# EFFECTS OF ORGANIC AND INORGANIC FERTILIZERS ON SOIL TOTAL BACTERIA, DENITRIFYING BACTERIA AND FUNGAL MICROBIAL COMMUNITIES IN A LONG-TERM EXPERIMENT, KABETE KENYA

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Soil fertility decline is increasingly leading to reduced food production worldwide. Over 70% of small holder farmers in the central highlands of Kenya are using crop manure, animal wastes and inorganic fertilizers to increase their farms fertility and subsequent productivity. The dilemma with these practices is that less is known on the impact of these resources on the below ground biodiversity particularly the microbial communities which play a key role in determining soil quality. This study describes the effects of organic, inorganic and/or a combination of both organic and inorganic fertilization on soil total bacteria, denitrifying bacteria and fungal community structure in a long-term (32 years) field experiment in Kabete Kenya. These soils were treated with organic (maize stover at 10 t ha$^{-1}$, farmyard manure at 10 t ha$^{-1}$) and inorganic fertilizers (120 kg N, 52.8 kg P plus farmyard manure at 10 t ha$^{-1}$ (N+P+FYM), 120 kg N, 52.8 kg P plus maize stover at 10 t ha$^{-1}$ (N+P+R), 120 kg N, 52.8 kg P (N+P), and a control (Nil and fallow) for over 30 years. General bacterial community structure, denitrifying bacteria and fungal community structure was analyzed by PCR-denaturing gradient gel electrophoresis (DGGE) targeting eubacterial 16S rDNA gene, nitrite reductase nir S rDNA gene and nir K rDNA gene and fungal 28S rDNA gene. Long-term fertilization with a combination of both organic and inorganic inputs increased soil microbial community diversity. Combination of organic and inorganic fertilizers had a significantly greater ($P<0.05$) impact on the both total bacterial and denitrifying communities diversity as well as the fungal communities, compared with mineral fertilizers alone. Mineral fertilization did not affect the DGGE banding pattern, while specific DGGE band was observed in organic farmyard manure-fertilized soils. The change of bacterial community in organic farmyard manure-fertilized soil might be because of the promoting effect of the compost on the growth of an indigenous bacteria species in the soil. Cluster analysis showed that the bacterial community structure in the N+P-treated soil was more closely related to the bacterial structure in the untreated soil (fallow and Nil) than that in soils treated with a combination of inorganic and organic or inorganic fertilizers alone. Fungal community structures in soils treated with N+P were closely related to those treated with N+P+FYM and N+P+maize stover. However, soils treated with organic inputs clustered away from soils amended with inorganic inputs indicating that organic inputs had an impact on both microbial communities. Results from this study suggest that bacterial and fungal community structures were closely related to agro-ecosystem management practices conducted for over the past 30 years. We emphasize the importance of combination of