

Can woody plants management provide soil amendments to enhance agroecosystem productivity and resilience in West Africa?

Georges Félix, Edmond Hien, Rabah Lahmar, Jean-Marie Douzet, Hassna Founoune-Mboup, Yacine Ndour, Dial Niang, Luc Séguis, Denis Gautier, Edmond Zongo, Raphaël Manlay, Bernard G. Barthès, Cathy Clermont-Dauphin, Dominique Masse, Mahamadou Belem, Jeroen Groot, Johannes Scholberg, Pablo Tittonell, Laurent Cournac

Students having contributed to results below: Marcel Z Ouedraogo, Arnaud Somé, Gaëlle Feur, Aurélien Penche

Contacts: laurent.cournac@ird.fr / www.wassa-eu.org



BACKGROUND

Soil degradation and fertility loss pose severe threats to the livelihood of farmers in sub-Saharan regions. Due to need for land, continuous cultivation with staple food has gradually replaced previous shifting cultivation systems, so that fallow periods have considerably reduced and no longer fulfil their soil regeneration role. In some West African areas, slash- and drought-tolerant shrub species are commonly present in farmers’ fields. Cut branches from these shrubs sometimes are placed on degraded soils as part of traditional soil restoration practices. Moreover, shrubs tend to intercept sediments and leaves and promote biological activity whereby they may form fertility islands of increased crop yield.

