

## **Temporal variation of soil properties, plant nutrition and arbuscular mycorrhizal symbiosis in *Lotus glaber* and *Stenotaphrum secundatum***

[ILEANA V. GARCÍA](#)\* and RODOLFO E. MENDOZA

Museo Argentino de Ciencias Naturales “Bernardino Rivadavia” (MACN), Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET), Av. Ángel Gallardo 470, Ciudad de Buenos Aires (C1405DJR). Buenos Aires. Argentina.

Phone and fax: 54 11 4982-9410.

\* Corresponding author

Species of genus *Lotus* are increasingly employed in pastures throughout the world because of their high productivity over a wide range of soils. There is a potential use of *Lotus* in relation to both salinity and flooding tolerance. *Lotus glaber* Mill. is an important naturalised legume on lowland grasslands in the Flooding Pampa of Argentina. These grasslands are subjected to periodic droughts or floods, and their soils show extreme values of salinity and sodicity. Mendoza and Pagani (1997) and Mendoza *et al.* (2000) reported high levels of root length colonized and high dependency of *L. glaber* on mycorrhizas in the Flooding Pampa soils, which are characterized by low P availability.

Arbuscular mycorrhizal (AM) symbiosis has a particular importance in improving plant nutrition. The effect is mainly due to the ability of mycorrhizal fungal hyphae to acquire phosphorus (P), or nutrients with low mobility such as Zn and Cu well beyond the limits of the rhizosphere depletion zone (Li *et al.*, 1991). Other benefit of the mycorrhizal symbiosis is to dismiss the detrimental effect of soil salinity (Ruiz-Lozano *et al.*, 1996) by improving nutrient uptake and water relations (Al-Karaki and Clark, 1998).

AM fungal root colonization and spore density have shown seasonality associated to host phenology and climate variations (Bentivenga and Hetrick, 1992; Escudero and Mendoza, 2005). Despite the importance of AM fungi in the physiology and nutrition of plants, little is known of factors affecting the seasonal dynamic of AM fungi in saline-sodic soils. Moreover, studies attempting to relate soil properties and plant P status with temporal variations in AM fungal colonization morphology and soil propagules at field conditions are necessary to better understand how soil properties and plant nutrient status influence AM-plant symbiosis in stressful environment.

The aim of the present work was to study the relationship between seasonal changes in root colonization morphology and changes in P uptake generated by growth stages of two forage species, *L. glaber* and *Stenotaphrum secundatum* (Walt.) O.K., commonly present in a saline-sodic lowlands of Depresión del Salado (Buenos Aires, Argentina).

Plant roots of both species were densely colonized by AM fungi (90% and 73% in *L. glaber* and *S. secundatum*, respectively) at high values of soil pH (9.2) and exchangeable sodium percentage (65%). The percentage of colonized root length differed between species, and showed seasonality. The morphology of root colonization had a similar pattern in both species. The arbuscular colonization fraction (AC) increased at the beginning of the growing season and was positively associated with increased P concentration in both shoot and root tissue. The vesicular colonization fraction (VC) was high in summer when plants suffer from stress imposed by high temperatures and drought periods, and negatively associated with P in plant tissue. Maximum AC and VC in roots of the two plant species take place at different seasons, suggesting a preference for the morphological forms by the fungus in a specific season. In this study, we observed arbuscules at all sampling times, suggesting that host plants and AM fungi may establish a functional symbiosis in this saline-sodic soil. Maximum number of entry points per millimetre of colonized root occurred in the growing season in both species when exchangeable Na and P in soil also increased, which is another evidence of AM fungus adaptability. Spore and hyphal densities in soil were not associated with AM root colonization and did not show seasonality. Our results suggest that AM fungi can survive and colonize *L. glaber* and *S. secundatum* roots, adapted to extreme saline-sodic soil condition imposed by the environment. The high levels of root colonization suggest that either the plants respond with slow root growth, the fungi colonize roots more completely, or the interaction enables considerable root colonization. The symbiosis responds to seasonality and P uptake by the host, altering the morphology of colonized root.

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