Accompanying the agroecological transition in Lao PDR: Opportunities and challenges for conservation agriculture in maize production areas

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Introduction

In developing countries, market integration and the commoditization of agriculture are often associated with rapid land use intensification, a simplification or standardization of the agricultural systems and increased economic and ecological risks (e.g. market fluctuations, pests, soil erosion). Conservation agriculture (CA) is considered as a key alternative for intensifying agricultural production while maintaining or restoring key ecosystem services. However, important questions have been raised regarding the potential of CA in a context of smallholder agriculture (e.g. Erenstein, 2003; Bolliger et al., 2006; Giller et al., 2009). CA is often deemed knowledge- and capital-intensive, hence incompatible with smallholder farming. For Giller et al. (2009), dissemination should concentrate on "socio-ecological niches" where CA is the most likely to be adopted by smallholders. Soil erosion issues, good access to farm inputs and markets and the presence of smallholders with sufficient land, labour and capital would constitute key criteria for identifying these niches. This paper focuses on two main research questions: "To what extent can CA compete with more conventional forms of agricultural intensification in a context of smallholder farming?" and "What is the value of a 'socio-ecological niche' approach to the dissemination of CA?"

Material and Methods

The data derives from field studies conducted in two regions of Lao PDR: southern Sayaboury Province and north-eastern Xieng Khouang Province (Slaats and Lestrelin, 2009; Lestrelin et al., 2011; Lestrelin et al., forthcoming). These studies assessed the socio-economic impacts of CA practices promoted by two agricultural research and extension initiatives. Research involved quantitative and qualitative surveys on changes in livelihood, land use and farming systems among 2,300 sample households in 30 villages targeted for CA experimentation and dissemination.

Results and Discussion

Since the mid-1980s, the government of Lao PDR has promoted a gradual liberalization of the national economy. Among the set of reforms advocated, the replacement of shifting cultivation by intensive market-oriented agriculture is recognized as a key stage in the transition towards market economy. As a result of market integration and policy incentives, total annual maize production has increased tenfold between 2000 and 2009 – from 117,000 to 1,130,000 tons. This transition represents an important contribution to the national economy. In 2008, agriculture accounted for about one third of the country's GDP and maize ranked first in volume and second in value among the agricultural commodities exported. At the forefront of this process, Sayaboury Province has become the first maize production zone of the country and an important supplier of the Thai animal feed and food processing industry. Xieng Khouang Province constitutes the fifth production zone and exports essentially to Vietnam. The maize boom has had very important consequences for land cover, land use and smallholder agriculture in the two provinces. Over the past decade, it has led to agricultural expansion (forest and fallow conversion), a generalization of ploughing practices and an increased use of pesticides. With the transition from shifting cultivation to intensive hybrid

maize monoculture, agricultural productivity has increased considerably while rural poverty has receded. However, a growing number of farmers are now confronted with land degradation issues (e.g. soil erosion, lowland siltation, weed pressure and chemical pollution), excessive production costs and indebtedness. Four main agroecological zones can be distinguished according to accessibility, market integration and capital outflows from early transitional areas to pioneer areas (Figure 1): (i) a zone long engaged in intensive agriculture and characterized by important land degradation issues, distress diversification (e.g. diversification of the commercial productions or re-emergence of subsistence crops) and mixed farming systems; (ii) a zone with degrading lands covered by intensive market-oriented monoculture and characterized by strong debt loads; (iii) a zone with productive lands engaged in a process of commoditization and intensification of agriculture; and (iv) a zone with productive lands covered by extensive subsistence-oriented agriculture. They correspond to successive stages in a historical pattern of land use intensification.

Three main direct seeding mulch-based cropping (DMC) systems have been experimented in the study areas: maize monocropping with residue management (proposed as a first step towards agroecological systems), maize – rice-bean intercropping, and biannual rotation maize – rice-bean. Funded through a 4-year extension programme, dissemination efforts have been particularly important in Sayaboury. As a result, adoption by smallholders has generally been much higher than in Xieng Khouang. Common patterns emerge nonetheless when looking at CA adoption across the two study regions (Table 1). In degraded areas long engaged in intensive agriculture, CA dissemination efforts have had stronger impacts than at any other stage of the agroecological transition. Farmers have also been more willing to experiment with complex CA systems based on intercropping and crop rotations. In contrast, where market integration was more recent, limited land degradation, important agricultural incomes and well-established service provision systems (e.g. combining ploughing and pesticide application services) have imposed considerable limits to the diffusion and long term adoption of CA. At an earlier stage of land use intensification, DMC maize monocropping was an attractive option for smallholders willing to engage in market-oriented agriculture with a limited increase in production costs. Finally, in subsistence areas, the diffusion of CA has been significantly hindered by the limited capacity of smallholders to invest into required technologies and inputs.

In the maize production zones of Lao PDR, critical windows of opportunity for CA-related interventions were, first, at an early stage of commoditization and intensification of agriculture and, second, at the latest stages of land degradation and economic diversification. In the first instance, CA dissemination and technical support may allow smallholders to engage in more sustainable agroecological transition pathways. In the second instance, CA represents an economically- and ecologically-sound alternative to conventional intensive agriculture. The concept of “socio-ecological niche” put forward by Giller et al. (2009) can certainly prove useful for characterizing areas where particular types of CA can offer most and are more likely to be adopted by smallholders. However, local socio-ecological systems are not just spatially diverse; they are highly dynamic and constantly reshaped by broader socioeconomic, political and biophysical driving forces. In that sense, rather than locating potential ‘hotspots’ for dissemination, the most important challenge for CA researchers and practitioners lies in identifying the key moments for intervention along specific agroecological transition pathways. Widespread adoption in some villages (e.g. in each target province, one village was surveyed where virtually all farming households had shifted to CA in 2008) suggests that, with an appropriate timing and adequate research and extension endeavours, CA can become a viable and accepted alternative to ploughing-based agricultural intensification – and this, even in a context of small-scale farming.

