ement Inputs

Impact of landuse types and farming practices on Arbsucular Mcorrhizal Fungi (AMF) and yield of maize and beans In Kenya

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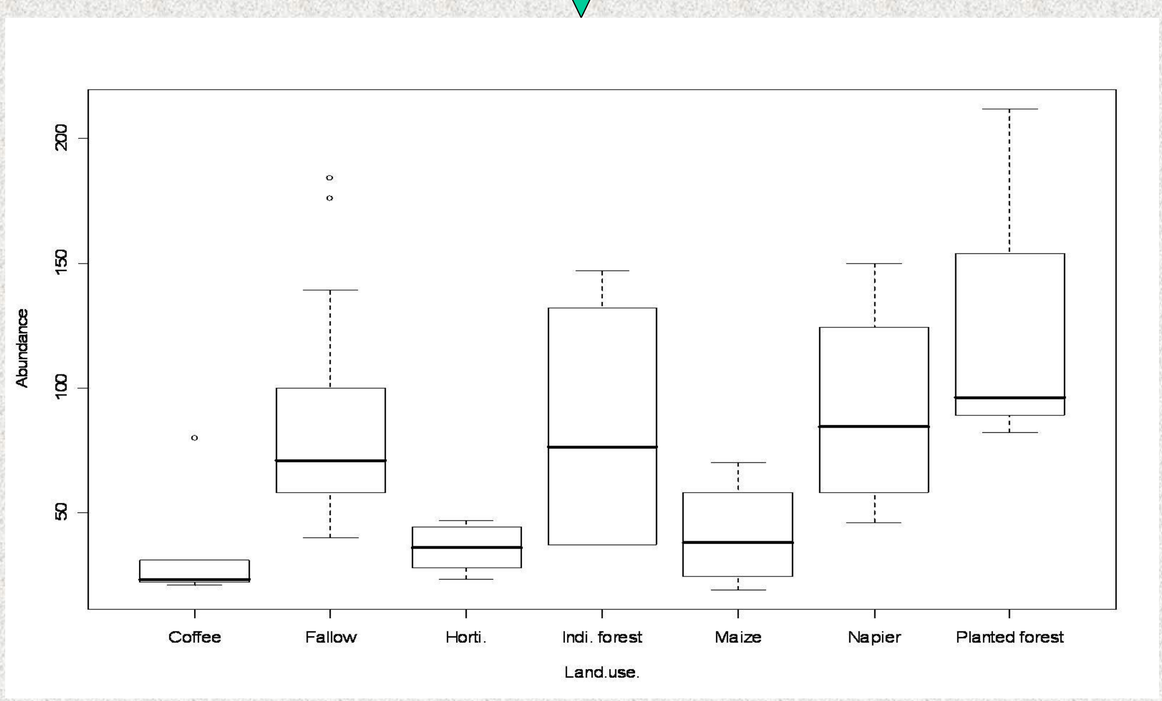
Arbuscular mycorrhizal fungi (AMF) are widespread and associate with up to 80% of plant species. Most roots in nature are colonized by this fungi. This association is a norm rather than an exception. Arbuscular mycorrhizal association maintains all ecosystems (agriculture, forests, grasslands, drylands mountain etc) and plays key roles in restoration of degraded ecosystems both natural and agricultural. Crops such as bananas, cassava and other tuber crops, beans, Acacias and other legumes depend on this association.

They are associated with low soil fertility and low phosphorus. Tropical soil are highly depleted in nutrients and are predominantly low in phosphorus. With Africas' dire need to combat poverty, application of fertilizer is mandatory and a win win situation where production is enhanced and sustained is the targeted.

