Conservation Agriculture for Food Security in Cambodia and the Philippines

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Introduction

Degraded landscapes are expanding annually in Southeast Asia. Rural poverty in upland communities increases pressure on natural resources like forest, soil and water. These are the last "capital" for the poor and they are rapidly diminishing due to non-sustainable management. Such practices reduce agricultural productivity, which in turn heightens food insecurity and exacerbates poverty.

Objectives

The goal is to promote conservation agriculture production systems (CAPS) as technologically-feasible, environmentally-sustainable, economically-viable, and gender-responsive systems that will contribute to food security of small farms in Cambodia and the Philippines. Conservation agriculture practice involves minimum soil disturbance, continuous mulch, and diverse species rotation. The objectives has an acronym GETS and they are:

Gender: Identify gendered limitations and advantages that can promote adoption of CAPS, and determine if CAPS will increase labor burden on women;

Economics: Identify field-and-farm-level CAPS that will minimize smallholder costs and risks while maximizing benefits and adoption;

Technology network: Quantify the effectiveness of SANREM-supported farmer groups in training knowledge leaders, in being knowledge transmission points, and in facilitating network connections leading to widespread adoption of CAPS; and

Soil quality: Assess soil quality and measure crop yield and biomass from CAPS, and compare them with soil quality and crop yield and biomass from conventional plow-based systems.

Methodology

Sites: The project sites are in Rattanak Mondul, Battambang province, Cambodia and Claveria Misamis Oriental province, Philippines.

CREATE approach: CREATE is an iterative process which is on-farm, with farmers, and for farmers. CAPS tested are chosen in consultation with farmer groups, local government, scientists, and other stakeholders in the community. Proposed CAPS are analyzed in terms of farm household accessibility, 'A,' and scientific and economic stability, 'B.' The CREATE protocol is: i) CAPS is proposed; ii) research on proposed CAPS conducted; iii) CAPS with tested and proven prospects diffused; and iv) necessary conditions provided for feasible CAPS to be adapted or adopted.

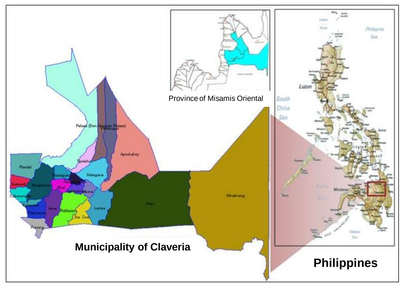
Treatments: Baseline data for each objective were gathered and networks are being established with stakeholders who can implement CAPS adoption when CAPS technology is proven to be successful. Stakeholders are getting involved while CAPS technology is being developed. Synchronization of the Cambodian and Philippines studies was done allowing for an excellent cross-cutting partnership that will benefit both countries. For both sites researcher managed and farmer managed sites were established. Twenty four farmers in Cambodia and 24 farmers in the Philippines are testing various CAPS. Researcher managed experiments for both countries had been established. For the Philippines, five promising cropping patterns were tested in comparison to conventional maize tillage. Table 1 shows the treatments. Treatments 1-5 uses dibble method in sowing maize seeds as well as the associated crops. All treatments were subjected to low and moderate fertility levels. Turn around period are reduced by immediately replanting after each harvest.

Table 1. Production schedule of CAPS treatments in acid sloping land. Claveria, Philippines

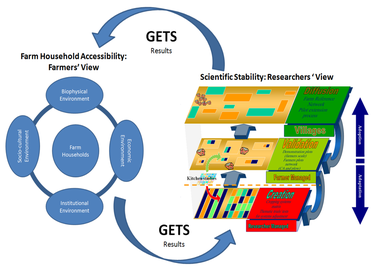
Treatments	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov
	First cropping year										Second cropping year					
T1	Arachis pintoi + Maize - A. pintoi + Maize															
	Maize 1st crop					Maize 2nd crop					Maize 3rd crop					
			A.Pintoi 1st pruning			A.Pintoi 2nd prunning										
T2	Maize + Stylosanthes – Stylosanthes fallow															
	Maize 1st crop					Stylosanthes fallow					Maize 2nd crop					
	Stylosanthes 1st pruning					Stylosanthes fallow										
T3	Maize + Cowpea – Upland Rice + Cowpea															
	Maize 1st crop				Cowpea 2nd crop			Maize 2nd crop				Cowpea 4th crop				
	Cowpea 1st crop		Upland rice 1st crop					Cowpea 3rd crop			Upland rice 2nd crop					
T4	Maize + Ricebean - Maize + Rice bean															
	Maize 1st crop							Maize 2nd crop					Maize 3rd crop			
					Rice bean					Rice bean						
T5	Cassava + Stylosanthes															
	Cassava 1st crop										Cassava 2nd crop					
	Stylosanthes 1st pruning					Stylosanthes 2nd pruning					Stylosanthes 3rd pruning					
T6	Maize – Maize (Conventional plow based)															
	Maize 1st crop					Maize 2nd crop					Maize 3rd crop					

