

## Antagonistic interactions between foliar endophytes and root mycorrhizal symbionts of *Lolium perenne*

Q. Liu<sup>1</sup>, A. J. Parsons<sup>1</sup>, J. A. Newman<sup>2</sup>, H. Xue<sup>1</sup>, S. Rasmussen<sup>1</sup>

<sup>1</sup>Grasslands, AgResearch Ltd., Private Bag 11 008, Palmerston North, New Zealand, E-mail: susanne.rasmussen@agresearch.co.nz, <sup>2</sup>University of Guelph, Ontario, Canada

**Key words :** Quantitative PCR, high sugar ryegrass, phosphorus supply

**Introduction** Lack of information on grass-endophyte-mycorrhizae interactions, mainly due to technical limitations for accurately estimating fungal concentrations, hampers our understanding of the symbionts effects on host metabolism and growth. By using quantitative polymerase chain reaction (qPCR) (Rasmussen et al., 2007), the complex interactions have been studied in perennial ryegrass cultivars differing in sugar content and under different phosphorus (P) supply levels.

**Materials and methods** The experiment consisted of 2 grass cultivars (high sugar, control) × 3 *N. lolii* endophyte treatments (nil, Lp19, AR1) × 3 mycorrhizal treatments (nil, *Glomus mosseae*, *G. intraradices*) × 2 P levels (high, low) × 10 replicates. Plants were grown in sand medium for 12 weeks in a climate chamber. Concentrations of endophytes in blades and stubble, and of mycorrhizas in roots were estimated by qPCR of genomic DNA, using endophyte specific chitinase, *G. intraradices* specific alkaline phosphatase and a *G. mosseae* specific phosphate transporter as target genes.

**Results** Under low P supply, mycorrhizal concentrations were significantly lower in endophyte infected plants compared to endophyte-free controls, and higher in the high sugar cultivar compared to the control cultivar (Figure 1). Endophyte concentrations in both leaf blade (Figure 2A) and stubble (Figure 2B) were significantly reduced by *G. mosseae* (mos), but not by *G. intraradices* (intra) compared to mycorrhizal-free controls (nil). Endophyte concentrations were also lower in the high sugar cultivar as well as under high P supply.

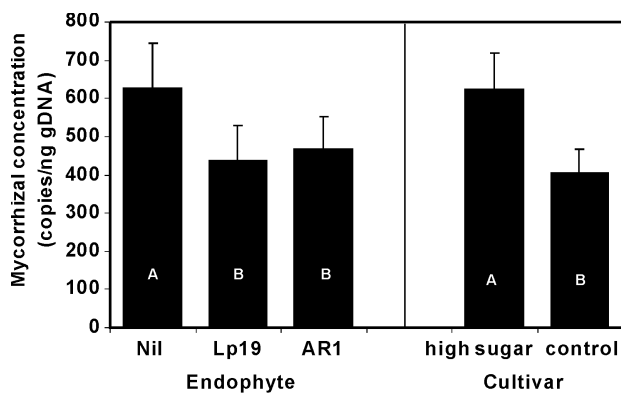


Figure 1 Treatment effects on mycorrhizal fungal concentration under low P conditions.

**Conclusions** Our results are direct evidence for antagonistic interactions between foliar endophytic and root mycorrhizal fungi. It was also shown that the degree of colonisation by both fungal symbionts in ryegrass associations is regulated by the carbohydrate content of plants and by phosphorus levels in soils.

### Reference

Rasmussen S. et al. (2007). High nitrogen supply and carbohydrate content reduce fungal endophyte and alkaloid concentration in *Lolium perenne*. *New Phytologist* 173: 787-797.

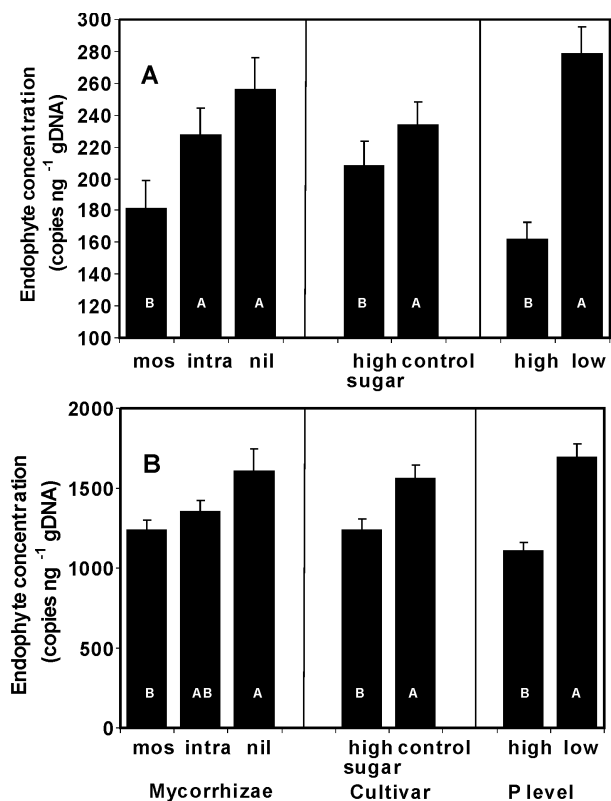


Figure 2 Treatment effects on endophyte fungal concentration in leaf blade (A) and stubble (B).