The Arbuscular Mycorrhizal symbiosis has ability to enhance the ability of roots to access nutrient under low soil fertility conditions which are most prevalent in the tropics and combat pests and diseases. A high percentage of fertilizer used is not available to crops due to fixation in highly acidic soils and leaching. Application rates can be reduced and loss minimized. Land degradation has not only affected soil chemical and physical properties but biological as well. The occurrence of AMF is low. AMF can be restored by either inoculation or manipulation with farming practices. This calls for the establishment of species diversity and factors that affect their occurrence and functions.

AMF spore abundance was evaluated along land use gradients from forest to cropping systems. See figure below. Highly intensive LUT had fewer AMF spores abundance (Coffee, Horticulture and maize) compared to planted forest, natural forest, napier and fallow

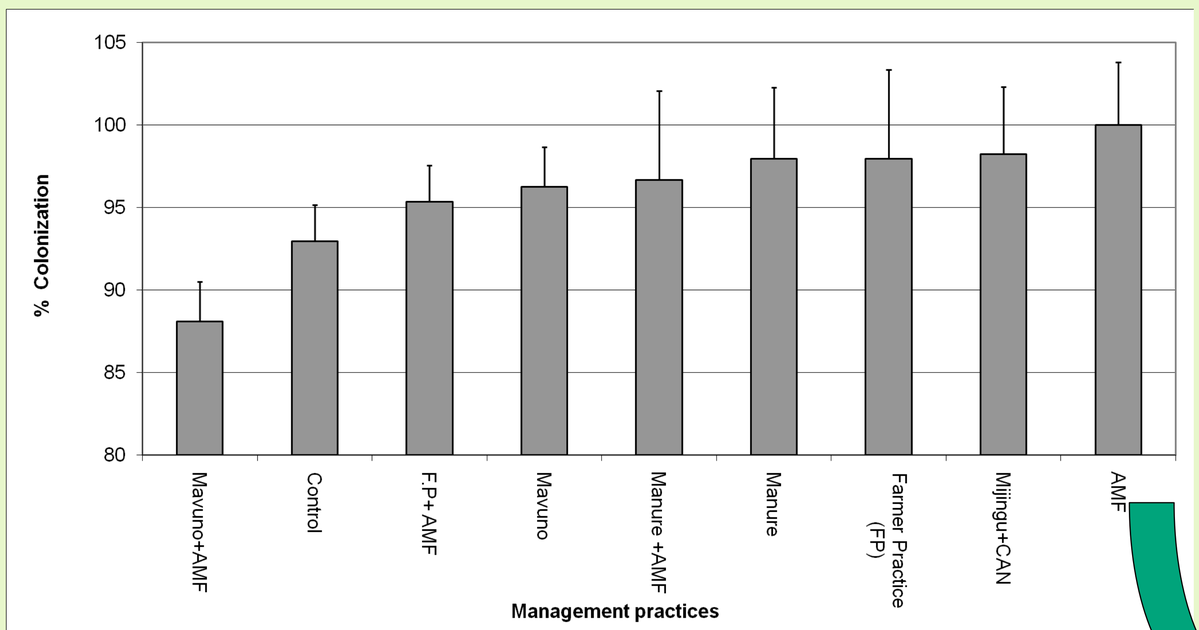


An experiment was established to evaluate the impact of management practices on AMF colonization, and the effect AMF inoculation with and without amendments on maize and bean yield

Fertilizer type	Recommended types
Manure	40-60tons /ha
Mavuno fertilizer	(40kg/ha)
Farmer practice : TSP + CAN	Farmer practice (TSP 200kg /ha and 150-200 kg /ha CAN)
Mijingu phosphate rock (4kg/plot and CAN 0.4 kg/plot)	177 kg/ha
AMF Inoculun 20g/ml paste	AMF (Seed coating)

Stained roots showing colonization by Arbuscular Mycorrhizal Fungi (AMF) characterized by (A) arbuscules appearing as deep blue in th ecortical cells of plant roots and (B) veicles (globose structures)

