Soil fertility management: Impacts on soil macrofauna, soil aggregation and soil organic matter allocation

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Abstract

Maintenance of soil organic matter through integrated soil fertility management is important for soil quality and agricultural productivity, and for the persistence of soil faunal diversity and biomass. Little is known about the interactive effects of soil fertility management and soil macrofauna diversity on soil aggregation and SOM dynamics in tropical arable cropping systems. A study was conducted in a long-term trial at Kabete, Central Kenya, to investigate the effects of organic inputs (maize stover or manure) and inorganic fertilizers on soil macrofauna abundance, biomass and taxonomic diversity, water stable aggregation, whole soil and aggregate-associated organic C and N, as well as the relations between these variables. Differently managed arable systems were compared to a long-term green fallow system representing a relatively undisturbed reference. Fallowing, and application of farm yard manure (FYM) in combination with fertilizer, significantly enhanced earthworm diversity and biomass as well as aggregate stability and C and N pools in the top 15cm of the soil. Earthworm abundance significantly negatively correlated with the percentage of total macroaggregates and microaggregates within macroaggregates, but all earthworm parameters positively correlated with whole soil and aggregate associated C and N, unlike termite parameters. Factor analysis showed that 35.3% of the total sample variation in aggregation and C and N in total soil and aggregate fractions was explained by earthworm parameters, and 25.5% by termite parameters. Multiple regression analysis confirmed this outcome. The negative correlation between earthworm abundance and total macroaggregates and microaggregates within macroaggregate could be linked to the presence of high numbers of Nematogenia lacuum in the arable treatments without organic amendments, an endogeic species that feeds on excrements of other larger epigeic worms and produces small excrements. Under the conditions studied, differences in earthworm abundance, biomass and diversity were more important drivers of management-induced changes in aggregate stability and soil C and N pools than differences in termite populations.