



Root litter decomposition in a sub-Saharan agroforestry parkland dominated by *Faidherbia albida*

A. Transitioning to Healthy Soils

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In agroecosystems, the decomposition of fine roots contributes to soil organic carbon stocks and may impact soil fertility, particularly in poor soils, such as those encountered in sub-Saharan regions. The aim of our study was to measure the decomposition rate of root litter from annual and perennial species according to soil depth and location under or far from trees in a sub-Saharan agroforestry parkland dominated by *Faidherbia albida*. Soil characteristics under and far from the trees were analysed from topsoil to 200 cm depth. *Faidherbia* tree, pearl millet and cowpea root litter samples were buried in litterbags for 15 months at 20, 40, 90 and 180 cm depths and soil moisture was monitored across the soil profiles. Root litter decomposition was mainly impacted by soil moisture and thus soil depth, with the main differences among plant species and depths observed during the first 1.5 months of decomposition. Due to their chemical recalcitrance, *Faidherbia* decomposed more slowly ($36 \pm 12\%$ remaining mass after 15 months of decomposition) than cowpea and pearl millet roots ($23 \pm 7\%$ and $29 \pm 11\%$ respectively), while both annual plants exhibiting lower rates of decomposition at depth than in the surface. Both *Faidherbia* fine roots and millet aerial biomass contributed slightly to higher stocks of C under the tree ($7761 \pm 346 \text{ g m}^{-2}$) than far from it ($5425 \pm 558 \text{ g m}^{-2}$) and from 0 cm down to 200 cm depth. Due to their slow root decomposition rates at depth and the increase in crop production in their vicinity, *Faidherbia* trees play a crucial role in increasing belowground carbon storage in semiarid Sahelian parklands.