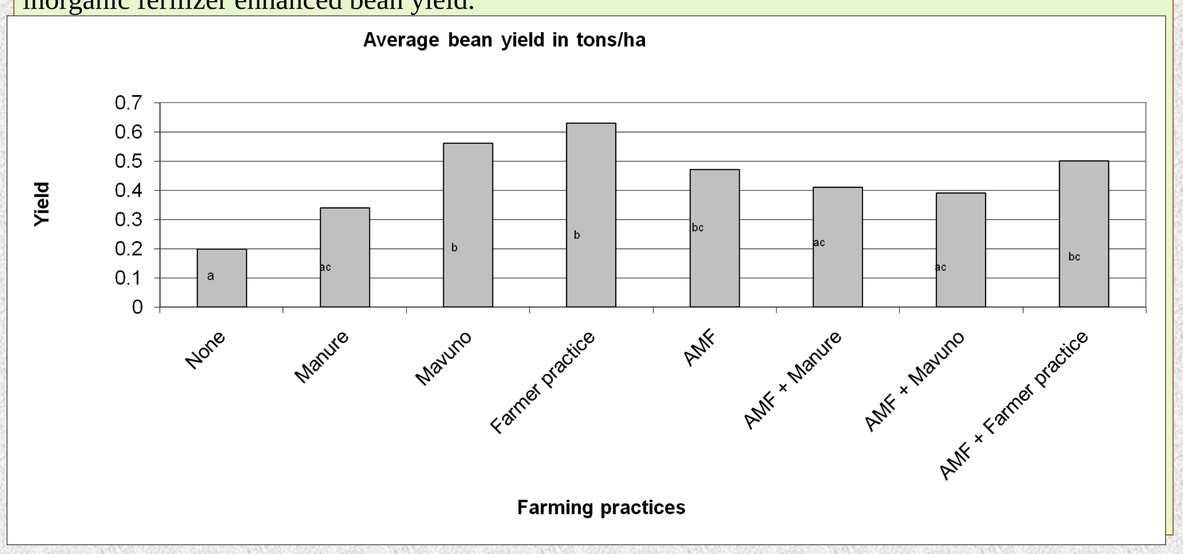
AMF Colonization is an indicator of AMF functioning. Arbuscules are characteristics of active stage of nutrient exchange and vesicles depict a stage in preparation for rest of the fungi. Total AMF colonization of roots as affected by management practices. AMF inoculated plants had the highest colonization and combination of AMF and mavuno and non-amended and non-inoculated control had the least colonization.



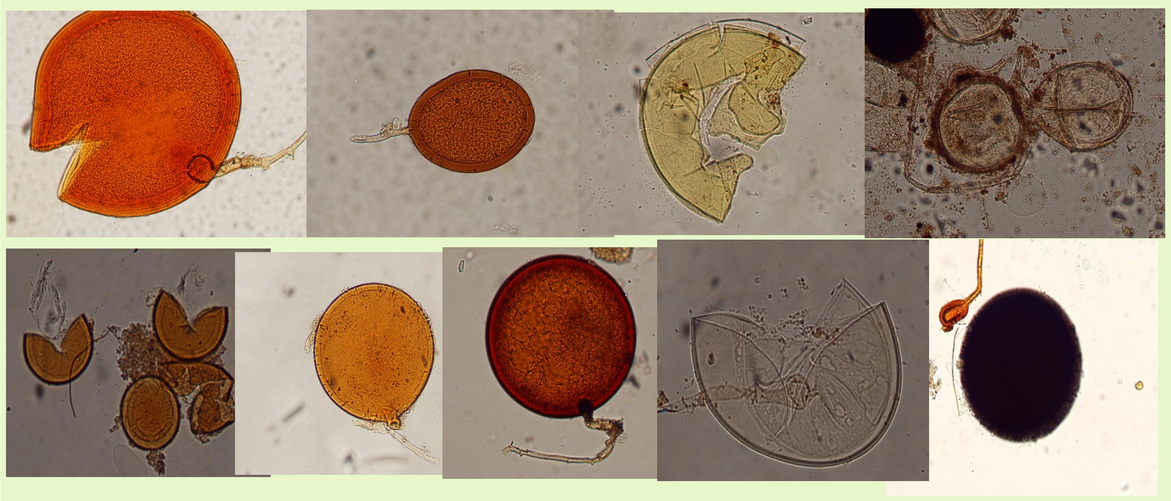
Maize yield and stover were significantly affected ($p = 0.003$ and 0.001 respectively) by management practices . Inoculation with AMF enhanced yield only when applied in combination with farmer practice, mavuno and manure. The quality of colonization was not compromised by the practices with total colonization In this soil fertilizer application did not compromise AMF quality.

