

Roots + belowground litter fate

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“*Faidherbia-Flux*”: A long-term Collaborative Observatory on food security, GHG fluxes, ecosystem services, mitigation and adaptation in a semi-arid agro-silvo-pastoral ecosystem (groundnut basin in Niakhar/Sob, Senegal)

Dry season, 2/3 of the year



Wet season, 1/3 of the year

“*Faidherbia-Flux*” Web site :
<https://lped.info/wikiObsSN/?Faidherbia-Flux>

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Root phenology in shallow soil and pits deep down to the water table

Mini-rhizotrons in Millet – Cowpea;
Automatic root scanners

Root traits (SRL, RLD, ...)

Root dynamics

Turnover – Litter

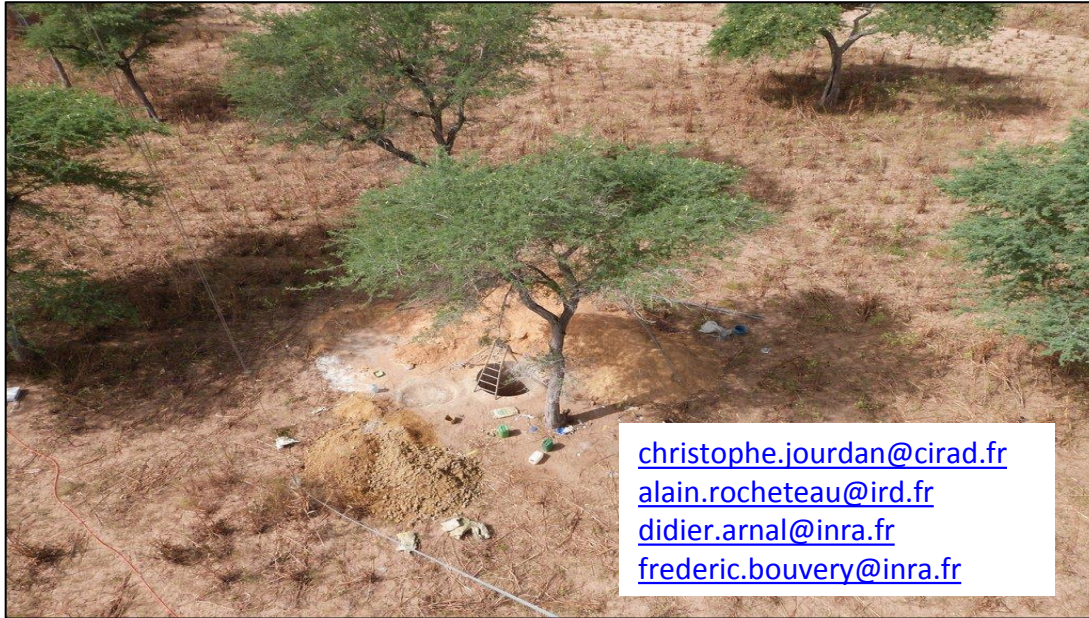
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Four 8m-deep pits (down to the water table) + two 4m deep pits,
ready to study interactions between soil and roots, tree and crop roots,
comparing 'under trees' and 'full sun' and regarding soil depth

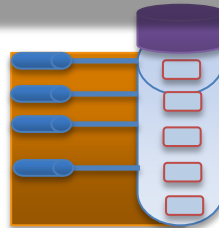


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Mycorrhization
Traits, root dynamics
Turnover, root litters



Root sapflow, root hydraulic redistributions
Nutrient fluxes (suction cap), soil humidity (TDR)
Water isotopes, N...



*Deep pits (-8 m) under and far from trees to
monitor root dynamics of crops and trees
with automatic root scanners, minirhizotrons,
suction cap and TDR probes*

Automatic root monitoring through automatic and autonomous scanners



Automatic scanners, suction caps and TDR probes set up down to the water table (-6 m).



Automatic recording of TDR probes and sap flow sensors.



Automatic scanners set up at 2m from the pit in topsoil horizons.

Deep fine root monitoring down to the water table



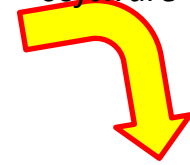
*Fine roots of *Faidherbia* at a depth of -6 m before the raise of the water table (left) and under 50 cm of water (right). Images taken a month apart at the end of the 2019 rainy season.*

Fine root dynamics monitoring through automatic root detection by deep learning

Groundnut fine root growth at a depth of 50 cm observed on September 13th, 2019



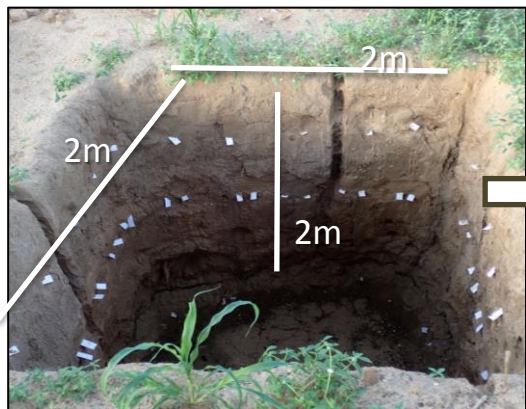
Automatic fine root segmentation through Scanorhize software



