# Effect of arbuscular mycorrhizal fungi (AMF) inoculation and management of indigenous AMF population on the ex-situ performance of maize and bean in Embu and Taita districts, Kenya

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## ABSTRACT

Many experiments examining the effect of Arbuscular Mycorrhizal Fungi (AMF) on crops are ambiguous and many of those demonstrating positive effects have been carried out in the greenhouse using simplified systems rendering the results not easily reproducible in the field. Therefore field experiments become necessary considering gaps in understanding of the Arbuscular Mycorrhizal (AM) association, importance of AMF species diversity and the effect of different agronomic practices on the ecology and function of AMF. The study demonstrated the importance of mycorrhizae in agricultural production systems in tropical landscapes, through establishing effects of various soil fertility management practices such as use of different fertilizers, use of manure, and slow releasing rock phosphate (mijingu) on AMF. Effect of direct AMF inoculation in the field and management of indigenous population and the performance of maize and bean were also evaluated. Soil from Below Ground Biodiversity (BGBD) test strips and demonstration blocks under FP (combination of TSP and CAN), mijingu, manure and mavuno (organic fertilize) application were sampled. The effects of existing AMF and AMF introduced across management practices were evaluated and compared to plant growth and yield. Mycorrhizal density and prevalence was determined over a period of two cropping seasons and the experiment replicated in the two benchmark sites namely Embu in the highlands of central Kenya and the coastal highlands in Taita-Taveta. This constituted the on-farm experiments of the project. On-station experiments were also set up and direct inoculation of AMF was done on common bean *(Phaseolus vulgaris* L*)* and maize *(Zea mays* L*)* intercrop; effects on crop performance were determined. Field inoculation with AMF has been demonstrated to positively affect the yield of maize and bean at Embu experimental site though not significantly different with application of the different soil fertility amendments. The use of inorganic and organic

fertilizers enhanced AMF utilization; the addition of these fertilizers to AMF led to higher crop yield as well as root colonisation compared to plots under AMF applied alone. A total of 15 AMF morphotypes were isolated and described from both Taita and Embu sites, majority being Gigasporaceae (9), followed by Acaulosporaceae (4) and Glomaceae (2). The highest species count was obtained from 0-10cm depth. Inoculation of plots with AMF was found to increase the total AMF abundance in the soil. However there was no significant ($p \geq 0.05$) difference in spore abundance at on-station experiments with use of different soil fertility amendment practices in the first season but varied less significantly ($p \leq 0.05$) after the second season but a marked reduction in AMF population was recorded with passage of each cropping season. On-farm experiments (test strips) also recorded a reduction in AMF population with subsequent season. The spore abundance showed no significant difference with application of the different soil amendments. This was also the case with species richness in the soil during the two seasons. In demonstration plots, there were significant ($p \leq 0.05$) differences in spore abundance among the different soil fertility amendment practices. Also a marked decrease in AMF population in subsequent cropping season was recorded. There was higher root colonisation as well as spore abundance in the soil under manure application with subsequent average maize and bean production. Manure application was found to be the best method to conserve AMF population in the soil and thus recommended as a cheap and an environmentally friendly method of soil fertility management.