Cash Crops in the Uplands: the Cardamom Experience[1]

Olivier Ducourtieux, Phoui Visonnavong and Julien Rossard

Abstract

Farmers are often blamed for destroying tropical forests, especially in the Lao PDR. Converting shifting cultivation into cash crop-based agriculture is recurrently presented as the solution merging forest protection and poverty alleviation. However, many attempts in the recent past have ended in failure.

The Rural Development Project of Phongsaly District (PDDP) has tried to introduce cardamom cultivation for export to China. With nearly 300ha of transplanted cardamom, the crop now involves more than 75% of farmers in the region. Lessons can be drawn from this experience, especially regarding prerequisites. The first is to prioritise economic issues over agronomic matters, in particular identify markets, traders or commercial risks. The second lesson is to appraise how the new crop will fit into the farming systems, which are rationally managed by the different classes of farmer, in accordance with their means of production and socio-economic environment.

Introduction: are cash crops an alternative to shifting cultivation?

Around the world and especially in the Lao PDR, farmers are often blamed for destroying tropical forests. Many authors point to the widespread practice of slash-and-burn agriculture as threatening the future of the Lao forest in upland zones (UNDP 1995; Watershed 2000; NAFRI and CIRAD 2003; Vorakhoun 2003). Shifting cultivation on slopes plays a major role in the Lao economy. In a country where 80% of the surface area is hilly or mountainous, those crops grown under shifting cultivation provide jobs to over 250,000 families (MAF 1999), i.e. 35% of the country's population, who are among the poorest in the country and essentially belong to ethnic minorities from the isolated mountains in the north, east and southeast of the country.

Introducing cash crops and promoting income-generating activities are the two means generally suggested by rural development programmes[2] for achieving the independent and potentially contradictory aims of poverty alleviation and forest environmental protection, by restraining agriculture in mountain regions to permanent, limited areas. This policy relies on the rarely explicit presupposition that it is possible for farmers to sell commercial products, whether animal or vegetal, and that the cash income obtained allows them to buy rice instead of growing it using slash-and-burn practices.

Rarely debated, the alternative to swidden cultivation, i.e. cash crops, is systematically promoted by development projects with encouragement by the Lao Government

[1] This paper is derived from a forthcoming article submitted to "Agroforestry Systems" journal. To learn more, go to: http://www.kluweronline.com/issn/0167-4366

[2] With irrigation, also.

Figure 1: Map of Phongsaly Province

(MAF 1999; MAF 2002; Lao PDR 2003) and International Organisations (ADB 1999; UNDP 2002; ADB 2003). Nevertheless, there have been many failures among recent attempts, (Ducourtieux 2000) and success has rarely been sustainable. Has the solution proven its effectiveness? This paper does not claim to provide a final response, but seeks to nurture debate by examining a local experience.

On the scale of a small agricultural region, this study deals with how a rural development project, the PDDP[3], has taken into account the local conditions in Phongsaly to introduce a new cash crop, medicinal cardamom, for export to the traditional Chinese pharmacopoeia market. The PDDP project team focused on farming techniques for this plant, poorly known outside of China. This issue is often the agronomist's first, or only, concern, yet dealing with it is far from enough if an operation is to be a success. The PDDP devoted most of its efforts to economic aspects: work productivity and risk limitation; and commercial aspects: market accessibility, limitation of commercial risks by identifying reliable operators, etc. The example of cardamom in Phongsaly will allow for a clearer definition of the conditions that need to be met for successfully introducing a cash crop.

[3] Rural Development Project of Phongsaly District.

Table 1: Ethnolinguistic Families in Phongsaly District (rural villages)

Ethnolinguistic Family		Ethnolinguistic Family	
Phu Noy	58%	Laoseng	10%
Ikko	13%	Lu	3%
Ho	13%	Hmong	3%

Sources: Phongsaly District & PDDP surveys

Agriculture in Phongsaly District

Economy based on shifting cultivation

Phongsaly District, a unique and extremely landlocked region, belongs to the province of the same name, the northernmost in the Lao PDR, wedged between China to the west and Vietnam to the east.

The district is essentially covered with rain forest and especially uneven terrain. Furthermore, the forest is very productive and is characterised by an uncommonly wealthy biodiversity (Chaz□e 1990; De Koninck 1997). Human activities, and in particular shifting cultivation, have historically transformed the climax vegetation. The existing formations are very diverse, ranging from primary forests to fire-maintained *Imperata cylindrica* savannah (Alexandre and Eberhardt 1998; Laffort and Jouanneau 1998; Baudran 2000).

Figure 2: Map of Phongsaly District

The population mainly belongs to the Sino-Tibetan ethnolinguistic family, with Lao Loum being absent from the rural environment: 20,000 inhabitants live in 82 rural villages[4], of which 80% do not have access to a road or track suitable for vehicles. It takes at least three days or more to reach some villages by foot.

