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Importance of Mycorrhizal Symbiosis for Maize in a Cameroonian Soil

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Abstract

Mycorrhizal symbiosis is assumed to play an important role in plant nutrition, growth and stress tolerance. Arbuscular mycorrhizal fungi colonize roots of many plant species including agricultural crops such as wheat, maize, rice, bean, cassava, banana, and improve acquisition of nutrients such as phosphorus (P), especially under low-P soil conditions. Mycorrhizal symbiosis is nowadays recognised to be integral part of the soil-plant systems. However, precise quantification of its contribution to plant growth and nutrition is still rather poor in many situations due to many potentially confounding factors.

Here we tested whether possible shift in mycorrhizal community composition and activity due to agricultural management can be claimed responsible for rapid productivity decline of maize following forest clearance in southern Cameroon. This was addressed by a cross-inoculation experiment that was carried out with soils collected from different land use systems in Cameroon (forest, short-term fallow, continuous cropping). The soils were first sterilized by gamma-irradiation and then inoculated with small amounts of non-sterile soil from the same or from a different land use system. Maize was growing poorly in the sterilized soils, and its biomass and P acquisition improved greatly upon inoculation with soil from the short-term fallow or from previously cropped field. Surprisingly, the improvement of maize growth and P nutrition following inoculation with forest soil did not reach the levels achieved with the other soils. Quantitative PCR with mycorrhizal species-specific markers showed significant differences in mycorrhizal communities in the roots of maize due to the origin of inoculating soil. However, these differences could not be made responsible for a yield decline following forest clearance, since the forest soil had the least stimulatory effect on maize growth and nutrition in our experiment, indication that some other factors are responsible for the system productivity decline after few cropping cycles on these soils.

Keywords: Arbuscular mycorrhizal community, fallow, land use systems, molecular quantification, phosphorus

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