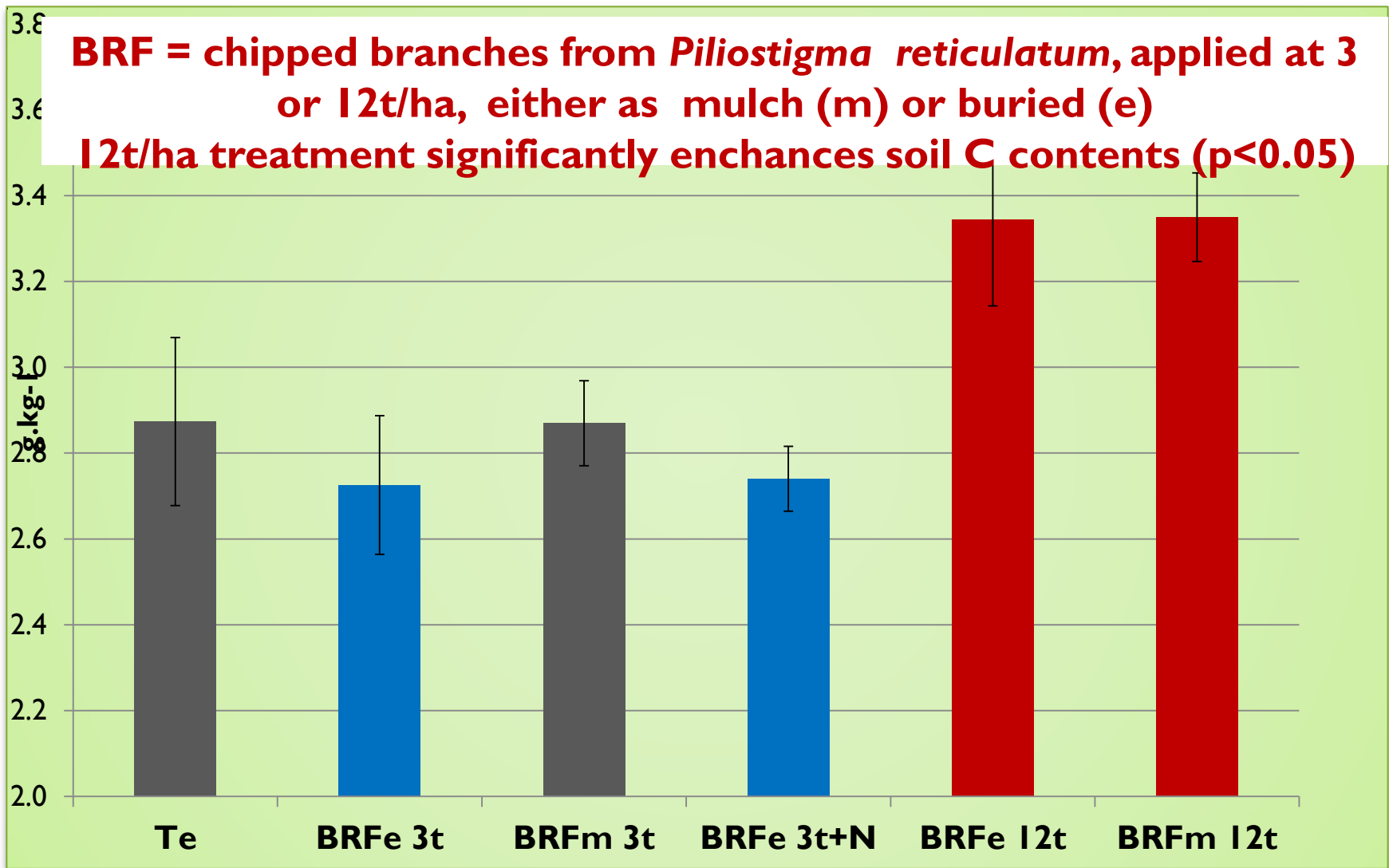
The WASSA project

In the EU-funded **WASSA** project we explore the use and management of **native woody resources** for providing an in situ renewable **organic amendment** as a basis for **increasing soil carbon** and biological status, thus sustaining fertility, enhancing water capture and utilization and therefore **buffering climatic stress**.

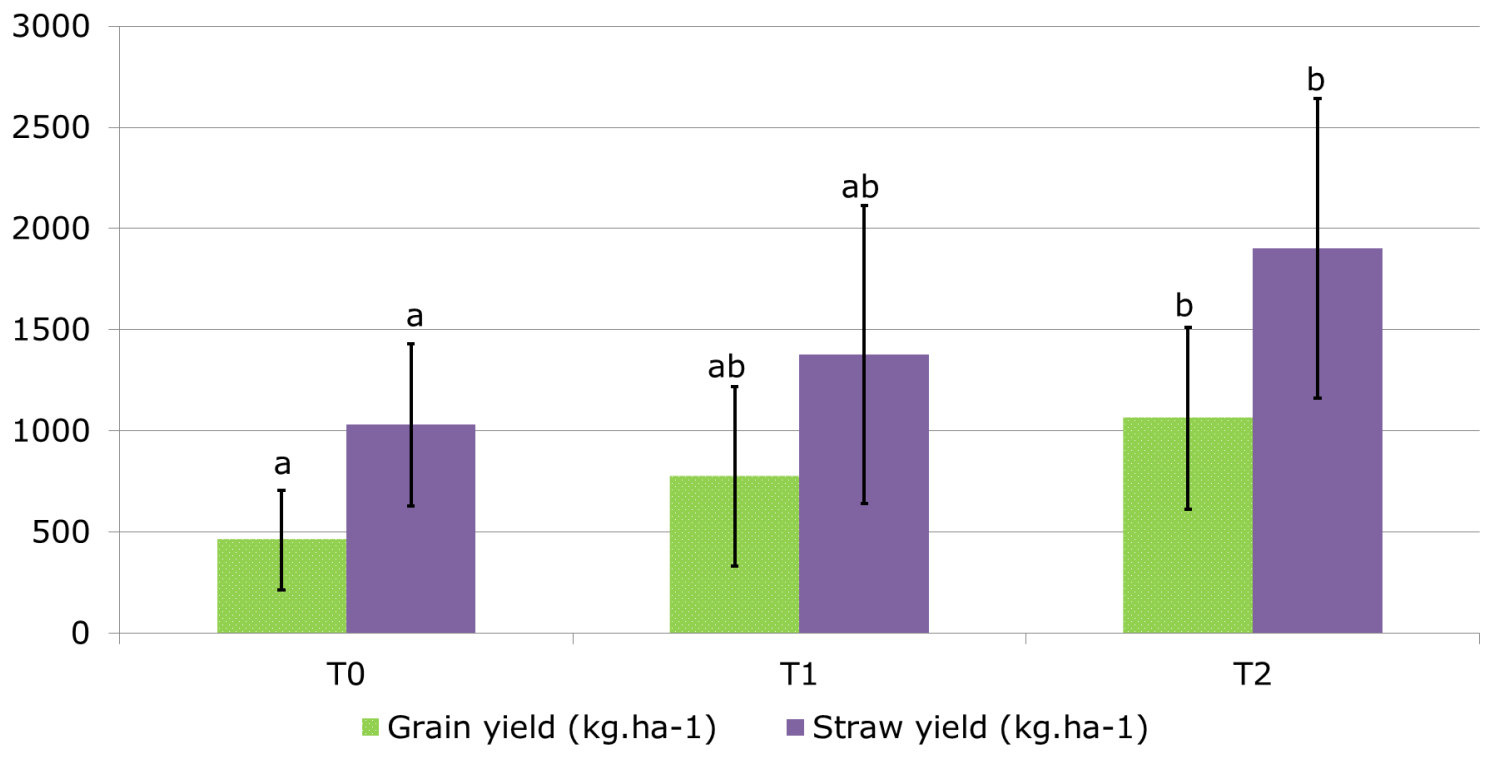
The project, based in Burkina Faso and Senegal, is investigating if a sustainable use of native woody resources (particularly ramial wood) could be made, in combination with other organic sources such as crop residues or manure, to amend soils and help preserving fertility at the whole field scale. Through experimental plots trials and farmers’ fields surveys, we are evaluating how woody residues use and management practices may impact agronomic performance and soil biological processes. Crop response to use of ligneous material and eventual application recommendations are related with the availability and distribution of woody resource in the landscape, and the ways it could be eventually increased and sustainably. The socio-economic implications of implementing such practices are also considered and the roles of local actors in promoting co-innovation are analysed.