The population essentially makes a living from swidden cultivation, which, combined with hunting, fishing and gathering, accounts for over 80% of household income (Ducourtieux 2004). Agricultural alternatives remain limited due to the absence of flat land that can be developed in the V-shaped valleys, difficult access to markets for cash products and the high incidence of health problems in animal raising.

In a village, agricultural production is based on the use of three distinct areas:

- **Family gardens**: in the village and alongside it.
- **The agroforest crown**: around and slightly above the village.
- **The slash-and-burn zone**: that makes up the essential part of the village land, with farmed fields and forest regrowth - fallow land (Laffort 1997; Alexandre and Eberhardt 1998; Baudran 2000).

Every year, nearly 3,500ha of forest is planted in Phongsaly district, corresponding to about 2,000ha that is cleared. After two years of cultivation, plots are left for forest regrowth. The build-up of solar energy, via photosynthesis, enables the reconstitution of secondary vegetal formations (thickets, forests, etc.) during a long fallow period, lasting from 6 to 18 years. These substantial periods enable the reconstitution and accumulation of biomass, which is a source of fertility for the next slash-and-burn crop cycle (Roder 2001). The limited availability of manpower in this lightly populated region (eight inhabitants/km□) is the bottleneck for Phongsaly's economy and agriculture. In Phongsaly's slash-and-burn production system, a family devotes 100% of its workforce to farming and hunting-fishing-gathering (Ducourtieux 2004). This workforce cannot clear more than 0.8ha land per active worker per year (Laffort and Jouanneau 1998; Keonuchan 2000) and any new activity involves dropping an already existing one.

With their means of production - manpower, limited capital and hand tools - and under Phongsaly's socio-economic conditions, farmers seek to maximise their work productivity[5] and limit the technical, climatic and commercial risks to ensure a minimal income for their family.

Collection activities (hunting, fishing and gathering) are an essential component of family economy in the region and provide 41% of the total income[6] for families in the village of Samlang, i.e. higher than crop (35% of the total income) or animal (18%) production. Gathering in the forest, mainly involves collecting bamboo shoots, "tipti" creepers (Urticaceae, probably *Boehmeria malabarica*) and wild cardamom.

Collecting (hunting, fishing and gathering) is therefore not a marginal or residual activity, although it is generally underestimated when surveys are conducted. Gathering is traditionally presented as being the survival strategy of the poorest, who otherwise

[4] The nine villages forming the town of Phongsaly, with 5,900 inhabitants, should be added to that total.

[5] Farmer rationality leads to maximising the income per active worker (Kip/workday), and not the yield (kg/ha or Kip/ha).

[6] Hunting provides 22% of a family's total annual income (snares and traps), gathering 11% and fishing 8% (nets and hoop nets).

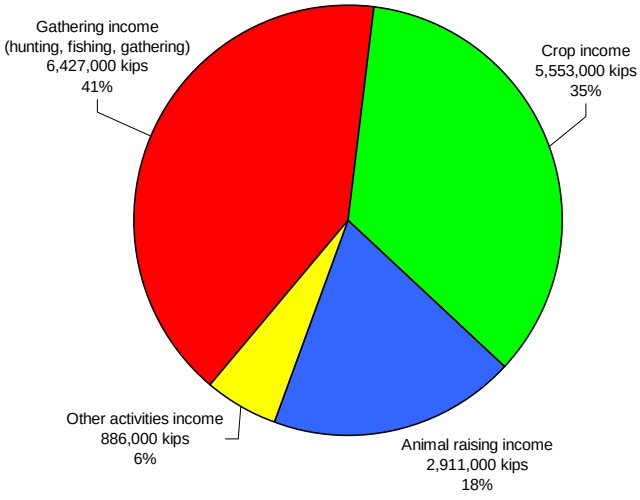

Figure 3: Breakdown of the Total Income of Families from Ban Samlang[7]

would not be able to feed themselves (UNDP 2002). This theory has proven to be unfounded in Phongsaly. The income earned from gathering is directly proportional to the total family income, which implies that the most well-off families are also the ones who profit most from gathering, hunting and fishing[8].

Rural development project of Phongsaly District

The Rural Development Project of Phongsaly District (PDDP) brings together the Governments of the Lao PDR and France to cooperate in an operation falling within the framework of poverty alleviation and environmental protection. The project's first aim is harmonious economic development for all the district's inhabitants. This economic development aim is a prerequisite to the second aim: limiting shifting cultivation in the long run.

To reach these two aims, the PDDP has targeted the development of cash products, making it possible to:

- Increase cash incomes (*Aim 1*).
- Purchase rice in order to progressively replace its production (*Aim 2*, *reduction of area used for slash-and-burn per family*).

Due to a lack of alternatives, such as development of valley bottom land, stabilising slash-and-burn at its current level requires the development of cash products to increase farmer income. The project is based on the hypothesis that higher food demand,

[7] A family's average total annual income: 15.6 million kip (US$ 1500, including the value of self-consumption), including 2.1 million kip (US$ 200) of cash income (Note: exchange rate 10,460 kip for US$ 1 in November 2003).

