

Potential impact of Faidherbia albida tree on soil infiltration in a semi-arid agroforestry system of the Senegalese groundnut basin: role of preferential flows?

Waly Faye, Didier Orange, Djim Mouhamadou Lamine Diongue, Frédéric Dô, Christophe Jourdan, Olivier Roupsard, Awa Niang Fall, Alioune Kane, Sérigne Faye, Simone Di Prima, et al.

▶ **To cite this version:**

Waly Faye, Didier Orange, Djim Mouhamadou Lamine Diongue, Frédéric Dô, Christophe Jourdan, et al.. Potential impact of Faidherbia albida tree on soil infiltration in a semi-arid agroforestry system of the Senegalese groundnut basin: role of preferential flows? . EGU General Assembly 2021, Apr 2021, Online, Austria. ⟨10.5194/egusphere-egu21-8768⟩. ⟨hal-04872226⟩

HAL Id: hal-04872226

https://hal.science/hal-04872226v1

Submitted on 14 Jan 2025

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons CC BY 4.0 - Attribution - International License

EGU21-8768
https://doi.org/10.5194/egusphere-egu21-8768
EGU General Assembly 2021
© Author(s) 2022. This work is distributed under
the Creative Commons Attribution 4.0 License.

Potential impact of Faidherbia albida tree on soil infiltration in a semi-arid agroforestry system of the Senegalese groundnut basin: role of preferential flows?

Waly Faye[1,2,3], Didier Orange[3,4], Djim Mouhamadou Lamine Diongue[1], Frederic Do[4], Christophe Jourdan[3,5,6], Olivier Roupsard[3,5,6], Awa Niang Fall[1,2], Alioune Kane[1,2], Sérigne Faye[1], Simone Di Prima[7,8], Rafaele Angulo-Jaramillo[7], and Laurent Lassabatère[7]

[1]EDEQUE, UCAD, Dakar (Sénégal) ;
[2]UMI Résiliences, IRD, BP 1386, CP18524, Dakar (Sénégal)
[3]LMI IESOL, IRD, ISRA, BP 1386, CP18524, Dakar (Sénégal)
[4]IRD, UMR Eco&Sols, Univ. Montpellier, IRD, CIRAD, INRAe, Institut Agro Montpellier (France)
[5]CIRAD, UMR Eco&Sols, Univ. Montpellier, IRD, CIRAD, INRAe, Institut Agro Montpellier (France)
[6]CIRAD, UMR Eco&Sols, BP 1386, CP18524, Dakar (Sénégal)
[7]Université de Lyon ; UMR5023 Ecologie des Hydrosystèmes Naturels et Anthropisés, CNRS, ENTPE, Univ. Lyon 1, Vaulx-en-Velin (France)
[8]Dipartimento di Agraria, University of Sassari, Viale Italia, 39A, 07100 Sassari (Italy)

The soil hydraulic properties controlling infiltration are dynamic depending on interrelated factors such as soil texture and structure, climate (rainfall intensity), land use, vegetation cover and plant root systems. These physical and biological factors directly influence the size and geometry of the conductive pores, and therefore the bulk density, soil structure and finally water infiltration at surface. In the Sahelian zone, the slightest modification of the physical properties of the soil has severe consequences on the soil properties and thus on hydrological processes. It is therefore essential to improve knowledge on the spatial distribution of the hydraulic behavior of soils for optimization of agricultural uses.

We used the BEST method (Beerkan Estimation of Soil Transfer parameters) on a toposequence of the Senegalese groundnut basin (Fatick region) in the Faidherbia-Flux observatory[1] where the average rainfall is 590 mm/yr. The studied toposequence (400 m long) is representative of a common agroforestry zone with annual cultivation of millet and peanuts and a sparse density of Faidherbia albida. The slope is low (1%) with small lowland areas made up of sandy soil with more clay (clay soil), while the glacis is represented by more or less compacted sand. The infiltrometry measurements were made with the automatic single-ring infiltrometer developed by Di Prima et al. (2016), used here for the first time in West Africa. The explicative variables tested are the type of soils, including: clay soils under tree (CLUT) and outside tree (CLOT), sandy soils under tree (SSUT) and outside trees (SSOT), and cattle trampled soils outside trees (TSOT) particularly compacted and largely present in the study area. BEST algorithms were applied to the experimental data to determine the hydraulic properties of the soils of the different variables and to draw water retention and hydraulic conductivity curves.

There are significant differences in infiltration rates between the sampled zones and in relation with the studied factors. The highest infiltration rate is found on sandy soils under tree (SSUT) with an average infiltration rate of 14.0 mm/min, followed by SSOT with 11.6 mm/min. Then the clay soils CLUT and CLOT are characterized by similar lower hydraulic responses with average infiltration rates of 6.9 mm/min and 6.2 mm/min, respectively. The average infiltration rate is the lowest on the compacted sandy soils TSOT, with only 5.4 mm/min. The study of the variability of the infiltration rates measured by class of variable shows a large variability for CLOT, CLUT and SSUT (decreasing order of variability). These results are in agreement with the measured values of dry soil bulk density. The high infiltration rates in the clay soils outside and under trees can be explained by the higher content of organic matter observed on the sampling, and probably by the existence of preferential flow activated by the macropores particularly present on clay soils (CLOT and CLUT) and on sandy soils under tree (SSUT).

Di Prima, S., et al., 2016. Testing a new automated single ring infiltrometer for Beerkan infiltration experiments. Geoderma, 262, 20–34. doi:10.1016/j.geoderma.2015.08.006

[1] Faidherbia-Flux : https://lped.info/wikiObsSN/?Faidherbia-Flux

How to cite: Faye, W., Orange, D., Diongue, D. M. L., Do, F., Jourdan, C., Roupsard, O., Niang Fall, A., Kane, A., Faye, S., Di Prima, S., Angulo-Jaramillo, R., and Lassabatère, L.: Potential impact of Faidherbia albida tree on soil infiltration in a semi-arid agroforestry system of the Senegalese groundnut basin: role of preferential flows? , EGU General Assembly 2021, online, 19–30 Apr 2021, EGU21-8768, https://doi.org/10.5194/egusphere-egu21-8768, 2021.