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Is There a Link Between Biological Nitrification Inhibition and Mycorrhizal Symbiosis in *Brachiaria* Grasses?

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Abstract

Arbuscular mycorrhizal fungi (AMF) are almost ubiquitous organisms living in symbiosis with 2/3 of vascular plants facilitating the uptake of nutrients by plants. In exchange fungi obtain their carbon from the plants. The benefits that plants obtain from the interaction between plant and fungus is believed to depend on nutrient limitations in the soil and can be regulated by the plant through modification of rhizosphere carbon (C) deposition enhancing or reducing the symbiosis. It has been proposed that nutrient stoichiometry, especially the nitrogen (N):phosphorus (P) ratio, may play a key role in AMF symbiotic functioning. The tropical grass species *Brachiaria humidicola* (Rendle) Schweick has the ability to release a substantial amount of exudates composed of substances inhibiting soil nitrification (a process known as Biological Nitrification Inhibition, BNI) which reduces N losses from soil and increases the plant nitrogen use efficiency. We hypothesise that such an advantage of high-BNI genotypes and improved N uptake could result in higher requirements of other nutrients, such as P, which may become the limiting factor for the crop growth and could lead to increased dependency on AMF symbiosis. Three *Brachiaria* genotypes differing in BNIs capacity were evaluated in a long-term field trial established at CIAT (Colombia). Root colonisation, AMF spore density and P fractions were determined before N fertilisation, one week and three weeks after ammonium sulphate application. *Brachiaria* genotypes with high-BNI capacity showed higher AMF root colonisation than low-BNI genotypes and this difference was increased after N application. Furthermore, soil P fractionation showed that the most available soil P fraction (Resin P), was lower in high BNI after N fertilisation which could indicate increased inorganic P uptake by AMF. Based on these observations, *Brachiaria* genotypes with high-BNI capacity seem to be better adapted to nutrient-poor environments coping better with both N and P limitations when compared to low-BNI cultivars. Nevertheless, the general validity of this observation needs to be confirmed based on studies in different soil types and including more *Brachiaria* genotypes. Our study provided promising insights in the role of mycorrhizal symbiosis for P uptake in relation to BNI capacity in *Brachiaria* grasses.

Keywords: Biological nitrification inhibition, *Brachiaria* grasses, mycorrhizal symbiosis, phosphorus

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