[8] Since the limiting factor of family economy in Phongsaly is the workforce, the family income increases depending on the manpower available, which makes it possible to devote more time to gathering activities.

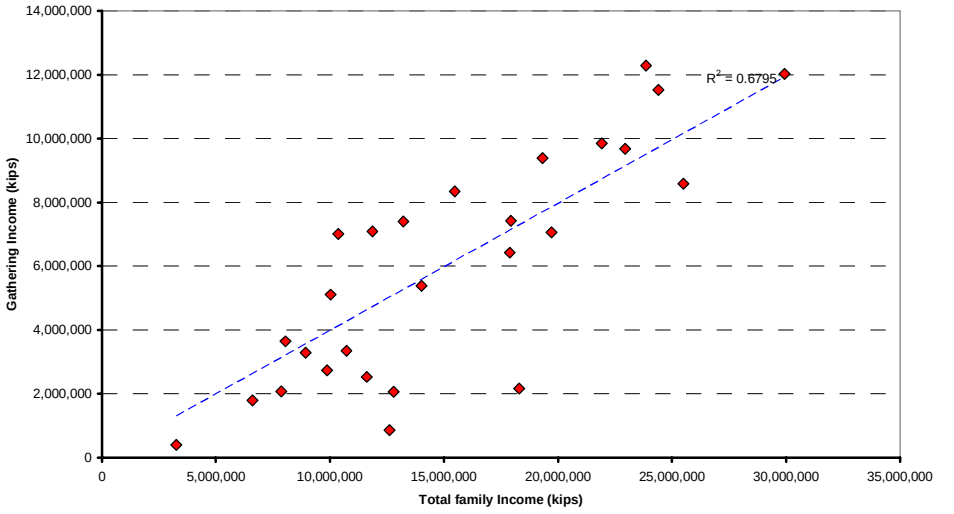

Figure 4: Gathering Income and Total Income (Ban Samlang)

due to demographic growth, should be met by purchasing rice. Those purchases are financed by the sale of farm products, whether vegetal or animal.

The project began its second phase in 2002, with a budget of 5.2 million EUR[9], including 73% in the form of a grant from the French Development Agency (AFD) and 22% in village participation. The second phase will be completed in 2006, after activities in the following fields have been achieved:

- Animal raising.
- Cash crops and marketing.
- Micro-finance.
- Opening-up access to villages.
- Village water supply.
- Primary education.

In 1994, the PDDP began by conducting an in-depth study of the agrarian systems in Phongsaly District (Alexandre and Eberhardt 1998; Laffort and Jouanneau 1998; Baudran 2000). The aim of this was to understand the coherence of local agriculture developed by farmers and to determine which proposals of action would be most relevant for submission to the farmers.

Cardamom emerged in those studies as an important component of family economies. At the time, it was the leading vegetal product officially exported by Phongsaly Province. The development of this gathered product was nevertheless hindered by two factors, which tended to limit the price offered to farmers:

- Social conditions of gathering (free access) tended to start the harvest too early, to the detriment of ripeness and hence product quality (Aubertin 2003).

[9] US$ 5.7 million; with the first phase (1996-2002), the operation's total budget reaches US$ 12 million.

Figure 5: Cardamom plantation

Figure 6: Cardamom blooming on the root plateau

- Wild cardamom does not have the same content in essential oils as the cardamom grown in China, preferred by industry, which limits it to only being a supplementary product, the prices of which depend on how much is produced in China.

The crop can be integrated into secondary forest formations that are dominant in Phongsaly, without any ecological damage. Planted under forest cover, it enables the conservation and development of a wooded stratum, a guarantee for the subsistence of forest environmental conditions (ecological diversity, soil structure and fertility, humidity, micro-climate, etc.).

Based on the project's aims of increasing farmer income while preserving the forest environment as well as on the feasibility study conclusions, the PDDP focused on introducing cardamom farming in Phongsaly District.

Introduction to cardamom cultivation

Medicinal cardamom: product, market and farming

Medicinal cardamom (*Amomum villosum var. xanthoides*) is a non-ligneous perennial plant, of the Zingiberaceae family[10]. It is used in traditional Chinese pharmacopoeia as an ingredient in the preparation of medicine for stomach aches. As such, it reaches a potential market of over 1.3 billion consumers, in addition to the Chinese dispersion in

Figure 7: Cultivated Cardamom Fruit, drying

[10] Medicinal cardamom should not be confused with aromatic cardamom (Elettaria cardamomum), used as a condiment in India and the Middle East, as well as in cosmetics.

