Residue retention and tillage effects on abundance of SOC fractions in low input continuous maize

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Smallholder farmers manage the largest proportion of arable land in Eastern and Southern Africa and their capacity to manage existing soil fertility resources are therefore of key importance to long-term regional food security. Minimum tillage and residue retention are the most widely adopted principles of conservation agriculture (CA) and are frequently promoted as suitable technologies for preventing further soil fertility decline. In this study we quantify the abundance of labile potassium permanganate oxidisable carbon (PPOC) and particulate organic carbon (POC), amongst other soil organic carbon (SOC) fractions, in the surface soil layers at two sites near Harare, Zimbabwe. Plots at each site were continuously treated with different levels of nitrogen (N), tillage and crop residues for 5 to 7 years. Contrary to previous studies our findings show that N application rates (0 and 90 kg N ha-1) did not influence labile and particulate organic carbon fractions. There was also no significant difference found in accumulation of total SOC between different residue loads of 4 and 8 t ha-1 indicating that changes in SOC accumulation are not strongly linked to above-ground biomass inputs. Throughout Sub Saharan Africa (SSA) soil fertility of CA cropping systems is often affected by a combination of multiple factors not commonly experienced in other published studies. In this SSA case study previously intense tillage regimes, extremely high capacity for soil N leaching, temperature and moisture availability fuelling rapid decomposition, and prevalence of soil fauna (e.g. termites) and strong seasonal winds reducing duration of residues retained were all highly influential on results of this study. We are currently analysing archived soil samples for changes in C and N pools during the cropping cycle with a view to elucidate N dynamics in low input CA systems.