A picture from the “NEWS” trial in Kamboinsé (Burkina Faso) research station: plots are conducted under conservation agriculture principles (restitution of straws on fields), modalities include zai vs no-tillage and 4 increasing densities (0, 500, 1000, 2000 shrubs/ha) of *Piliostigma reticulatum* shrubs which have been implanted in the plots and will be managed as annual slash-and-mulch © R Lahmar

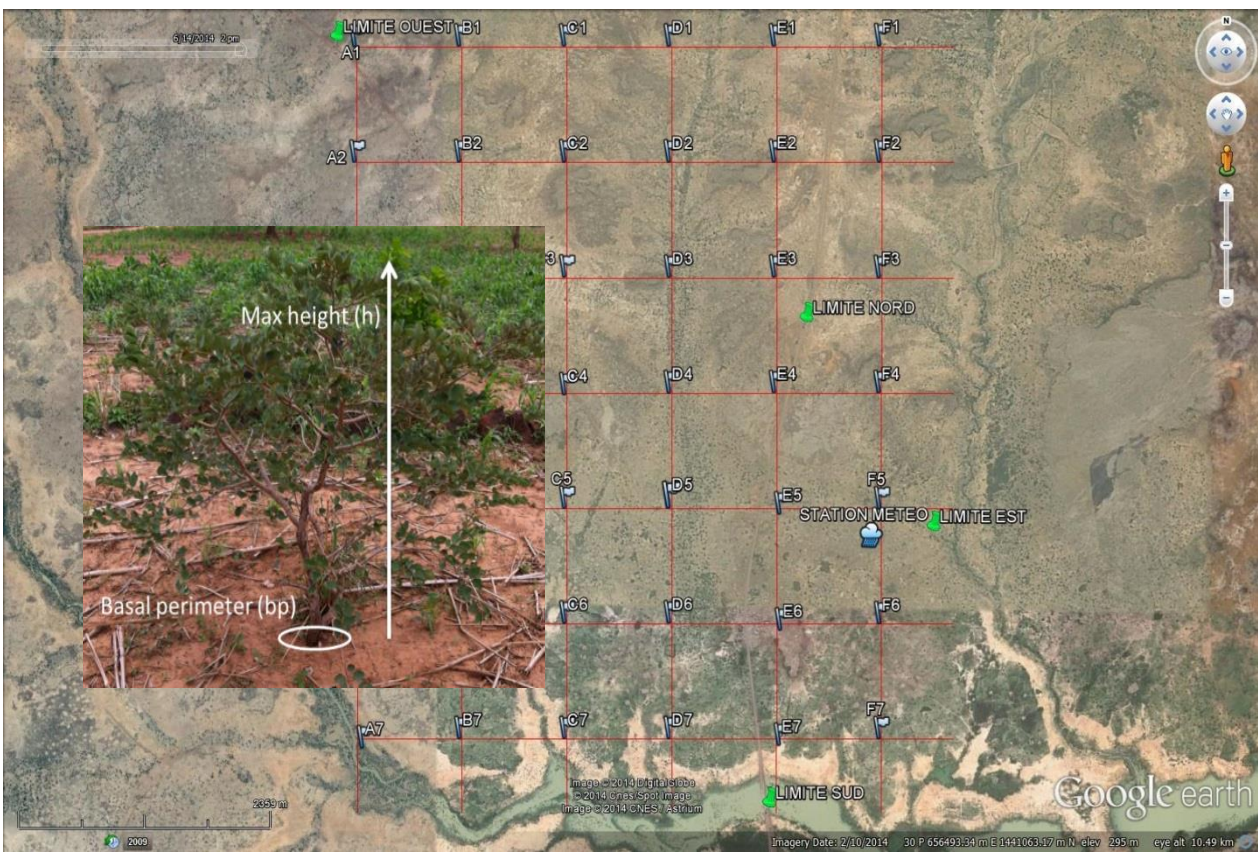


Results from Gampéla research station (Burkina Faso): Increasing amount of chipped ramial wood amendment tend to increase soil carbon content.



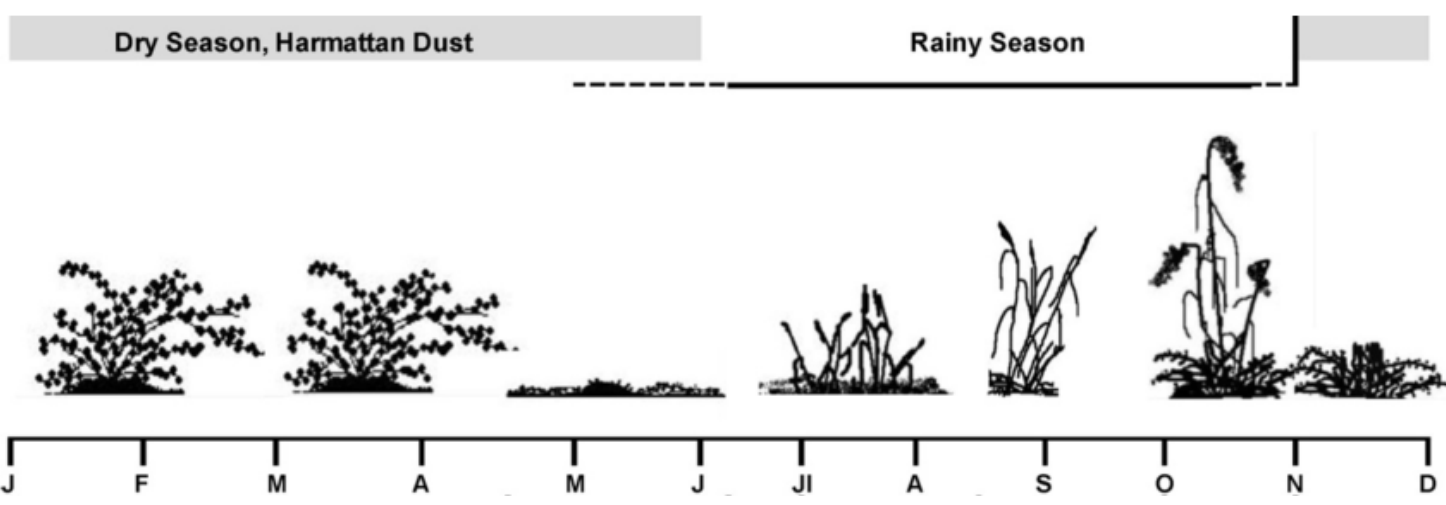
Average results from trials in farmers’ fields in the Yilou district (Burkina Fazo). Fields from 12 farmers have been separated in three plots receiving variable amounts of *Piliostigma reticulatum* mulch (0, 1, 2t/ha); otherwise fields were conducted homogeneously, following regular farmer’s practice, without any specific guidance. Average impact of the mulch on straw and grain yields is depicted here.