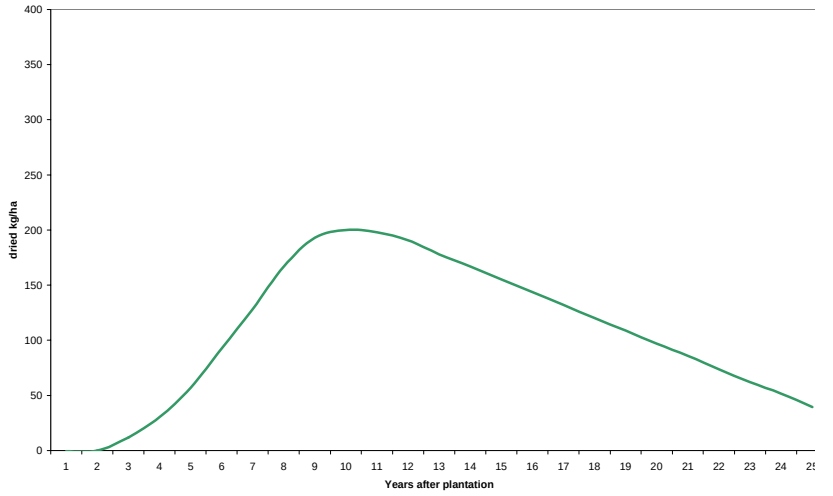

Figure 8: Model of Yield Evolution in a Cardamom Plantation

Asia (20 million, De Koninck, Roche *et al.* 2000) and the rest of the world. The demand by the traditional Chinese pharmaceutical industry accounts for 2,000t a year whereas production stagnates at half of that, with the remainder being met by gathered products of lower commercial quality (Saint-Pierre 1998).

Cardamom grows wild in Southeast Asian tropical forests at moderate altitude. It is fond of humid and shady[11] environments. The most favourable conditions include a mean yearly temperature ranging from 19-22□C, with over 12□C in the coldest months, and annual rainfall of between 1,200 and 2,400mm (Zhou, Yao *et al.* 1999).

Cardamom produces new plants very fast from stolons (or runners) once it reaches one to two metres in height. The root system is not deep[12], extending out in aerated, humus-rich and slightly acid soil[13]. Sensitive to drought, the April-May blossoming deteriorates if soil humidity is less than 22%. Flowers develop on the stolons, near the root plateau. Pollination is by insects (*Apiscerana indica and dorsati, Nomia strigate*; Zhou 1993).

The fruit ripens in August, the period in which it is picked, dried and marketed.

Generally gathered in the forest in Laos[14], medicinal cardamom has been grown for a long time in China in the Canton region. It was introduced in the 1960s to the Prefecture of Xhishuangbanna (Yunnan Province), where it has become a major product[15] enhancing the economic development of the Phongsaly border region (Zaifu 1998; Zhaohua *et al.* 1998). The cardamom farming technique aims at imitating the spontaneous growth of wild cardamom: Plantations are located in natural shade after areas have been slightly cleared, seedlings are then transplanted once the topsoil has been prepared and weed-

[11] From 10 to 60% of light transmitted, with an optimum of 30% to 40%.

[12] 80% of the roots are developed in the first ten centimetres of the soil; the root system is not over 20 cm deep.

[13] Content in organic matter > 3 %, pH from 5.5 to 7.0 (tolerance from 5.0 to 7.5).

[14] With the notable exception of the Bolovens Plateau, where it has been cultivated for decades (Ducourtieux 1994; Pelliard 1998; Babin 1999; Grimeaud and Meaux 1999).

[15] 8,000 ha, 80% of the Chinese production of cardamom in 1998.

ing is done for the first two years after which the plantation is thinned out annually[16] (Zhou 1993).

The first fruit appears three years after planting, whereas the first economically significant harvests begin in the 5th year and continue increasing until the 10th year. The plot wears out slowly over a ten-year period. Reasoned management entails replanting around the 15th year so that the crop can be regenerated.

Work is limited on a plot. The initial weeding, then clearing and harvest require less than 50 workdays per hectare, to which two to five days of drying in the sun should be added[17], depending on climatic conditions.

A one-hectare plot produces from 20 to 750kg of dried fruit depending on its age, conditions (shade, humidity, fertility) and the year: production varies substantially, depending greatly on the date when the rain starts in April-May, as this conditions the quality of blossoming and pollination. In September 2003, dried cultivated cardamom was marketed in Phongsaly at 20,000 Kip/kg (US$ 1.90/kg, producer's price) this compares with 5,000 Kip/kg (US$ 0.5 /kg) for wild cardamom.

The PDDP: preference for a commercial approach over an agronomic one

The feasibility study mentioned the possibility of the PDDP being involved in the introduction of a cardamom crop. Before raising the issue with farmers, the project team strove to check the validity of this theory.

The first unknown factor dealt with the conditions of market access. In January 1998, a joint project/local agricultural service mission went to Xhishuangbanna to meet with commercial operators and discuss market prospects for sugar cane, tea and cardamom. Only cardamom appeared to offer sustainable economic guarantees for the Phongsaly farmers, with a stable demand, a local offer restrained by limited Chinese resources in tropical forests and hence a lucrative price level for the farmwork, despite the costs of access (transportation) to an export market (Saint-Pierre 1998).

