



Tropentag, September 15-17, 2021, hybrid conference

“Towards shifting paradigms in agriculture
for a healthy and sustainable future”

Manure Application Negatively Affected Arbuscular Mycorrhizal Fungal Diversity on Enset (*Ensete ventricosum*) Roots in Ethiopia

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Abstract

In low-input agricultural systems with low soil fertility, arbuscular mycorrhizal fungi (AMF) play an important role in plant nutrition, protection and water use. Evaluating how common agricultural practices in such systems affect the composition of AMF communities is therefore an important step towards sustainable intensification. Here, we characterised the AMF communities in enset roots in smallholder enset-based farming systems in South Ethiopia and assessed the effects of manure on those communities. We used Illumina MiSeq amplicon sequencing to quantify AMF diversity and community composition in the roots of 181 individual enset plants from 23 farms. Roots were collected from both the inner garden of the farm, which regularly receive manure applications and from the outer garden at the margin, which receive manure only very occasionally. AMF communities in both inner and outer gardens were comprised primarily by species belonging to Glomeraceae, which accounted for 67% of the total operational taxonomic units (OTUs) recorded. Inner gardens receiving regular manure application were associated with higher soil pH, available P, organic carbon, total N and C:N ratio, and with significantly lower AMF richness and diversity. Whereas available P, total N and organic carbon explained the decrease in AMF richness and diversity, shifts in AMF community composition between inner and outer gardens were explained by soil pH and organic carbon. Therefore, intensified manure application enhances soil nutrient availability and soil organic carbon but results in lower enset AMF richness and diversity, and in a shift in AMF community composition. More optimal allocation of manure across the whole farm area may benefit both AMF communities and overall enset production.

Keywords: Enset, Glomeraceae, high-throughput sequencing, manure, mycorrhizal fungi