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Land use and nutrient inputs affect priming in Andosols of Mt. Kilimanjaro

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Organic C and nutrients additions in soil can accelerate mineralisation of soil organic matter i.e. priming effects. However, only very few studies have been conducted to investigate the priming effects phenomenon in tropical Andosols. Nutrients (N, P, N+P) and 14C labelled glucose were added to Andosols from six natural and intensively used ecosystems at Mt. Kilimanjaro i.e. (1) savannah, (2) maize fields, (3) lower montane forest, (4) coffee plantation, (5) grasslands and (6) Chagga homegardens. Carbon-dioxide emissions were monitored over a 60 days incubation period. Mineralisation of glucose to $14CO_2$ was highest in coffee plantation and lowest in Chagga homegarden soils. Maximal and minimal mineralisation rates immediately after glucose additions were observed in lower montane forest with N+P fertilisation (9.1% $\pm$ 0.83 d -1) and in savannah with N fertilisation (0.9% $\pm$ 0.17 d -1), respectively. Glucose and nutrient additions accelerated native soil organic matter mineralisation i.e. positive priming. Chagga homegarden soils had the lowest $14CO_2$ emissions and incorporated the highest percent of glucose into microbial biomass. 50-60% of the 14C input was retained in soil. We attribute this mainly to the high surface area of non-crystalline constituents i.e. allophanes, present in Andosols and having very high sorption capacity for organic C. The allophanic nature of Andosols of Mt. Kilimanjaro especially under traditional Chagga homegarden agroforestry system shows great potential for providing essential environmental services, notably C sequestration.

Key words: Priming Effects, Andosols, Land Use Changes, Mt. Kilimanjaro, Allophanes, Tropical Agroforestry