During this mission, the team also sought to identify private farm produce trading companies interested in operating with cardamom in Phongsaly.

As the market survey phase proved conclusive, the PDDP then went on to the second preparatory stage of introducing the cardamom crop. The issue was to check whether it was technically possible to cultivate cardamom with Phongsaly's soil and climatic conditions. The project commissioned a team of XTBG[18] researchers to carry out a research mission of the environment and soil, which concluded that it is possible to grow medicinal cardamom in the hills of Phongsaly District, as long as planting was avoided in bam-

[16] The optimal density is around 20 plants/m□, based on planting one plant/m□. The transplanted stems can be transplanted on a new plot, enabling the extension of the plantation at a lower cost.

[17] The use of a dryer increases work productivity while improving the quality of the product due to rapid, complete and controlled drying.

[18] Xhishuangbanna Tropical Botanical Garden in Menglun, research centre of the Chinese Academy of Sciences network. It is most likely the only institution having ever undertaken research on medicinal cardamom (Zhou 1993).

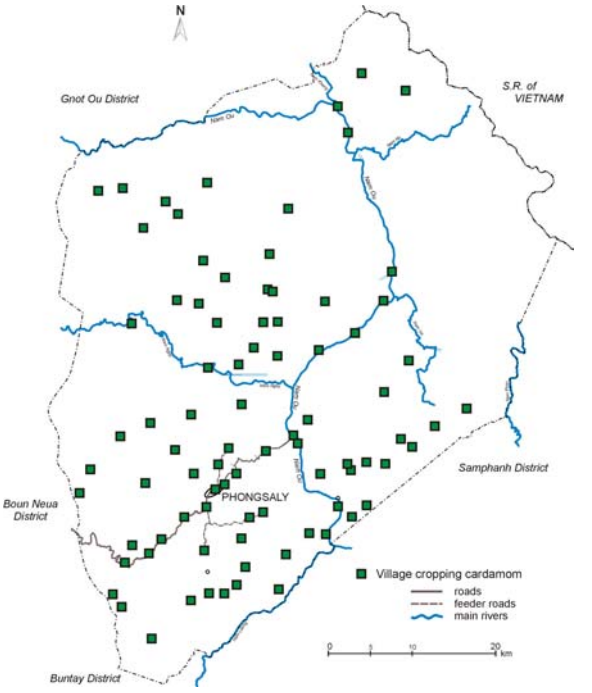

Figure 9: Map of Villages having begun Cardamom Cultivation with PDDP Support

boo thickets[19], on fallow land of less than five years old[20] or at over 1,000m in altitude (Zhou, Yao *et al.* 1999).

In order to limit risks for the farmers, the project team did not immediately start promoting the crop on a large scale. An experiment was first launched by 25 volunteer farming families, in five diversified villages in Phongsaly district. The aim was to use a limited sample to test the aptitude of the plant to resume growth after a lengthy transportation period and transplanting under Phongsaly conditions. With 6,400 stalks supplied by the project in July 1998, the families were growing 7,000 plants in late 1998 and 9,600 in March 1999. This provided proof of the possibility of introducing medicinal cardamom plants from China for a farm crop in Phongsaly.

After the conclusive phases of market study, commercial canvassing, agronomic research and farmer experimentation, the PDDP was able to promote cardamom growing on a large scale.

Together with the district authorities and the PDDP provincial steering committee, the project team studied several modalities of plant supply:

a) Project grant.

b) Cash purchase by farmers, with a very high cost per hectare (US$ 400) that was beyond their investment capacity.

[19] Due to the competition between the superficial root networks and the level of soil acidity in bamboo forests.

[20] Young fallow land is generally covered with fast-growing ligneous heliophyte species (Macarana denticulata Bl. Trema orientalis (Linn.) Bl., Mallotus paniculatus Muell-Arg.), which generally die after a five-year period (thus deteriorating the cardamom plantation) and are then replaced by long-life species (Antidesma acidum Retz., Astonica scholaris (Linn.) Kurz, Albizia chinensis (Linn.) Merr.).

c) Sale of plants on credit, at cost price, along the model of the Agricultural Promotion Bank operations for cash crops promoted by the local administrative services (sugar cane and tea).

d) Cash sale of plants, at a price sufficiently subsidised to make the planting of a plot accessible.

e) Credit in seedlings, with reimbursement in kind, after several years.

Options (b) and (c), and to a lesser degree option (d), are extremely unjust: the programme promoter, the PDDP, was definitely not taking a risk with the new crop. Option (e) was eventually chosen, since it offered the possibility of extending the plantations into new zones after a few years by distributing the reimbursed seedlings. Each farming family had the opportunity of borrowing a maximum of 1,000 seedlings, *i.e.* sufficient for a plantation covering one-tenth of a hectare.

Due to the proximity and similarity of the zones and farmer rationalities, the cropping system of the Xhishuangbanna farmers was selected as a model for popularisation.

