cancha Carreras ranch (51º 13´21´´ S; 72º 15´34´´W), in south Patagonia, Argentine. The climate is cold temperate with a mean annual temperature of 6ºC and 563 mm of mean annual rainfall. Grasses growing under the trees were represented by *Agrostis capillaris*, *Festuca magellanica*, *Deschampsia flexuosa* and *Dactylis glomerata*, with a general vegetation cover of 80-100%. *N. antarctica* (66 ± 7 years old) forest under study has a density of 4750 tree ha^{-1} and a dominant height of 5.8 m, used as sylvopastoral system. Grasses growing in an adyacent grasslands were selected to represent "the open landscape" with a vegetation cover of 95% mainly constituted by *A. capllaris*, *Festuca gracillima*, F. *magellanica* and *Carex sp*.

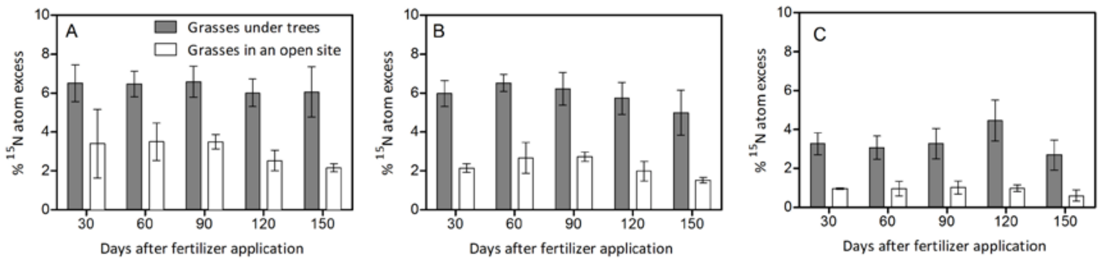
Concerning the *N. antartica* silvopastoral system, 50 m^2 were isolated with polyethylene barrier (1 m depth) and three 1.8 m^2 grazing exclousures were located. In the adyacent grassland, also three exclousures were selected and isolated following the same procedure. ^{15}N labeled fertilizer was applied over the isolated plots at rates of 103 and 130 kg N ha^{-1} for the open site and silvopastoral system, respectively. The silvopastoral area received more fertilizer because of the expected additional tree N uptake. In spring (early November), isotopically-labeled N was applied as 10% $^{15}NH_4{}^{15}NO_3$ solution. After application, plots were watered with deionized water simulating a 1 mm rainfall to facilitate ^{15}N incorporation into the soil and root absortion. Herbage grown in exclosures was collected (aerial parts and from 30 cm depth) at 30, 60,90, 120 and 150 days after fertilizer application using 0.1 m^2 quadrants to estimate biomass, N and ^{15}N concentrations. In the laboratory, herbage was separated in leaves, roots and tillers, dried at 55 ºC to constant weight, weighed and then three 5 g subsamples of each component were ground in a mill for chemical analysis. ^{15}N

enrichment (atom excess) was calculated by subtracting ^{15}N atmospheric abundance (a = 0.3666 %) since there are no data about its natural abundance available.

RESULTS AND DISCUSSION

^{15}N atom excess was detected in all components of grasses: leaves, tillers and roots, although the aerial components had the highest concentrations (Figure 1). In general, grasses growing under trees usually had double ^{15}N atom excess in leaves and tillers compared with grasses growing in the open grassland (Figure 1 A y B). This may indicate that grasses growing under trees better absorbed the fertilizer added than grasses located in the open site. In these sites where water deficit is common owing to the low precipitations and the high wind speed, it is likely that grasses “protected by trees” took advantage and absorbed more of the N fertilizer applied. Our results are in agreement with Treydte et al. (2008) who found that grases growing under trees had lower water stress and that increased their water use efficiency in shade. Similarly, Bahamonde et al. (2012) reported that in sites where *N. antarctica* trees reached heights below 8 m, water availability was the main limiting factor for grass production, and trees play a beneficial role decreasing wind speed and increasing relative humidity, creating a more favorable environment for understory vegetation compared with the adjacent grasslands. Roots also accumulated the ^{15}N added (Figure 1 C) and this could be associated with a N storage mechanism.

Figure 1. ^{15}N atom excess in A) leaves, B) tillers and C) roots of grasses growing under *N. antartica* trees in a silvopastoral system and grasses growing without trees, in an adjacent open grassland in south Patagonia, Argentine. Measures were made after isotopically labeled N was applied as ^{15} 10% $NH_4{}^{15}NO_3$ solution.



CONCLUSIONS

Grasses growing under *N. antartica* trees absorbed twice as much ^{15}N than grasses developing in the open grassland. This may indicated that trees facilitated N absorption by grasses since they may improve environmental conditions like for instance, reducing water stress by protecting from strong winds.

REFERENCES

Bahamonde, H. (2012) Efecto de las variables ambientales sobre la producción primaria neta aerea y el contenido de proteína bruta de gramíneas en sistemas silvopastoriles de ñire (*Nothofagus antarctica*): creación de un modelo de simulación. Tesis para optar al grado de Magíster. Universidad deBuenos Aires.

Mordelet, P. and Le Roux, X. (2006) Tree/grass interactions. InLamto. Springer, New York, pp 139–161.

Peri, P.L. and Ormaechea, S. 2013. Relevamiento de los bosques nativos de ñire (*Nothofagus antarctica*) en Santa Cruz: base para su conservación y manejo. Ediciones INTA, Buenos Aires.

Simmons, M.T., Archer, S.R., Teague, W.R., Ansley, R.J. (2008) Tree(*Prosopis glandulosa*) effects on grass growth: an experimental assesment of above-and belowground interactionsin a temperate savanna. Journal of Arid Environments 72:314–325.

Treydte, A. C., van Beeck, F. A. L., Ludwig, F. and Heitkönig, I. M. A. (2008). Improved quality of beneath-canopy grass in South African savannas: local and seasonal variation. Journal of Vegetation Science, 19(5), 663-670