Regional Conservation Agriculture project proposal in degraded annual cropping systems areas in South East Asia

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Introduction

The Conservation Agriculture Network for South East Asia (CANSEA) was created in 2009 to develop conservation agriculture (CA) cropping systems in South East Asia in 2009. The interest of such a network is that each country can contribute to conservation agriculture (CA) advances as CA principles are not yet widespread. In all countries involved there are specific areas where negative environmental impacts with long-term repercussions on natural resources such as, production decrease and health risk increase due to chemical input. In extreme cases loss of soil fertility would be irreversible for cash-crops. So Conventional agriculture vs. conservation agriculture conversion should be an opportunity where the current practices are questionable to counteract all negative environmental and economic externalities of crop intensification. The aim of this paper is to put the milestones of a conservation agriculture research for development project which would be proposed to funders such as ADB, IFAD, by three Southern Asia research institutions, the National Agriculture and Forestry Research Institute (NAFRI, Lao PDR), the Northern Mountainous Agriculture and Forestry Science Institute (NOMAFSI,Vietnam), the Yunnan Academy of Agricultural Sciences (YAAS, China). All three partners have belonged to the Great Mekong Sub-region (GMS) program since 1992 in different sectors such as agriculture, to improve coordination focus mainly on remote areas and small-farming systems.

Material and Methods

Definition of concepts and choice of target areas. Each country has its own problematic (Julien *et al*., 2008; Tao *et al.*, 2008; Doanh *et al.*, 2008); and we first tried to define what soil degradation means for farmers mainly with economic aspects such as income returns in the short term, as well as for the civil society with environmental aspects such as soil quality. We are convinced therefore that it would be useful to integrate environmental and economic studies. In our project we integrated the two meanings of land degradation, both for natural and human causes. *Agronomic research for development methodology.* CA extension is low because many problems occur at the same time such as, lack of government subsidies, landscape management, specific machinery and low market access for secondary crops. Our concept all throughout the project, is simultaneously to work with different levels: field, household, village and region, and to begin with all expected stakeholders, farmers organizations, private sector, as well as government agencies. *Choice of indicators.* Our concept is to mix formal knowledge and local practices at each scientific work level in a win-win approach as scientists can learn more if they could benefit from farmers' experiences. Validated results should be explained in a comprehensive way. *National skills.* Since national institutions are reluctant to be involved in regional programmes because they consider they do not have full control over developing synergies, it is also important to highlight each country 's field of expertise.

