

Are crops commonly associated with plantain a source of ecological services?

TRADITIONAL plantain-based cropping systems are generally mixed: both perennial and annual crops are commonly associated with plantain. Agroecology promotes agrosystem diversity: plant associations enhance biological processes, provide agrosystem services such as biological regulation of pests and diseases or fertility restoration, and help reduce chemical inputs. Designing innovative and sustainable plantain-based cropping systems require scientific and technical knowledge concerning the effects of commonly associated crops on plantain crop. What agrosystem services do crops commonly associated with plantain provide?



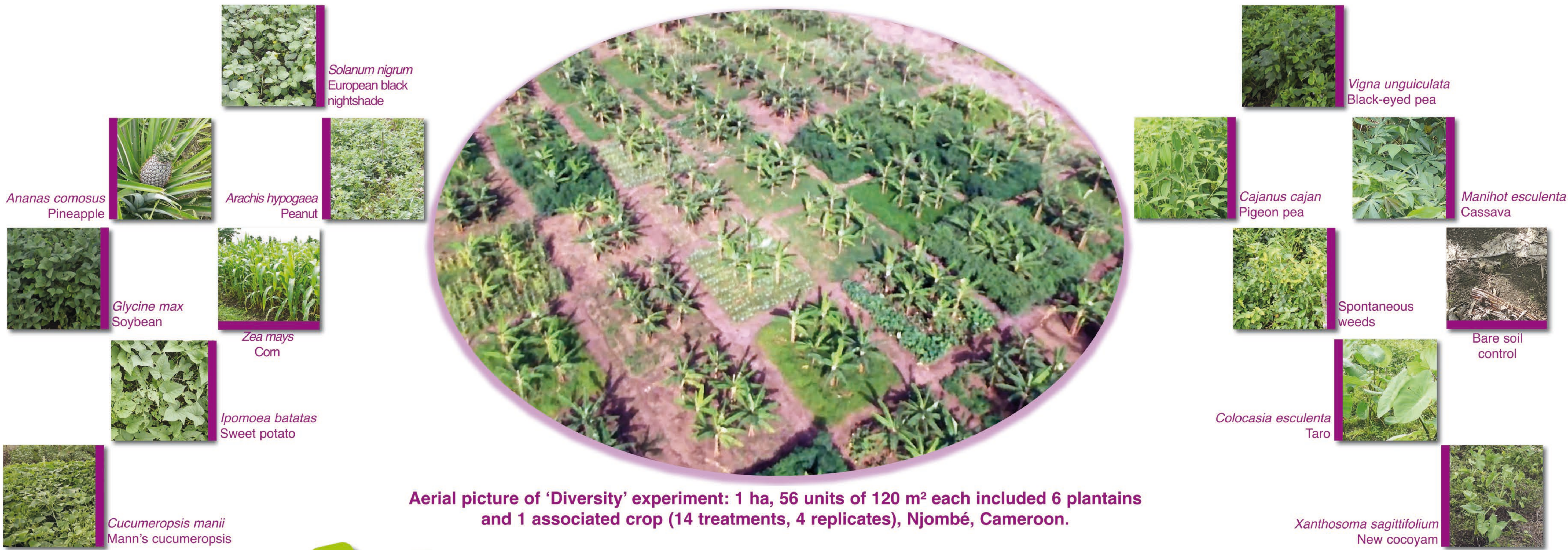
Common diversity of a plantain-based cropping system, Bouba III, Cameroon, © S. Dépigny, 2010



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Methodology

12 annual crops commonly associated with plantain in West and Central Africa, 1 spontaneous vegetation and 1 control (bare soil) were tested as factors influencing plantain production and pest and disease control. A completely randomized experimental plot was designed. Measurements of growth parameters were used to quantify the production service. Assessment of pest and disease populations and damage was performed to quantify pest and disease control service.



Aerial picture of 'Diversity' experiment: 1 ha, 56 units of 120 m² each included 6 plantains and 1 associated crop (14 treatments, 4 replicates), Njombé, Cameroon.

Results (preliminary results because observations still persist)

Measured effects on production, and pest and disease populations as well as damage at flowering.

	Production service				Pest and disease control service			
	C50	Ht	NEL	PFP	NLL	Cs D	Cs P	Rs P
Manihot esculenta	5.7%	13.9%	11.8%	41.8%	-34.3%	92.9%	-5.9%	-42.9%
Cajanus cajan	0.6%	8.2%	7.8%	30.5%	-33.7%	269.7%	165.9%	100.0%
Ipomoea batatas	-3.0%	-4.9%	13.2%	36.5%	-37.9%	108.0%	-21.2%	414.3%
Ananas comosus	-5.6%	-7.8%	4.3%	18.6%	-27.1%	189.4%	3.5%	100.0%
Colocasia esculenta	-7.2%	-8.5%	4.7%	21.1%	-27.7%	112.8%	-18.8%	557.1%
Cucumeropsis manii	-8.5%	-8.2%	3.1%	17.6%	-12.9%	139.9%	-24.7%	214.3%
Arachis hypogaea	-8.6%	-7.3%	-2.9%	4.0%	5.2%	48.1%	-12.9%	114.3%
Xanthosoma sagittifolium	-10.7%	-9.1%	-3.5%	2.8%	1.3%	86.0%	2.4%	57.1%
Solanum nigrum	-11.8%	-11.8%	-1.3%	7.0%	-0.1%	43.0%	-10.6%	-85.7%
Zea mays	-12.3%	-11.9%	6.3%	32.4%	-37.6%	240.0%	2.4%	42.9%
Vigna unguiculata	-13.4%	-12.2%	0.7%	15.2%	-9.1%	48.7%	-8.2%	-14.3%
Glycine max	-19.3%	-18.3%	-3.1%	10.7%	-9.1%	70.0%	-45.9%	614.3%
Spontaneous weeds	-9.3%	-9.1%	10.1%	33.0%	-39.4%	341.3%	-42.4%	242.9%

- Production was reduced and crop cycles were increased by most studied crops.
- Black weevil damage increased with all studied crops while black weevil population followed the same trend.
- Radopholus similis populations were generally increased by most studied crops.

Percentages of 'bare soil' control values. Statistically significant differences with 'bare soil' control are in bold type. C50: circumference at 50cm above soil; Ht: height; NEL: number of emitted leaves; PFP: planting-flowering period; NLL: number of living leaves; CsD: Cosmopolites sordidus damage; CsP: Cosmopolites sordidus population; RsP: Radopholus similis population

Discussion and Perspectives

Comprehensive results obtained from the 'Diversity' experiment should be the first complete characterization of a large panel of 12 annual crops commonly associated with plantain. Competition for plantain production, plantain pest and disease control, and agrosystem fertility pathway will all be quantified. Subsequently, this knowledge will be used within a model to design and evaluate in silico innovative plantain-based cropping systems based on agroecological concepts and practices. Collaborative work with farmers will also support tests of interesting innovative cropping systems.