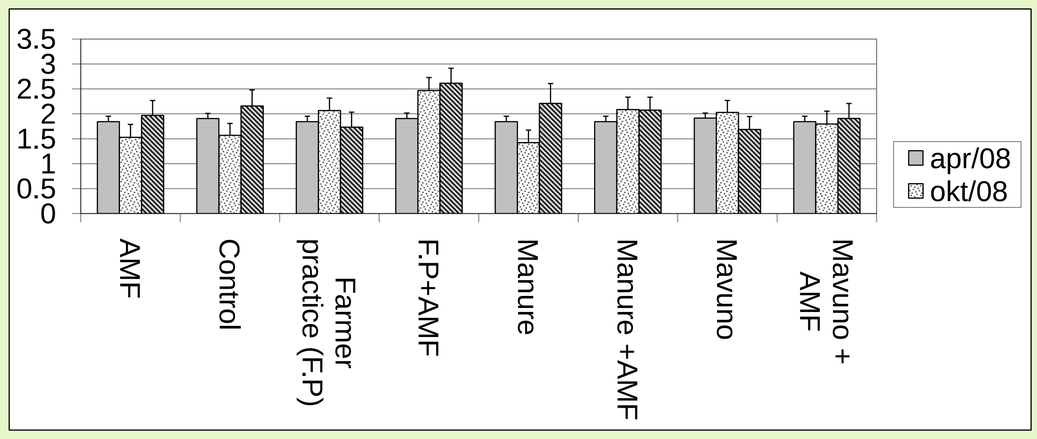
Management practices	% Colonization	Yield in tons/ha	Stover in tons/ha
Control	61.61a	1.06	1.34
AMF	71.70a	0.46	1.77
FP	72.62a	2.142	2.56
Manure	65.47a	0.99	1.70
Mavuno	64.37a	1.62	2.63
Minjingu	63.83a	5.10	5.60
FP + AMF	62.87a	1.07	2.03
Manure + AMF	70.08a	0.76	1.54
Mavuno + AMF	72.64a	0.66	2.40
SED	4.89	0.54	0.46

At one of the trial sites, organic (MAN = Manure), Inorganic (MAV = Mavuno, FP = Farmer practice CAN + TSP) and AMF inoculation applied singly and in combination with organic and inorganic ferilizer enhanced bean yield.



AMF spores like colonization are also a good indicators of soil health. Spores are mostly produced in response to stress or the end of growth period. All management practices had no significant effect on mean spore abundance (Spores were extracted from 150g dry weight soil)





Mean spore abundance under different management practices in maize and bean intercrop

Conclusion

Application of input should correspond with conservation of microbial organisms and their functions. Since soil fertility in Africa has declined tremendously, application of soil beneficial organisms may not solve the food crisis. Application of fertilizer in low fertility soil in this study did not significantly affect AMF establishment (Colonization) of AMF. Manure and Rock P sustained AMF colonization better than inorganic input (Farmer practice and mavuno). However, there is clear indication of landuse types affecting AMF. Practices that restore and sustain soil biodiversity are crucial for the sustenance of biogeochemical processes and ecosystem services at large, most of which can only be restore by soil organisms.