

Intercropping annuals with Perennial Native Evergreen Woody Shrubs: An Alternative Agroecological Response to Resources Degradation and Food Insecurity in Africa Drylands



Kamboinsé Crop-NEWS long-term experiment, sorghum (*Sorghum bicolor* var. Kapelga) development in October 2013. (Photo: R. Lahmar)

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Backgrounds

Low input annual rainfed cereal-based systems have resulted in many soil degradations in Africa drylands, altering the soil functions and the systems' resilience. Alternatively, appropriate intercropping of cereals with native evergreen woody shrubs (Crop-NEWS systems) is possibly able to restore the degraded lands and, ultimately, to improve crop production (e.g. Lahmar and Yacouba, 2012; Lahmar et al., 2012; Tittonell et al., 2012). These hypotheses are being evaluated in the Kamboinsé long-term experimentation.



Kamboinsé Crop-NEWS long-term experiment, shrub (*Piliostigma reticulatum*) development in May 2014. (Photo: R. Lahmar)

Material and methods

On a continuous sorghum crop (*Sorghum bicolor* var. Kapelga) where crop residues are maintained uniformly as mulch, the effect of the density of shrub (*Piliostigma reticulatum*) is tested in interaction with the zaï technique compared to no-tillage.

The experimentation, located in the 2iE Campus - Burkina Faso (12° 28.031'N; 1° 32.929'W), includes a two-factor randomized block design with four replicates. The first factor is shrub density: 0, 488, 976 and 1953 shrub.ha⁻¹. The second factor is soil tillage: no-till and zaï. The shrub is a multipurpose species that develops alongside the Sahelian belt and can be easily propagated from seeds. The plot size is 13,6 x 20m. The experimentation started in 2012. Shrubs were installed in August 2012; zaï was introduced in 2013 season. Sorghum was hand sown at 0.8 x 0.8 m spacing. Fertilizer was directly applied to sorghum solely. Grain yield was measured at each planting position while straw yield was measured in two 11.5 m² sized subplots.



Kamboinsé Crop-NEWS long-term experiment, installed devices for water and rootsphere studies, May 2013. (Photo: R. Lahmar)

First agronomic results

Shrubs are not developed enough to influence grain and straw yield during the two first years (table 1). However, on this mulch-covered crop, data clearly show that zaï performed better than no-till.

Table 1. Sorghum yields obtained in 2013 (673mm rainfall; 4.5 ton.ha⁻¹ straw mulch; 50 Kg.ha⁻¹ NPK (14/23/14) and 25 Kg.ha⁻¹ Urea (46%)).

	grain (ton.ha ⁻¹)		straw (ton.ha ⁻¹)	
	Soil_tillage		Soil_tillage	
	zai	no tillage	zai	no tillage
Shrub density (ha ⁻¹)				
0	1,13	.	2,96	.
488 (L)	1,37	0,98	2,44	2,27
976 (M)	1,32	.	2,83	.
1953 (H)	1,49	1,06	2,97	2,52
density effect	NS	NS	NS	NS
Mean Tillage effect at L and H density (ha ⁻¹)	0,41	(P=0.02)	0,31	NS



Kamboinsé Crop-NEWS long-term experiment, zaï combined with straw mulch, May 2013. (Photo: R. Lahmar)

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References

Lahmar R., Yacouba H., 2012. Zaï et potentiel de l'association cultures annuelles-arbustes natifs. *In* : Dia Abdoulaye (ed.), Duponnois Robin (ed.). La grande muraille verte : capitalisation des recherches et valorisation des savoirs locaux. Marseille: IRD [Marseille], p. 203-223.

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. [20120521]. <http://dx.doi.org/10.1016/j.fcr.2011.09.013>

Tittonell P., Scopel E., Andrieu N., Posthumus H., Mapfumo P., Corbeels M., Van Halsema G., Lahmar R., Lugandu S., Rakotoarisoa J., Mtambanengwe F., Pound B., Chikowo R., Naudin K., Triomphe B., Mkomwa S., 2012. Agroecology-based aggradation-conservation agriculture (ABACO): Targeting innovations to combat soil degradation and food insecurity in semi-arid Africa. *Field crops research*, 132 : 168-174. [20120521]. <http://dx.doi.org/10.1016/j.fcr.2011.12.011>