

Organic resources quality and soil fauna: their role on the microbial biomass, decomposition and nutrient release patterns in Kenyan soils

Nancy, K. Karanja; F.O, Ayuke; M.J, Swift

Date: 2006

Abstract

Five organic resources commonly used for soil fertility maintenance in large parts of Kenya were selected for litter decay and nutrient mineralization studies that were conducted in three farms (Machakos, Kabete and Njabini) located at an elevational transect ranging from 1500 to 2800 m above sea level. These organic residues included: bean trash, maize stover, tree prunings (*Grevillea robusta*), *Senna spectabilis* foliage, cow and poultry manures. Organic residues were either mulched or incorporated in the soil. Satellite experiments were also carried out in each of the three sites with one additional site at Maseno based in western Kenya. These experiments aimed at assessing the role of soil biota in the decomposition and nutrient release. Soil fauna were excluded from control plots using 1-mm mesh litterbags. The organic residues were different in chemical composition i.e. nitrogen (N), phosphorus (P), potassium (K), carbon (C), lignin (L) and polyphenol (PP) contents, which in turn influenced their rate of decomposition and nutrient release patterns. Bean trash decomposed and released N and P faster than either the maize stover or *Grevillea* prunings. The slowest rate of decomposition observed for *Grevillea* prunings could be attributed to the high lignin content (24%). The N release was influenced by (L+PP):N ratio. Bean trash having a ratio of 10 released N faster than either maize stover or *Grevillea* prunings whose respective ratios of 20 and 13. P release was influenced by both C:P and N:P ratios. Maize stover with C:P and N:P ratios that were higher than the critical levels of 123 and 10 respectively, mineralized and released P more slowly than either bean trash or *Grevillea* prunings. Incorporated materials decomposed and released nutrients faster than surface applied materials. For surface applied organic materials, the delay in litter decay ranged from 4.1 to 4.4 days for every 100 m increase in altitude, while for incorporated materials the delay in litter decay ranged from 1 to 3 days per 100 m increase in elevation. This implies that farmers at higher elevations would benefit more by incorporating residues before planting, while at low elevations post emergence surface application would lead to improved nutrient availability. Njabini and Kabete recorded significantly higher microbial biomass (C, N and P) than Machakos. This could be linked to the higher organic C, higher total N, higher moisture content but lower temperatures reported for Njabini and Kabete than Machakos. Soil fauna enhanced decomposition of organic residues, although their role in influencing nutrient availability to crops from the organic residues may depend on the nature of the material. Fauna had no significant influence on nutrient release patterns of *Senna* possibly due to secondary compounds present in *Senna*, which were lower than the critical levels of 15 for lignin and 4 for polyphenol respectively. Key words: Resource quality, placement, soil fauna, decomposition, nutrient release, microbial biomass