



4th World Congress on Agroforestry

20-22 May 2019
Montpellier, France

Book of Abstracts



Long-term *Piliostigma reticulatum* intercropping in the Sahel: Impact of the density of shrub on sorghum yield

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Continuous cropping of cereals and reduction of fallow periods contribute to soil degradation in Africa drylands, altering the soil functions and the systems' resilience. Alternatively, appropriate intercropping of cereals with native evergreen woody shrubs is proposed as a way to restore degraded lands and, ultimately, positively impact crop yields (Lahmar et al., 2012; Bright et al., 2017). The effect of the density of shrubs (*Piliostigma reticulatum*) was tested on a continuous sorghum crop (*Sorghum bicolor*).

The experimentation is located in the 2iE Campus – Kamboinsé, Burkina Faso (12°28.031'N; 1°32.929'W) including randomized block design with four replicates. Shrubs were installed in August 2012 with different shrub densities: 0, 488, 976 and 1953 shrub ha⁻¹; Sorghum was cultivated using the Zaï technique (traditional planting pits) since 2013 season. Fertilizers were provided on the sorghum crop only in the first 2 years. Each year, the shrubs were coppiced before the start of the rainy season in June, and during the cropping season (starting from 2016). All the shrub biomass was used as soil cover. After sorghum grain yield was harvested, the remaining sorghum biomass was also left on the soil surface.

Piliostigma aboveground dry matter have increased during the 4 years of monitoring (from 2015 to 2018), reaching in 2018 a production of 6160 kg ha⁻¹ (dry matter) for both the highest shrub densities (976 and 1953 shrub ha⁻¹), and 3890 kg ha⁻¹ for the lowest density (488 shrub ha⁻¹). Sorghum grain yields declined progressively since 2014 when we stopped using fertilizers, and for all treatments.

Our results over a 5-year trial support the fact that *Piliostigma* intercropping alone do not significantly increase sorghum yield. *Piliostigma* is a non-nitrogen-fixing legume shrub that allows the stabilization of soil carbon content but not of soil nutrient nitrogen and phosphorus (Félix et al., 2018). Further researches combining *Piliostigma* with other sources of nutrient would need to be tested. For example in 2018 we started to study the effect of adding cowpea (*Vigna unguiculata* L. Walp, nitrogen-fixing legume) to the intercropping of shrub with sorghum. Another consideration is the time required to achieve measurable benefits. It was observed that it took more than 4 years to obtain consistently increased yields of sorghum when shifting to an optimized *Piliostigma* system (Bright et al., 2017).

This experiment is the support for various studies on hydrology of soil and on nutrient cycling (CGIAR Research Program “Grain Legumes and Dryland Cereals”, LeapAgri “Ramses II” project, MacKnight “3F” project).

References:

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