References

Bolliger A, Magid J, Amado TJC, Neto FS, Ribeiro MFS, Calegari A, Ralisch R, De Neergaard A, 2006, Taking Stock of the Brazilian "Zero-Till Revolution": A Review of Landmark Research

and Farmers' Practice, Advances in Agronomy 91, 47-110.
Erenstein O, 2003, Smallholder conservation farming in the tropics and sub-tropics: a guide to the development and dissemination of mulching with crop residues and cover crops, Agriculture, Ecosystems and Environment 100, 17-37.
Giller KE, Witter E, Corbeels M, Tittonell P, 2009, Conservation agriculture and smallholder farming in Africa: The heretics' view, Field Crops Research, 114, 23-34.
Lestrelin G, Nanthavong K, Jobard E, Keophoxay A, Khambanseuang C, Castella J-C, Lienhard P, 2011, "To till or not to till?" Opportunities and constraints to the diffusion of Conservation Agriculture in Xieng Khouang Province, Lao PDR, Outlook on Agriculture (in press).
Lestrelin G, Tran Quoc H, Jullien F, Rattanatray B, Khamxaykhay C, Tivet F, forthcoming, Conservation agriculture in Lao PDR: Diffusion and determinants for adoption of DMC systems in smallholder agriculture, Renewable Agriculture and Food Systems (submitted).
Slaats J, Lestrelin G, 2009, Improving cropping systems by introducing Conservation Agriculture: Taking stock of the results and methodology of research-development in southern Sayaboury province, Lao PDR, PCADR, Vientiane, 115 p.

Figures and Tables

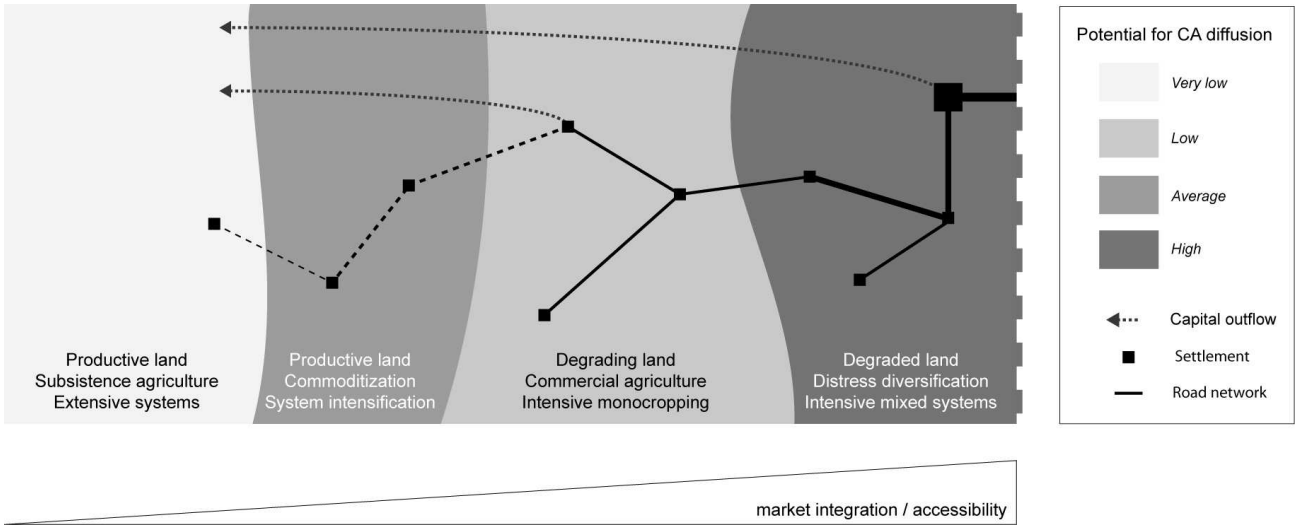

Figure 1. Agroecological transition stages and potential for adoption of conservation agriculture.

Table 1. Adoption and abandon rates in the two study areas and four agroecological transition stages.

Agroecological transition (stages)	Sayaboury Province (21 villages, n=2084)			Xieng Khouang Province (9 villages, n=270)		
	Adoption* (2008)	Extent of CA♣ (2008)	Abandon♠ (2004-2008)	Adoption* (2008)	Extent of CA♣ (2008)	Abandon♠ (2006-2008)
Productive lands Subsistence Extensive systems	-	-	-	4%	76%	8%
Productive lands Commoditization Intensification	40%	50%	30%	27%	61%	11%
Degrading lands Commercial agriculture Intensive monocropping	13%	31%	54%	13%	32%	55%
Degraded lands Diversification Intensive mixed systems	41%	65%	30%	-	-	-
Total	**24%**	**53%**	**36%**	**12%**	**53%**	**21%**

* Percent of farming households
♣ Percent of total farmland among CA farmers
♠ Average abandon rate between year n and year n+1 of CA practice