In 1999, the PDDP signed a contract with a Chinese company for the supply of 1,150,000 cardamom seedlings, purchased from Chinese villagers, to be delivered in July to 1,050 families in 27 villages in the south-western part of Phongsaly District. The contract was original: the project paid only 80% of the total cost at seedling delivery; the remaining 20% was paid three years later, after the Chinese company had bought the first production[21].

Monitoring of the newly planted plots showed high mortality of cardamom seedlings. In January 2000, only 27% of the plants delivered in July 1999 were still alive. This was not an incurable problem as the plants multiply rapidly by stolons (1-5 offshoots/year), but it delayed the beginning of production by one or two years. There are several reasons that may explain why the renewed growth was clearly lower than that experienced with the trial plots the previous year:

- The transplanting/replanting interval was too long. Some plants arrived too dry and then died before producing shoots.
- Delivery loads were scheduled too closely together, with plants suffering from transportation conditions (in particular crushing caused by overcrowded loads) as well as the time required for distributing 250,000 seedlings at each session.
- Overall, the seedlings were too old and leafless, which prevented their renewed growth and made offshoots the only possibility for regrowth.
- Planting took place too late (mid-to-end July), which only left two months of rainfall for the regrowth of the seedlings and also complicated distribution logistics, with rivers at their highest level and tracks that were unusable by trucks, making distribution lead-times even longer.

[21] The farmers remained free to sell their cardamom to the traders of their choice, based on offers; the Chinese company was contracted to make sure that all the production had been marketed and if need be, buy the unsold stock.

Based on these observations, the project modified delivery logistics for the year 2000. Distribution was brought forward to June and carried out over several sessions[22], each one involving less villages, fewer, younger and leafier plants and trucks with smaller loads. 970 families in 35 villages received a total of one million plants.

Under these conditions, plant regrowth went more smoothly than in 1999 and by mid-2001, 63% of the plants delivered to the plots were still surviving.

The PDDP resumed the procedure in June 2001 for delivery to the last district villages whereby 830 families from 30 villages received 880,000 seedlings.

By late 2001, 4,900 families in 87 villages had begun growing medicinal cardamom. 72% of farm families in Phongsaly District willingly responded in favour of the project's proposal and planted 220ha in a contractual approach. The project invested over US$150,000 for the purchase of the plants.

Although gathering cardamom is an ancient custom in the region, growing it is a new practice, not spontaneously mastered by the farmers. The PDDP accompanied the distribution of the plants with extension operations: in-field training by the project team and study trips to China. Each village selected a volunteer to become the community's technical cardamom consultant; these representatives then participated in study trips to Xhishuangbanna aimed at:

- Training farmers on growing cardamom based on the experience of Chinese farmers.
- Enabling Phongsaly farmers to meet Chinese cardamom traders to discuss quality conditions and become more aware of their demand and organisation.
- Showing the Phongsaly farmers to what extent cardamom was essential in the economic start-up of Xhishuangbanna and how it still plays a role now.

In three sessions, from January to December 2000, all the district villages participated in this activity, together with project agents and local administrative civil servants (Phongsaly Province and District).

Current results: success to be consolidated

In August 2001, the first cardamom fruit was harvested from trial plots planted in 1998. These plots gave an average yield of 64kg/ha (dried), an encouraging result but varying substantially from one family and one village to the next (0 to 380kg/ha).

By the end of 2003, with the transplanting, the area of farmed cardamom reached 270ha in Phongsaly District. Production, still in the growing phase (refer to figure 8) reached 1,100kg (dried) in 2002 and 3,000kg in 2003, with a value of 20 million Kip (US$ 1,900) and 60 million Kip (US$ 5,700) respectively. Four to five years from now, annual income could reach 600 million Kip (US$ 57,000) from the same area of land.

[22] 13 deliveries of 77, 000 plants each in 2000 instead of five deliveries of 230,000 plants in 1999.

Despite these encouraging results, the operation has encountered some problems, which, although not crippling, require the project team's attention in order to maximise farmers' profits:

- Prices have drastically dropped since 2000[23]. This drop is probably related to the disappearance of the State pharmaceutical companies who supervised the market in Xhishuangbanna (Saint-Pierre 2003) and the increase of regional production (China, Laos, Myanmar). Although, due to the progressive reorganisation of the industry, prices rose again in 2003 they have nevertheless still continued to fluctuate, depending on production levels in the Chinese provinces[24]
- Marketing conditions have not established a balance of power that is favourable to farmers in their commercial negotiations, which partially explains why price levels in Phongsaly are clearly lower than those in Xhishuangbanna. Cardamom is marketed in late August-early September, at a time when rice stocks in the villages are at their lowest, or even totally finished. Farmers are in a hurry to sell their produce to buy the rice they are lacking. At this time, in the middle of the rainy season, drying the fruit on mats and in the sun is problematic. The product is marketed damp; and the loss of quality and risks of deterioration have repercussions on the price paid to farmers.
- Compared with wild cardamom, cultivated cardamom still only makes up a small portion of Phongsaly exports. This does not allow for any recognition of the qualitative specificity of the product to emerge, which is often sold in mixed batches at the price of gathered cardamom.

