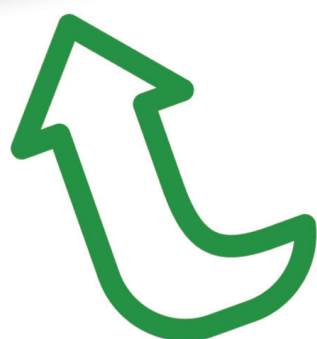


CANSEA a R&D Network on Agroecology Transition in South East Asia

Developing appropriate-scale mechanization for CA-based cropping systems in South-East Asia

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Key results and lessons learned from the Action

Developing an appropriate scale mechanization is an essential dimension of Conservation Agriculture (CA) R&D for smallholders. CA, based on the combined mobilization of 3 principles (1) no soil tillage, (2) permanent soil cover and (3) species diversification in rotation, constitutes a key corpus of techniques for agroecological systems dealing with field crops and agricultural commodities. For smallholders engaged in annual cash crop production, agro-ecological alternatives must pair with labor productivity improvement without introducing bottleneck in working calendar. This is notably true in South-East Asian contexts where off-farm activities offer attractive complementary income options for smallholder farmers with limited land access. This is also particularly necessary because commodities like maize and cassava for animal feed industry for instance present limited and/or constrained possibilities of price premium for acknowledged agroecological quality. In addition,

CA based alternatives must be sufficiently "practicable" to get a chance to substitute plow-based cropping systems supported by a wide provision of services for soil tillage and even conventional sowing, like it is the case in West Cambodia.

Integrating this dimension of an innovation process attached to CA development, the Conservation Agriculture Service Center (CASC) and the Appropriate-scale Mechanization Consortium (ASMC) have dealt with two complementary dimensions of an appropriate-scale mechanization development for Cambodian smallholders.

Which mechanization -i.e. tools x traction unit- for sustainable CA-based cropping systems?

Several tools have been introduced, tested and adjusted mostly for tractor (# 80 HP) and power tiller (# 12 HP) like roller crimper, boom sprayer, planter and seeder, small-scale round baller (integration CA – livestock production). Sometimes, the conception of new CA

systems calls for specific implements like NT-Cassava planter able to operate in mulch, broadcast seeder for sowing in standing cover crop prior to its control or for sowing a cover/relay crop in standing crop (e.g., rice, soybean...) before harvest.

Which mechanisms to make mechanization accessible and affordable for all types of field crops producers?

Introduced tools are evaluated as well as their operation costs and possible uses within cropping and farming systems. Regarding planter, collective purchase by group of farmers has been tested. In addition, collaboration with manufacturers allowed the development of regional and local made no-till planters with a price 35% to 60% lower than similar implement imported from Brazil. A recent study assessing the business model of service providers brought highlights on opportunities and constraints to integrate NT seeding as service for smallholders.