Results and Discussion

Target areas and objectives (table 1). In Xayabury, Oudomxay and Bokeo Provinces in Lao PDR, land degradation increased with increasing market access for maize as a cash-product in areas near the borders of Thailand, Vietnam and China, totalising about 10,000 km^2. The traders encourage the farmers to use heavy mechanization by providing credit (Julien *et al*., 2008). At the same time herbicide is reaching high levels, such as 20 l/ha for commercial products. Farmers commonly use government prohibited products such as atrazin and paraquat. Soil and pesticide run-off then occur. We also find the same problem in Son La Province in Vietnam and Dali Prefecture in Yunnan where the use of chemical fertilizer, respectively with maize and rice based cropping systems varies from 400 to 5,000 kg/ha, as well as widespread use of herbicides and insecticides (Tao *et al*., 2008; Doanh *et al*., 2008). Large flat areas also are not yet cultivated because the soil has a very low fertility status and the cost of fertility management would be too high. We find this in Savannakhet Province in Lao PDR, where specific parent material gives the soil a coarse texture, as well as in scattered plains in Binh-Dinh Province in Vietnam. Soil pH water is below 5, increasing the cost of soil fertility build-up. In Yunnan in rice cropping systems the high cultivation rate combined with continuous tillage and insufficient organic soil matter, contribute to a decline of soil organic matter and high emissions of C in the atmosphere. In upland areas a large amount of crop residue is burned and shortage rainfall events provide high risk of a human food crisis. In all target areas water management at the watershed level should be taken into account in order to secure farmers incomes and food security. *Methodology and technologies* (table 2). At the beginning of the project we would conduct a multidisciplinary Rapid Rural Appraisal (RRA) showing the capacity to update socioeconomic factors. The record of farming and non-farming activities, land tenure, livestock, perennial and annual product links, market access with also soil quality, slopes, climate variability, would be the baseline survey, permitting us to select pilot areas and representative farms which could be representative of the rest. A Farm Reference System (FRS) would be created as a set of representative farms that show various biophysical and economical characteristics where few technologies would be applied as support for similar farms. Perennial experiments innovations on CA cropping systems would be compared with conventional cropping systems on selected watersheds managed by a research team with a close relationship with selected farms. A permanent Stakeholder Network (SN) would join government authorities as decision makers, traders as for technology suppliers and products buyers, extension services and farmers' organizations. This SN would play a major role in the definition of subsidies coming from expected environmental services created by CA technologies. Also it would be useful to supply specific mechanization and input, market access of diversification products, such as livestock, perennial crops and forage crops. According to different works on CA promotion (Julien *et al*., 2008; Tao *et al.*, 2008; Doanh *et al.*, 2008), adequate equipment for direct seeding is a prerequisite for successful CA. New machine constructors with no-tillage tools begin to be recognized in such places as China. Even though they are not located in Yunnan Province, their support would be sought, in engaging them in the process of innovation. Further expertise from more advanced countries in CA technologies such as Brazil or Australia would be proposed. Particularly Southern Brazil has a large range of direct-sowing machines for all kinds of work power, manual, two-wheel tractors, animal or four-wheel tractors (table 1). Mechanization would be also useful for managing weed and crop residue to provide better weed control by avoiding seed maturation and better residue soil cover. *Let's start at the end.* In conclusion, lessons from the past have shown that the decrease of farmers 'income is the most important motivation that would convince them to adopt CA technologies (Kassam et al., 2009). Degraded areas integrate economical, environmental and social impacts in small-farming systems which concern with the entire the human community. To inverse this trend a strong relationship is required between authorities, the private sector, farmers 'organizations in representative pilot areas with the leadership of research teams. This first step should define what kind of subsidies would be efficient for small farms for future extension engaging governmental authorities and the private sector.

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Figures and Tables

Table 1. Characteristics of the degraded area in the three countries.

Country Domain		Location	Degraded area	Level of poverty	Degradation type	Soil texture	Wet season duration	Main crop based cropping systems	Labour input
Laos	Upland	Xayabury, Oudomxay, Bokeo Provinces	10,000 km^2	Medium	Human	From sand to clay	8 months 1,300mm	Maize-Legume	Manual, 2 and 4 wheel-tractor
	Lowland	Savannakhet Province	15,000 km^2	High	Natural	Sand	7 months 1,300 mm	Rice-Legume	Manual, 2 and 4 wheel-tractor
Vietnam	Upland	Son La Province	20,000 km^2	High	Human	Clay	8 months 1,100 mm	Maize-Legume	Manual and animal
	Lowland	Binh Dinh Province	4,000 km^2	High	Natural	Sand	8 months, 1,600 mm	Maize-Peanut-Sesame	Manual and 2 wheel-tractor
China (Yunnan)	Upland	Dehong Prefecture	10,000 km^2	High	Human	Clay	6 months 1,100 mm	Soybean-Citrus tree	Manual and animal
	Lowland	Dali Prefecture	6,000 km^2	Medium	Human	Clay	6 months 1,100 mm	Rice-vegetable	Manual and animal

Table 2. Expected outputs for each given methodological level.

Methodological level	Environmental	Economical	Social
Perennial Experiments	C, N, water budget	Basic economic data	Window of knowledge
Farm Reference System	Input requirements	Technical books Perennial and annual crops, livestock integration	Use farmers as extension facilitators Farmers 'field school
Stakeholder Network	Subsidies coming from environmental service Land use planning	Links between production and market	Large scale Extension