Promiscuous arbuscular mycorrhizal symbiosis of yam (Dioscorea spp.), a key staple crop in West Africa

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Yam (Dioscorea spp.) is a tuberous staple food crop of major importance in the sub-Saharan savannas of West Africa. Optimal yields commonly are obtained only in the first year following slash-and-burn in the shifting cultivation systems. It appears that the yield decline in subsequent years is not merely caused by soil nutrient depletion but might be due to a loss of the beneficial soil microflora, including arbuscular mycorrhizal fungi (AMF), associated with tropical ”tree-aspect” savannas and dry forests that are the natural habitats of the wild relatives of yam. Our objective was to study the AMF communities of natural savannas and adjacent yam fields in the Southern Guinea savanna of Benin. AMF were identified by morphotyping spores in the soil from the field sites and in AMF trap cultures with Sorghum bicolor and yam (Dioscorea rotundata and Dioscorea cayenensis) as bait plants. AMF species richness was higher in the savanna than in the yam-field soils (18-25 vs. 11-16 spp.), but similar for both ecosystems (29-36 spp.) according to the observations in trap cultures. Inoculation of trap cultures with soil sampled during the dry season led to high AMF root colonization, spore production, and species richness (overall 45 spp.) whereas inoculation with wet-season soil was inefficient (two spp. only). The use of D. cayenensis and D. rotundata as baits yielded 28 and 29 AMF species, respectively, and S. bicolor 37 species. AMF root colonization, however, was higher in yam than in sorghum (70-95 vs. 11-20%). After 8 months of trap culturing, the mycorrhizal yam had a higher tuber biomass than the nonmycorrhizal controls. The AMF actually colonizing D. rotundata roots in the field were also studied using a novel field sampling procedure for molecular analyses. Multiple phylotaxa were detected that corresponded with the spore morphotypes observed. It is, therefore, likely that the legacy of indigenous AMF from the natural savanna plays a crucial role for yam productivity, particularly in the low-input traditional farming systems prevailing in West Africa.

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