Degraded Landscape in Claveria, Philippines

Conservation Agriculture in Cambodia



Claveria, Misamis Oriental, Philippines



CREATE Model Application Approach
Creation-Research-Extension-Action-Teaching-Education

Results

Cambodia: The assessment of the main cropping systems shows an increase with time in the Gross Profit Margin (GPM) (Table 2 and Fig. 1). With CAPS, the yield is increasing from year to year while charges are decreasing: no ploughing, decreasing weed pressure, etc. The GPM on CAPS managed plots is slightly lower than the traditional ones during the two first years. However, the constant decrease of the yields observed in the ploughing-based systems leads to an ineluctable drop in the profit margins when those from CAPS plots increase with the number of crop cycles.

Table 2. Yield according to the cropping system and the number of years of CAPS

Cropping System	Yield (ton / ha)	Plots (Nb)
Millet / Maize + *Stylosanthes g.* // Maize+ *Stylosanthes g.* Year 1*	3.7 (±0.8)**	12
Maize + *Stylosanthes g.* // Maize+ *Stylosanthes g.* Year 2	3.6 (±1)	16
Maize + *Stylosanthes g.* // Maize+ *Stylosanthes g.* Year 3	4.1(±0.6)	3
Maize in Traditional Management (Plowing)	3.3 (±0.7)	20

* One year of CAPS practices, ** ± Standard deviation

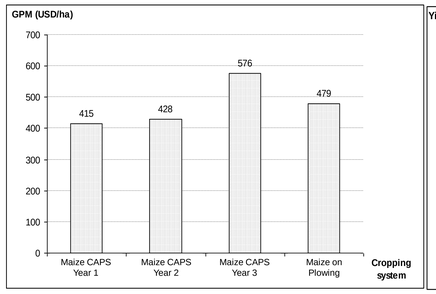


Fig. 1. GPM (USD/ha) according to cropping system and the number of years of CAPS

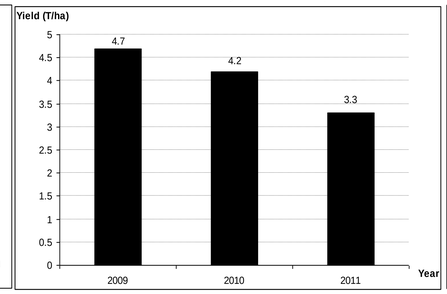


Fig. 2. Evolution of the corn yields from 2009 to 2011 within the SANREM plots control network

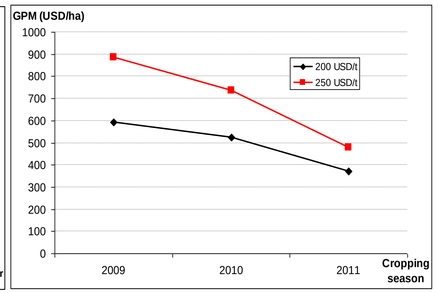


Fig. 3. Evolution of the GPM (USD/ha) from 2009 to 2011 within the SANREM plots control network

Philippines: Cassava with *Stylosanthes* (T5) gave the highest total dry matter yield among all other treatments followed by conventional maize production (Fig. 4a). Maize plus cowpea plus upland rice (T3) performed the least in dry matter yield (Fig. 4a) but gave the highest sales (Fig. 4b) because of the relatively high price of beans. Also shown in Fig. 4a, cover crop *A. pintoi* performed the least in biomass production compared to *Stylosanthes*. In terms of maize yield, conventional production performed the best in this first cropping year compared to all other treatments having maize. The spacing between plants as well as the low fertility inputs might have resulted in competition effects between maize and the cover crops. The crops were only fertilized with two fertility levels 0N-30P_2O_5-0K_2O and 60N-30P_2O_5-30K_2O. Fertilizer input adjustment might reduce competition effects and thus is adjusted on the next production cycle.

