Potentials and challenges of Conservation Agriculture in the western upland areas of Cambodia. A case study in Rattanak Mundol, Battambang province

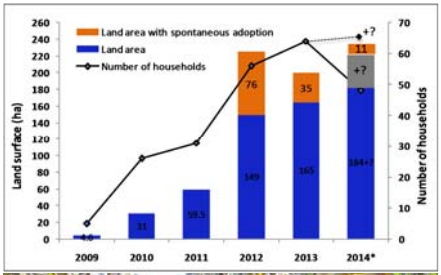
R. Kong, S. Boulakia, V. Sar, K. Soeurng, B. Thy, V. Leng, L. Huot, S. Nhem, S. Pheav, M. Reyes, F. Tivet, L. Séguy

Context and objective

Rattanak Mundol is one of the last Khmer Rouge stronghold areas in the western Cambodia, where 440,000 ha of forest lands have been reclaimed in a decade after the full peace establishment on all national territory in 1998. The ever increasing market demand, the available agricultural inputs and private services for plowing, induced drastic changes in smallholders habits. Small scale subsistence farming, based on upland rice and peanut, quickly shifted to commercial farming based on soybean (2003), corn (2005) and cassava productions. Intensive plow-based tillage and ridging with cassava monoculture have induced a marked soil fertility depletion and soil degradation. Coupling with climate change impacts (drought and flooding) and higher production costs (chemical fertilizers and chemical weeds control), this development scheme has jeopardized the agronomic and economic performances of the farms. On-farm assessment and network of pre-extension have been used since 2009 through the Feed the Future Innovation Lab for Collaborative Research on Sustainable Agriculture and Natural Resources Management (SANREM) to introduce direct seeding mulch-based cropping systems (DMC) for sustainably intensification and diversification.

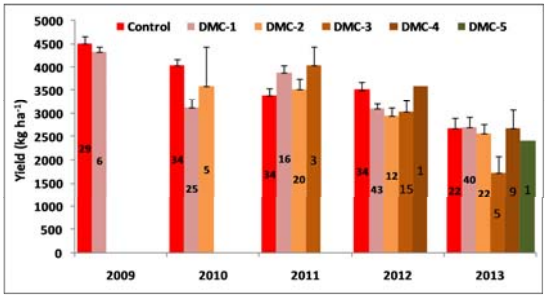
Proposed cropping systems and evolution of DMC adoption

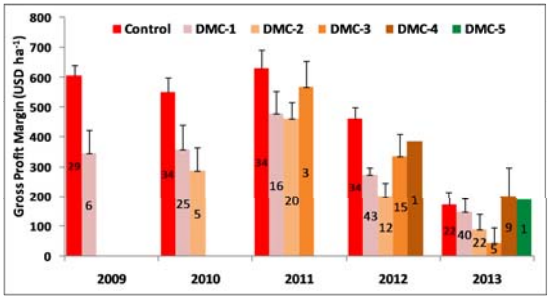
Pigeon pea (*Cajanus cajan*) is successfully tested as cover crop for corn to replace Stylo (*Stylosanthes guianensis*) on this highly-akaline Mollisols soil with pH 6.5-8.0. For its possible competition, especially on poor soils with low fertilization, pigeon pea is sown 10-15 days after corn sowing in the inter-row. The network of pre-extension increased from 2 target villages, few households and hectares in 2009, to 4 villages, 200 ha and 64 household in 2013, even facing yield damage due to long drought span in 2012, and ending with the 300USD ha^{-1} free-interest credit on inputs and services. The farmers are convinced by no-till on crop residues, saving the cost of soil preparation, higher flexibility regarding the sowing date, and soil restoration improvement. However, they are still reluctant to investing additional labor for sowing of pigeon pea.



Yield performance and gross profit margin (GPM)

Irrespective to the years of DMC practice, the yield of corn under DMC management was similar to those observed under conventional management, expected under higher fertilizer level (70N-30P_2O_5-30K_2O) where higher yields were observed under DMC. As a result, the GPM of DMC plots were lower than those under conventional plow-based management (CT), except in 2013.





Note: Bars indicate the mean; Number inside the bar is number plot; bar caps represent the standard error ; DMC-1 means1 year DMC practice

Potentials and challenges for adoption and scaling up

The proposed DMC based cropping systems are compatible with the operations conducted by the private contractors, generally involved in machinery, pesticides and fertilizers supply. The farmers are curious for innovative technologies that could reduce labor and production cost, while sustaining the crop productivity. Some farmers already invested in a 4-row and 2-row direct seeders. Pigeon pea could be used for cattle and pig fattening which is being promoted by NGOs in the region. Additional engineering and research works should be conducted to assess the best combination of density and sowing date of pigeon pea with corn to reduce water competition that could occur. Others legumes species that could be eventually broadcasted (reducing labor requirement) should be evaluated on these alkaline soils. Access to specific DMC equipments (Machine Auto Part Co., Ltd, Thailand), fertilizers, and cover crops are today facilitated, but the lack of financial support represents one of the main constraint to the extension of DMC cropping systems. Developing DMC systems for cassava (after chiseling for furrow opening), in rotation with corn or soybean integrating a nutrient cycling strategy (limiting stem removal of cassava), represent one of the main challenge in Cambodia.

Conclusions

- Farmers are convinced by no-till sowing on crop residues, to save cost and to preserve the soil potentialities. However, any additional cost or labour input impair the use of cover/relay crops, such as no-till sowing of mungbean or pigeon pea.
- Training and communication are also one of the main issues to promoting DMC cropping systems. Improvement in know-how and skills of both smallholders and extension agents is needed.
- Giving additional value to the cover/relay crops (cash and/or animal feeding), facilitating the access to credit with low interest rate (subsidy for payment for environmental services) through farmer cooperative will boost the adoption of DMC cropping systems.

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