The project is currently working with villagers on two topics aimed at eliminating part of these constraints:

- Introduction of driers to help:
  - improve product quality;
  - reinforce farmers' negotiation power by facilitating temporary storage;
  - reduce the work involved in the drying period.
- Commercial promotion of Phongsaly cultivated cardamom to make the market aware of its qualitative specificity.

The PDDP's action for introducing a cash crop such as cultivated cardamom is not limited to the supply of seedlings and the extension of crop techniques. It is based on commercial work upstream and is broadened by technical and economic supervision downstream.

[23] From 5 to 7 US$/kg dried in China in 1995-1998, the price bottomed out in 2002 at less than 2 US$/kg.

[24] In addition to the production from the historically concerned provinces (Guangdong, Xhishuangbanna), there are new competitors — Guangxi and Guizhu provinces — with limited potential but which will play a role in forming prices (Saint-Pierre 2003).

Lessons learned from the experience: conditions to be met in order to successfully introduce a cash crop

In the Lao PDR's upland regions, farmers clear away forest, creating a link between the two successive phases of slash-and-burn cultivation (Chaz□e 1998):

- A short crop period of one to three years using the fertility built up in the forest biomass.
- A fallow period, varying in length of one to twenty years, during which fertility builds up through regeneration of the forest.

These production systems are often effective for the economy of farming families in terms of security and productivity (Dufumier 1996; Ducourtieux 2004). Implemented for centuries, they have had a limited impact on the forest environment in Laos. They are nonetheless not sustainable, as demographic growth generally leads to accelerating crop rotations (Dufumier 1999). If the fallow period is less than three to four years, soil fertility is not renewed and erosion increases dramatically (Ramakrishnan 1992; Moa, Valentin *et al.* 2002; Van Keer 2003).

To prevent the crisis of shifting cultivation systems and limit their ecological impact, it is essential to plan ahead and promote new production systems based, in particular, on cash crops, to help:

- Improve the farmers' standard of living by increasing their cash income.
- Progressively substitute rice production by rice purchase in upland regions, in order to reduce the area annually cleared by each family.

Nevertheless, a cash crop is not automatically a viable alternative to slash-and-burn agriculture. In some cases, erroneous choices can lead to an increase in poverty and forest degradation. Introducing sugar cane in the Phongsaly highlands degraded the soil through mineral exploitation of the fertility[25], while reducing farmers' income (Ducourtieux 2000). Those errors made by development projects and programmes, supported by the farmers, occurred due to a lack of study and comprehension of the local agricultural conditions. Although those in charge generally think about the agronomic adaptation to the natural environment, the socio-economic context (lasting access to the market, price conditions, farmers' priorities, etc.*)* is too often neglected. Such oversights lead to unsuitable proposals, logically refused by the farmers, which both waste limited public resources, and are sources of tension between villagers and administrative services.

Introducing a new cash crop is not a foregone conclusion; it can only succeed if farmers accept it and make it their own. Based on the cardamom experience in Phongsaly, three conditions required for success can be identified:

1. ***Cash crops proposed must be more productive*** than shifting cultivation with regards to the limiting factor of agriculture in the zone: labour (workforce). In order for farmers to accept the activity conversion, the new speculation must bring in more per workday to the farmers than the current family production, i.e. a minimum level of 14,000 Kip (US$ 1.3) per workday (Ducourtieux 2004).

[25] For a yield of 20-50 t/ha, a field of sugar cane removes over 200 kg/ha/yr of mineral elements from the soil, compared to 15-20 kg/ha/yr for a slash-and-burn field (CIRAD, GRET et al. 2002). At the end of the crop cycle, the slash-and-burn field has lost 40kg of mineral elements; the secondary forest is rapidly regenerated during the fallow period. For the sugar cane field, the mineral losses reach 600kg/ha and Imperata cylindrica is dominant on the fallow land to the detriment of the ligneous essences.

2. ***Cash crops proposed must offer more security than*** shifting cultivation. Farmers cannot accept a drop in their food production (rice) for a risky production, with inconsistent results according to good years and bad years. The risks to be minimised deal with the markets and economic fluctuations (price variation, evolution or disappearance of demand, etc.), as well as natural conditions (climate, soil, pests and disease, etc.).

3. ***Cash crops proposed must be easily transportable.*** In upland regions like Phongsaly, villages practising swidden cultivation are especially remote. Reaching roads open to vehicles and, from there, to markets requires hours or days of walking on steep paths. Cash crops must be sturdy and non-perishable in order to withstand such transportation conditions. The value per mass and volume unit (price/kg and price/m^3) must be sufficiently high to enable economically profitable transportation[26].