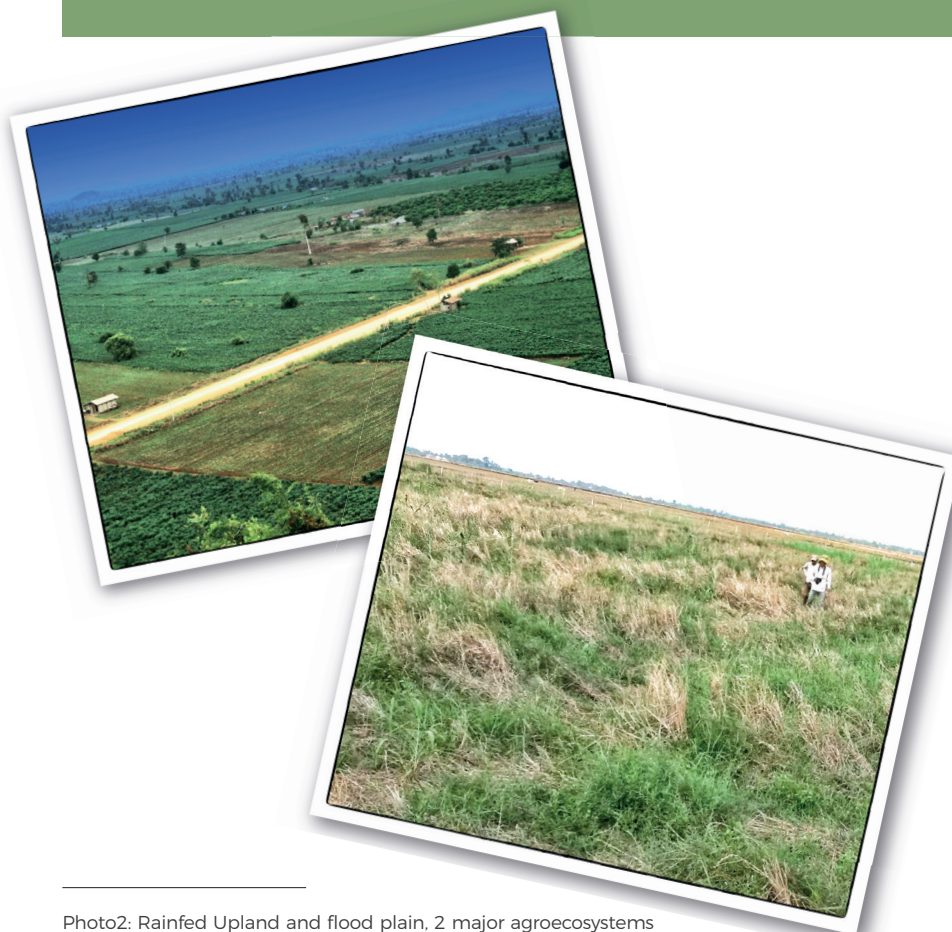


Photo2: Rainfed Upland and flood plain, 2 major agroecosystems in Western regions of Cambodia (Credit Kong R and F. Tivet)

Context of the Action

In Western region of Cambodia, pioneer front dynamics conducted to the reclaim of more than 200,000 ha in 15 years since late 90's. The process, sharing many "agrarian features" with the contemporary maize boom in Xayaburi province (RDP Lao), lead to the emergence of a new form of agriculture in the country with smallholders installed on rainfed upland agroecosystems and dominantly engaged in annual cash crops production for regional agroindustry (e.g. animal feed, starch ...). After deforestation, massive infringement on biodiversity and water resource degradation, farmers are dealing with soil fertility depletion, climate conditions perceived as increasingly erratic and fluctuating markets for maize and cassava, the two major cash crops. In this context, the General Directorate of Agriculture has been implementing through the CASC and its partners, a long term R&D platform on innovation process structured around controlled reference plots and farmers network, on both rainfed upland and rice cultivation in the flood plains of the Tonle Sap lake.

Objectives of the Action

The action has contributed to the introduction of three specific machines requested to open new fronts in cropping systems conception and co-design with farmers: (i) a no-till planter for Cassava, (ii) a roller crimper, and (iii) a broadcast seeder.

Partnership

The action is implemented by the CASC of the Department of Agricultural Land Resources Management (DALRM), the Department of Agricultural Engineering (DAEng) of the General Directorate of Agriculture, Ministry of Agriculture, Forestry and Fisheries, and CIRAD. It prolongs and completes R&D operations supported by The Feed the Future Innovation Lab for Collaborative Research on Sustainable Intensification (Appropriate-Scale Mechanization Consortium, Royal University of Agriculture, University of Illinois Urbana-Champaign, Kansas State University, USAID).



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Location and description of the Action

The three introduced machines allow to develop and foster interactions with farmers in Rattanak Mondul and Banon districts on the conception of innovative cropping systems with reduced impact on natural resources (i.e., erosion control, low or no herbicide application) and enhanced agroecological functions. The Cassava planter opens possibility to step forward in agroecological management of Cassava, from strip-tillage based planting to strict NT implementation with undisturbed soil cover. This approach diminish the number of operations for cassava planting, improving flexibility of the crops sequence management, especially for late “dry season” Cassava. The roller crimper, both for power tiller and tractor, allows to develop planting green pathway with multiple benefits on weeds management, nutrients cycling efficiency as well as on labor productivity of smallholder farmers. The broadcast seeder improves the quality and productivity of sowing in standing crops or cover crops and allows to develop additional *planting green* patterns.



Photo3: Cassava NT planter and broadcast seeder



Photo4: Use of roller crimper for planting green of maize on sunnhemp, Rattanak Mondoul, Battambang, June 2018

Expected impacts and prospects

Retrospective glimpse on these R&D attempts conducted in West Cambodia with farmers network during several years highlights that farmers see short-term interest of a machine far before to perceive medium-term benefits of CA and induced agroecological services. It should invite to consider the development of an appropriate-scale mechanization provision as a key element, easy to “grasp” by farmers because solving technical, logistical and productivity problems, to enhance complex innovation process attached to deep systemic changes. Dealing with smallholders engaged in annual field crops production, developing access to an appropriate mechanization may serve as a vector for agroecological transition.

In the near future, a platform to share and disseminate information would contribute to a better support for stakeholders in their CA initiatives through the creation of a website dedicated to equipment users. Such platform should also stimulate the setting up of network of users interested by specific implement, with several expected benefits:

- providing adapted advices to users on implements while limiting the investment risks (avoid inadequate machines, known capacity and operation costs...);
- rapid dissemination of users recommendations (“tips” for the calibration, the adaptation, the use and the management of the implement);
- bringing visibility on local companies investing in the development of implements for agroecological systems management, with quality acknowledged by users (farmer, service provider).

Useful links and contacts

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