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Soil carbon stabilization and turnover at alley-cropping systems, Eastern Germany

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Alley-cropping system is seen as a viable land-use practice for mitigation of greenhouse gas CO_2, energy-wood production and soil carbon sequestration. The extent to which carbon is stored in soil varies between ecosystems, and depends on tree species, soil types and on the extent of physical protection of carbon within soil aggregates. This study investigates soil carbon sequestration at alley-cropping systems presented by alleys of fast growing tree species (black locust and poplar) and maize, in Brandenburg, Eastern Germany. Carbon accumulation and turnover are assessed by measuring carbon fractions differing in decomposition rates. For this purpose soil samples were fractionated into labile and recalcitrant soil-size fractions by wet-sieving: macro (>250 μm), micro (53-250 μm) and clay + silt (<53 μm), followed by determination of organic carbon and nitrogen by gas-chromatography. Soil samples were also analysed for the total C&N content, cold-water extractable OC, and microbial C. Litter decomposition was evaluated by litter bags experiment. Soil CO_2 flux was measured by LiCor automated device LI-8100A. No differences for the total and stable (clay+silt, <53 μm) carbon fraction were observed between treatment. While cold water-extractable carbon was significantly higher at maize alley compared to black locust alley. This may indicate faster turnover of organic matter at maize alley due to tillage, which influenced greater incorporation of plant residues into the soil, greater soil respiration and microbial activity.