Identifying "win-win" options among farmers' cropping strategies in two Beninese villages

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Background

- Increases in farm food production, income and labour productivity are needed to meet the growing food demand (SDG1), reduce farmer poverty (SDG2) and develop decent work (SDG8) in sub-Saharan Africa.
- Decreasing farmers' dependency on fertilizers, herbicides and pesticides will decrease fossil energy consumption (SDG13), preserve human health (SDG3) and life in water and on land (SDG14 and 15).

Hypotheses

- "Win-win" options exist among current farmers' cropping strategies: substantial farm food production, income and labour productivity with limited chemical inputs.
- These options are not feasible for low-resource endowed farms.

Objectives

- To identify "win-win" options among farmers' cropping strategies as a basis for promoting sustainable agriculture.

Methods

- *Sites* - Two Beninese villages; Zonmon in the south and Pelebina in the north-west.
- *Surveys* - Zonmon: 333 fields of 25 farms during the 2014 dry, long rainy and short rainy seasons. Pelebina: 290 fields of 34 farms during the 2014 dry and rainy seasons.
- *Statistical analyses* - Redundancy analyses to investigate the relationship between farm performances (measured as food production, income and labour productivity), farm resource endowment (cash available for purchasing chemical inputs and seeds and planting materials, land and labour assets), and farmers' cropping strategies.

Results

- Farmers' cropping strategies accounted for 43% and 62% of variation in farm performances and resource endowment in Zonmon (axes RDA1 and 2 in Figure 1) and Pelebina (axes RDA1, 2 and 3 in Figure 1), respectively.
- In Zonmon, large areas under maize (e.g., in farm 65) were associated with high farm performance and low chemical inputs cost but with high labour use and large area owned in uplands (Table 1 and Figure 1). Large areas under rice (e.g., in farm 10) were associated with high farm income and food production but also with low labour productivity, high chemical inputs cost, high seeds and planting materials cost, high labour use, and large area owned in uplands.
- In Pelebina, large areas under assina yam (e.g., in farm 44) were associated with high farm performance and low chemical inputs cost but also with high seeds and planting materials cost (Table 1 and Figure 1). Large areas under cotton (e.g., in farm 66) were associated with high farm income but also with low food production, low labour productivity, high chemical inputs cost, high labour use, and large area owned in uplands.

Conclusion

- Cropping strategies supported by credits (rice in Zonmon; cotton in Pelebina) were not among the win-win options.
- The identified win-win options (Figure 2) were not viable for farms with low levels of resource endowment (labour and land assets in Zonmon; cash in Pelebina).

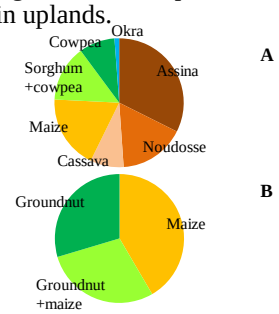

Figure 2. "Win-win" options from outstanding farms. A. Farm 44 in Pelebina (5.0 ha). B. Farm 65 in Zonmon (2.4 ha).

Table 1. Regression coefficients from RDA analyses and adjusted R squares from partial RDAs.

Objective	RDA response variables	Zonmon Intercept (mean)	Zonmon Rice	Zonmon Maize	Pelebina Intercept (mean)	Pelebina Cotton	Pelebina *Assina* yam	Pelebina Maize	Pelebina *Noudosse* yam	Pelebina Cassava	Pelebina Sorghum +cowpea
Max	Food production (kcal)	2,164,836	528,773	864,871	10,252,665	-157,045	1,693,844	833,535	537,532	2,637,201	1,480,907
	Income (FCFA)	135,879	183,234	50,847	1,359,350	14,547	207,600	39,269	294,168	-119,460	18,329
	Labour productivity (FCFA person-day^{-1})	1875	-878	104	6575	-266	1085	-371	1138	-1597	-745
Min	Chemical inputs (FCFA)	9594	32,704	-1118	69,004	7496	-7334	7544	6191	6430	9647
	Seeds and planting materials (FCFA)	18,718	46,830	-1320	185,060	-1551	42,503	6152	45,870	-11,494	4428
	Labour use (person-days)	119	245	23	304	25	-9	23	44	-1	25
	Area owned in uplands (ha)	2.00	0.85	0.13	10.01	0.32	-0.03	0.45	0.48	0.52	0.60
	Area owned in wetlands (ha)	0.18	0.04	0.01	0.79	0.03	0.02	0.11	-0.04	0.35	0.20
R^2_{adj}			0.34 ***	0.11 ***		0.17 ***	0.08 ***	0.08***	0.06 ***	0.04 **	0.02 *

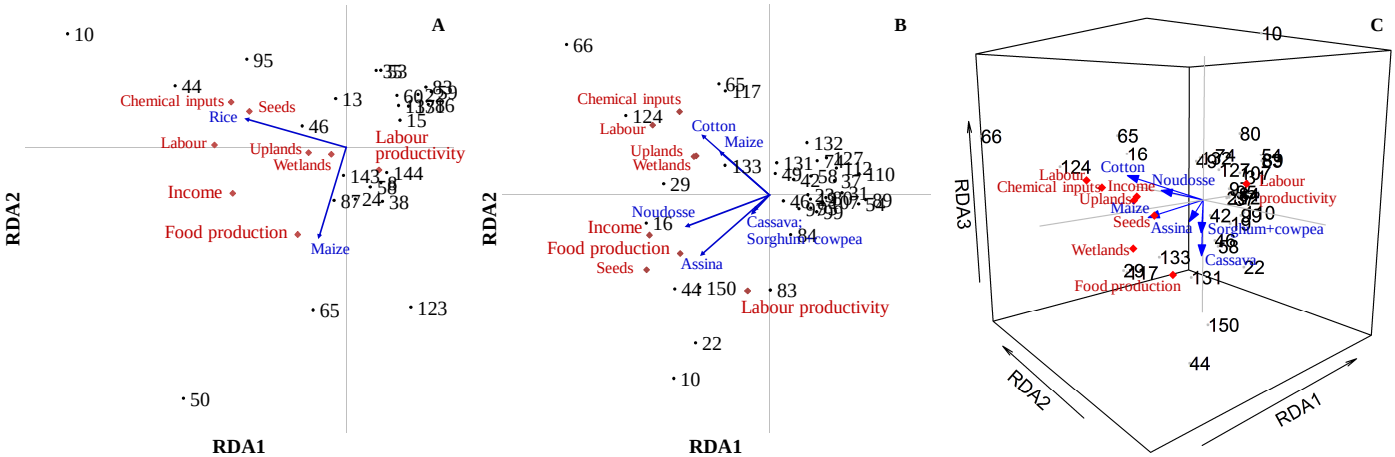

Figure 1. RDA triplots. A. Zonmon (axes RDA1 and 2). B. Pelebina (axes RDA1 and 2). C. Pelebina (axes RDA1, 2, and 3). Performance and resource endowment variables are symbolised by red diamonds. Cropping strategy variables are symbolised by blue arrows. Farm scores are symbolised by black points and/or farm identification numbers.

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