CAPS treatments are diverse compared with conventional maize (Table 1). Maize with cowpea relayed with cowpea plus upland rice CAPS is more diverse, having 3 crop components, than other treatments (Fig. 5a). The soil cover provided by CAPS act as effective soil binding function on surface soils preventing rill erosion as observed in conventional plow-based maize cropping system (Fig. 5b).

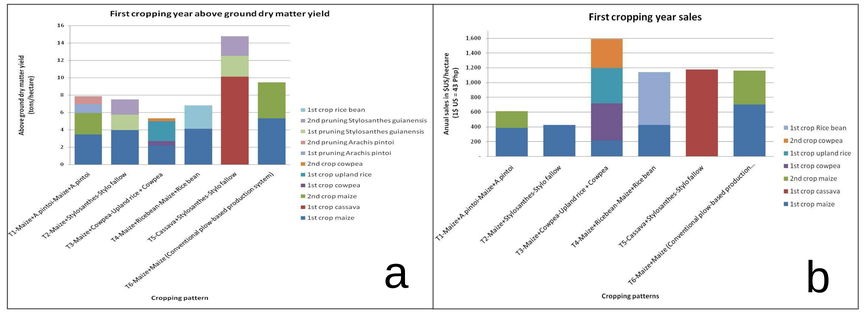


Fig. 4. First cropping year dry matter yield of CAPS (a) and First cropping gross income of CAPS (Maize priced at 302 USD/ton; Cowpea at 1162 USD/ton; Rice bean at 930 USD/ton; and Cassava at 151 USD/ton) (b). Claveria, Misamis Oriental, Philippines.

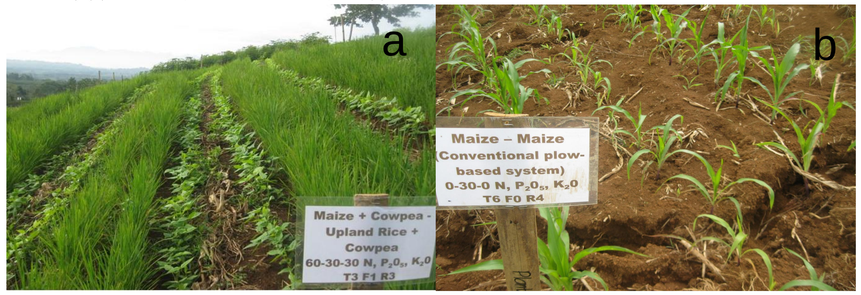


Fig. 5. Upland rice planted after cowpea and cowpea planted after maize (a); and rill erosion observed under plow-based maize production (b). Claveria, Misamis Oriental. Philippines.

Conclusion

Conservation Agriculture is being practiced in many parts of the world yielding promising sustainable production systems. This project brings conservation agriculture in the humid tropical climate of Southeast Asia. Initial results showed that in Cambodia CAPS gradually produced higher maize yield within three years. The evolution of CAPS plots network is quite positive, but the transition period from plowing to CAPS in three years can be tricky for farmers. Subsidies could be considered as a way to indirectly provide incentives for a pronounced technical change and to finance the soil capital restoration. Similar system, e.g. public security fund allocated to the Micro-Finance Institution providing credit line to farmers and/or farmers organizations, should be implemented aiming at a large extension, especially when targeted on small-medium farmers. In the Philippines, maize, cowpea and upland rice in sequence provided the lowest grain yield of maize and total dry matter yield but provided the most income due to higher market price of cowpea seeds. This system has low turn-around period and the most diverse cropping pattern and offers continuous ground cover. Conventionally grown maize provided the highest maize yield due to lesser competition under low fertilizer application rate and the least diverse and most prone to erosion. Among cover crops tested, *Stylosanthes* showed to be more productive than *A. pintoi* making it a suitable cover crop under CAPS.

Principles of Conservation Agriculture *McD* Principles of Conservation Agriculture

Minimum soil disturbance, continuous mulch and Diverse species

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