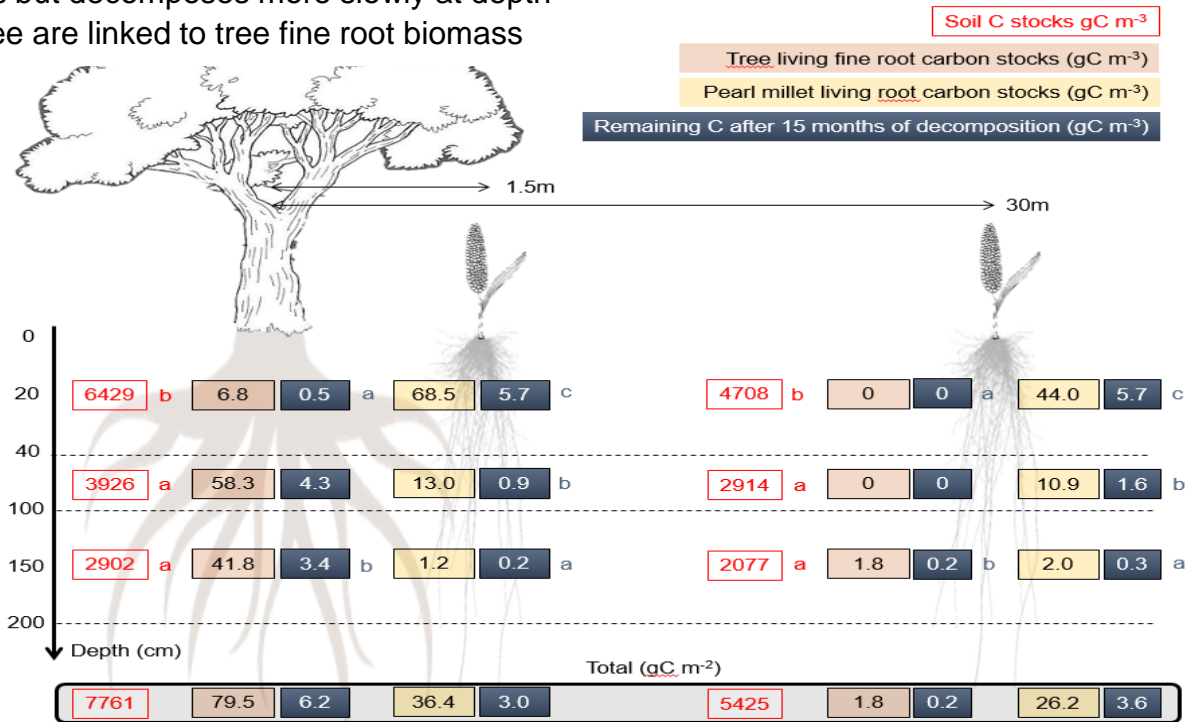
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Measurement of the fine root litter decomposition kinetics with root litterbags in 3 pits under the tree and 3 pits far from the tree, at four soil depths and for 3 species (*Faidherbia albida*, pearl millet and cowpea).

- Root litter decomposition occurs mostly in the first 1.5 months
- Tree root litter decomposes more slowly compared to crop root litter
- Tree root C inputs are higher by 7-fold at depth than in topsoil
- Crop root litter is more important in topsoils but decomposes more slowly at depth
- Higher soil C stocks under than far from tree are linked to tree fine root biomass



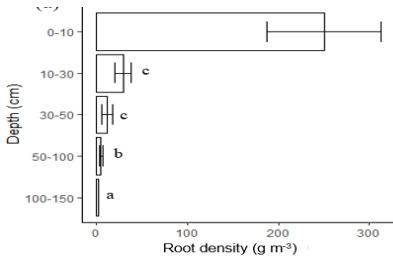
One of the pits with the buried root litterbags



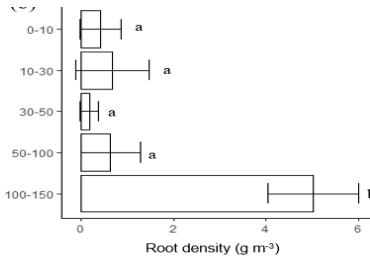
Quantitative and qualitative assessment of the root systems down to 150 cm deep, according to the locations under and far from the tree.

2020 : *Faidherbia albida* + pearl millet

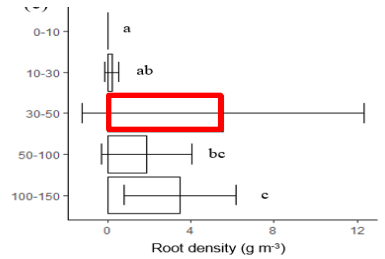
2021 : *Faidherbia albida* + peanut & weed



Pearl millet



Faidherbia **under** the tree



Faidherbia **far** from the tree

- Root complementarity: crop root zone at 0-10 cm of depth and tree root colonizing from 100 cm of depth : response to the cohabitation with annual crops ?
- Faidherbia living roots found far (+30m) from the trunk: compensation of the nutrients shortage in the deep layers with a high exploration zone.
- Root N content increasing with depth for Faidherbia and pearl millet
- Pearl millet root C:N is higher under than far from the tree

Peanut : data to be analyzed...

Articles

- Siegwart L, Bertrand I, Roupsard O, Duthoit M, Jourdan C. 2022. Root litter decomposition in a sub-Saharan agroforestry parkland dominated by *Faidherbia albida*. *Journal of Arid Environments* 198, [104696.https://doi.org/10.1016/j.jaridenv.2021.104696](https://doi.org/10.1016/j.jaridenv.2021.104696).

Communications

Shared databases

[Faidherbia-Flux Collaboratif\Database
https://baobab.sedoo.fr/](https://baobab.sedoo.fr/)