Potential for increasing shrub density towards ligneous resource optimization



Grid for woody vegetation survey in the Yilou landscape (Burkina Faso). Vegetation metrics are recorded and allometry-based biomass estimation performed.

Stock and production inventory and modelling



Shrub-crop temporal arrangement observed in Burkina Faso farms. During the dry season, *Piliostigma reticulatum* shrubs grow spontaneously on farmer fields. At the beginning of the cropping season, these shrubs are pruned and applied as mulch on the fields to maintain/enhance soil organic matter. © Lahmar et al., 2012.

Ligneous resource management and modelling

Ramial wood application trials in controlled conditions

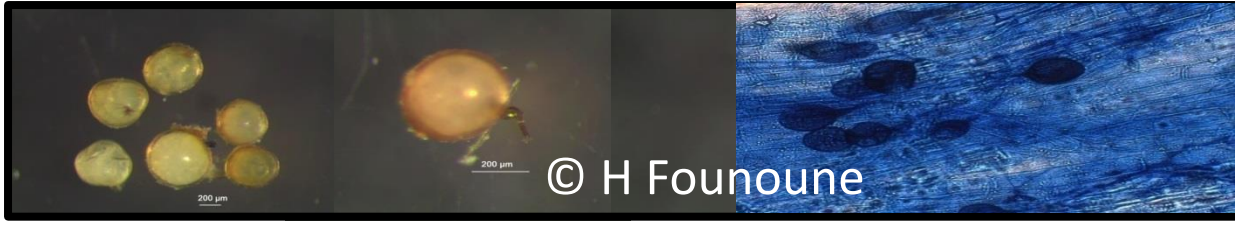
Assessing benefits from RW application, effects on soil fertility and crop yield

Evaluating resources: ramial wood availability and environmental issues linked to their use

Designing co-innovation, identifying practice optimization potential

Ramial wood application in farmers’ fields and agronomical diagnosis

Identifying key biological processes



Gigaspora sp *Gigaspora rosea* Mycorrhizal infection

Fungal interactions assayed at ISRA facilities in Dakar



Termite activity – Litterbag experiments in Kamboinsé station (Burkina Faso) © R. Lahmar

The burkinabè NGO EBEN EZER is a WASSA partner and promotes ramial wood use for food production. Some photos taken from the Kindi region illustrate that the NGO tries to address practice implementation issues at different levels © E Zongo



Discussion with farmers in the field about the fertility island phenomenon and woody amendment promotion



Protected regeneration and tree planting to increase ligneous resource.



Conception and local fabrication of a chipping machine to replace the tedious wood cutting handwork;.

REFERENCES

Lahmar R., Bationo B.A., Dan Lamso N., Guero Y., Tittonell P., 2012. Tailoring conservation agriculture technologies to West Africa semi-arid zones : Building on traditional local practices for soil restoration. Field crops research, 132 : 158-167.

Barthès, B.G.; Penche, A. Hien, E. Deleporte, P. Clermont-Dauphin, C. Cournac, L. Manlay, R. J. Agroforestry Systems, 89: 81-93

Ramial wood amendment practice inventory

Technical (co-)innovation perspectives

Regulatory (co-)innovation perspectives (incl competition for use)