Improving Smallholder Livelihood, Watershed and Soil Management through Conservation Agriculture in Laos

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Over the past fifteen years, farming systems have changed drastically in Laos, with swidden systems giving way to more modern agricultural technologies in many areas. In southern Xayabury traditional systems have collapsed, with a transition from subsistence agriculture to intensive cultivation of cash crops, led by the demands of the Thai market. Notable changes in agricultural practices have included the adoption of heavy mechanisation and use of pesticides. With the support of local traders, maize is now widely sown throughout the region and is spreading to more areas every year. With agricultural intensification, rotational cultivation systems and fallow periods are disappearing, being progressively replaced by a 'resource-mining' agriculture that has serious social and environmental costs, including increased soil erosion (leading to destruction of roads and paddy fields), loss of soil fertility, and chemical pollution of the environment. On high-altitude plains, in the upper part of the Nam Ngum river basin (Xieng Khouang province), large areas of savannah grasslands are under-utilized by smallholders with main farming systems based on lowland paddy fields, livestock production with extensive grazing on savannah grasslands, and off-farm activities. Regarding these situations, the Lao National Agro-Ecology Programme (PRONAE) is implementing an iterative research-development approach based on conservation agriculture. The aim is to find innovative systems that will reverse the present resource-mining practices used in southern Xayabury, and to develop alternatives systems for higher plains and remote areas like those in Xieng Khouang province. This holistic approach emphasises the process of adaptation and validation by farmer groups, meaning that priorities are defined by smallholders in light of the constraints of their farming systems and the overall environmental conditions.

Since 2002 in Xayabury and early 2003 in Xieng Khouang, the programme has developed and adapted diversified systems that, as much as possible, integrate annual cropping and livestock production. These innovative alternatives are based on no-till systems, with use of multipurpose species (*Brachiaria* sp., finger millet, pigeon pea, *Crotalaria* sp., and *S. guianensis*), through a participatory approach involving village communities and groups of farmers. The two main systems currently in use in both provinces are presented in this paper.

The first system described is the extension, in southern Xayabury, of no-tillage systems with residue management. Farmer groups from different villages were consulted to gauge the biophysical diversity and farming strategies of the region. In 2006, a survey was carried out in four villages to estimate the current level of dissemination of DMC systems at village level. The agro- and socio-economic results of this work are presented and discussed in this paper. Results show that the level of DMC dissemination differs greatly among the villages surveyed depending on their environmental and socio-economic conditions. Farmers adopt DMC systems primarily because of the socio-economic advantages they bring (e.g. low production costs), and also when intensive cropping systems have become unproductive and/or unprofitable owing to soil depletion. The introduction of mechanisation into DMC systems appears to be a key factor encouraging fast adoption and wide dissemination of these innovations. Lack of both credit systems and access to agricultural inputs present significant limitations to dissemination of the DMC systems. While positive results (increases in net income and labour productivity) have clearly been displayed, and growing interest in widespread adoption has been observed, realising all the biophysical and economic advantages of DMC is a long process. No-tillage systems have to be progressively improved through the use of rational crop rotations, relay crops and cover crops to reduce herbicide and input costs.

The second system under extension and described in this paper is generation of efficient and economically viable livestock production on high plains. This system is a first step towards the regeneration of savannah grassland for annual cropping. Cattle were fattened on improved pastureland (*Brachiaria ruziziensis*) and all agronomic and economic data recorded to analyze the viability of this system. In 2005, weight gain and seed production obtained during this experiment produced a gross income of $879 over 1.5 ha, enough to covers the cost of all fencing, fertiliser, seed, and animal management in the first year. Barbed wire fencing and fertiliser formed the main expenses. In the medium term, the cost of fencing could be reduced by growing living fences (hedges) using species such as *Acacia mangium*, *A. auriculiformis*, *Calliandra calothyrsus*, and *Jatropha* sp. Development of specific market channels for seeds could indirectly improve pasture management, avoid high stocking rates and generate new

income that could be invested in fertiliser and animal care. If converted into rice the income generated in 2006 by this cattle fattening represents 1.8 tonnes of rice, a very high yield on the high plains.

The PRONAE approach emphasises the progressive development of teamwork with all stakeholders: smallholders, agronomists, DAFEO staff, development projects, policy-makers and the private sector. One of the main challenge of this approach is to transfer systems and technologies to extension agencies and the private sector through a medium-term research and development programme. Independent management of research and development programmes still seems some way off at PAFO and DAFEO, since authorities and extension workers are still to understand the benefits and advantages of these activities.