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Root distributions and traits in a semi-arid agroforestry parkland dominated by *Faidherbia albida*: potential impacts on soil C and nutrient stocks?

Siegwart Lorène¹, Bertrand Isabelle¹, Jourdan Christophe¹,²
¹UMR Eco&Sols, Univ Montpellier, CIRAD, INRAE,IRD, Montpellier SupAgro, Montpellier, France
²CIRAD, UMR Eco&Sols, F-34398 Montpellier, France
lorente.siegwart@supagro.fr

The **objectives** of this study were:
- to assess the tree and crop root distribution and traits down to 150 cm deep in a Sub-Saharan agroforestry parkland dominated by *Faidherbia albida* in Senegal
- to quantify the contribution of tree and crop root-derived C inputs to soil C stocks along the soil profile

Root biomass density was measured by manual sorting from a large volume of soil (1m² x soil layer). Root mapping was assessed by counting the root impacts. Roots were sampled for functional traits and chemical composition analysis.

**Methods**

**Experimental set-up of the pits** (1 m * 1 m * 2 m deep):
- 2 locations (under the tree and far (+30m) from the trunk)
- x 5 soil layers (0-10, 10-30, 30-50, 50-100, 100-150 cm)
- x 2 plant species (tree and annual crop)
- x 2 rotations (2020: pearl millet and 2021: groundnut)
- x 3 replicated trees

**Results**

Deep tree roots with low biomass density vs. shallow crop roots with high biomass density $p$-value = $6.31 \times 10^{-3}$

→ **complementarity theory for associated plants** (Van Noordwijk et al. 1996)

At 30cm deep, tree roots were found at +30m from the trunk, in higher quantity than under the tree $p$-value = $3.88 \times 10^{-3}$

→ **compromise** of the tree between water acquisition in deeper soil layers during the dry season (Fig. 3) and nutrient acquisition in topsoil during the wet season → plasticity of the perennial root system (Zanetti et al., 2015)

**Highlights**

- Tree fine roots found at +30m of the trunk at 30 cm of depth: attesting the compromise between water and nutrient acquisition
- 96% and 83% of the tree root C inputs are located below 100cm of depth under and far from the tree, respectively
- From the topsoil to the water table, the tree fine roots contribute to 27% (under) and 18% (far from tree) of the total annual root-derived C inputs to soil

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