If only one of these conditions is not met, the failure of the cash crop proposed is predictable.

Conclusion

Introducing cash crops is not a miraculous solution, automatically crowned with success, for stabilising shifting cultivation. Their promotion requires prior in-depth thought about the socio-economic conditions and suitable research in an on-farm environment. A single crop cannot be a sustainable solution, in particular in terms of economic risks for the farmers. A crop must be planned in association with breeding activities and other crops, within the existing production systems. If well-designed and implemented, the promotion of cash crops can contribute to increasing farmers' income while preserving the forest.

Trends and mirages are common in the development sector and often only lead to costly and dangerous failures for the farmers, the first victims of erring ways. Those in charge of development, projects and administrations alike, are much more effective when they take into account the socio-economic agricultural environment and its local historical evolution. By listening and better understanding farmers, those in charge are capable of developing new technical and economical practices with the farmers that make it possible to reach the national policy goals in the fight against poverty and environmental protection.

Authors

Olivier Ducourtieux is a Doctoral candidate at the Paris-Grignon National Institute of Agronomics (INA P-G). E-mail address is: olivier.ducourtieux@laposte.net.

Phoui Visonnavong is National Program Director, PDDP (Rural Development Project of Phongsaly District). E-mail: cclpddp@laotel.com

Julien Rossard is an agronomist working for the PDDP. E-mail: jrosaard@laotel.com

[26] This article deals with cash crops, but these requirements also apply to breeding systems. Mobile cash products, like cattle, should be favoured in these regions.

Bibliography

ADB. 1999. *Report and recommendation of the President to the Board of Directors on a proposed loan to the Lao People's Democratic Republic for the shifting cultivation stabilization pilot project*. Manila: Asian Development Bank. 72 p.

ADB. 2003. *Draft Country Strategy and Program Update - Lao People's Democratic Republic*. Manilla: Asian Development Bank. 98 p.

Alexandre, J. and Eberhardt N. 1998. *Des systèmes agraires de la rive gauche de la Nam Ou*. Paris: CCL. 331 p.

Aubertin, C. 2003. *Cardamom (Amomum spp.) in the Lao People's Democratic Republic: the hazardous future of an agroforest system product* in *Forest products, livelihoods and conservation: Case studies of NTFP systems*. Volume 2 – Asia. Djakarta: CIFOR Publications: 22-38.

Babin, P. 1999. *Etude du système agraire des terres hautes du Plateau des Bolovens*. Paris: INA P-G. Mémoire de Mastère. 106 p.

Baudran, E. 2000. *Derrière la savane, la forêt*. Paris: CCL. 192 p.

Chazée, L. 1990. *Les mammifères du Laos et leur chasse*. Vientiane: UNDP. 69 p.

Chazée, L. 1998. *Evolution des systèmes de production ruraux en République Démocratique Populaire du Laos 1975-1995*. Paris: L'Harmattan. 430 p.

CIRAD, GRET *et al.* 2002. *Mémento de l'agronome*. Paris: Ministère des Affaires Etrangères - GRET - CIRAD. 691 p.

De Koninck, R. 1997. *Le recul de la forêt au Vietnam*. Ottawa: IDRC. 99 p.

De Koninck, R. *et al.* 2000. *Pégase: Pédagogie Asie du Sud-Est*. Université Laval (Québec) - Université du Québec (Montréal). [online 10/2003] URL: http://www.casa.umontreal.ca/pegase.

Ducourtieux, O. 1994. *L'agriculture du Plateau des Bolovens*. Rome: FAO. 187 p.

Ducourtieux, O. 2000. *Substitute cash crops for slash-and-burn agriculture: dream or reality?* in EC Workshop on Sustainable Rural Development in the Southeast Asia Mountainous Region: drawing lessons from experience. Hanoi: European Union. 5 p.

Ducourtieux, O. 2004. *Shifting cultivation and Poverty: a complex issue.* Paper presented at the workshop "Poverty Reduction and Shifting Cultivation Stabilization in the Uplands of Lao PDR: Technologies, approaches and methods for improving upland Livelihoods". Luang Prabang, Lao PDR: NAFRI-LAUFRP. January 27 – 30, 2004.

Dufumier, M. 1996. "Minorités ethniques et agriculture d'abattis-brûlis au Laos." *Cahier des sciences humaines*. 32(1): 195-208.

Dufumier, M. 1999. "La déforestation au Laos." *Globe mémoires* (2): 45-47.

Grimeaud, J. and Meaux M. 1999. *Diversité des situations agraires de la zone basse du plateau des Bolovens - sud Laos*. Montpellier: CNEARC/ESAT. Mémoire d'Ingénieur. 151 p.

Keonuchan, K. 2000. *The adoption of new agricultural practices in northern Laos: a political ecology of shifting cultivation*. Sydney: University of Sydney. PhD thesis. 225 p.

Laffort, J. 1997. "L'agriculture montagnarde phuno du nord du Laos: vers la fin de l'autosubsistance." *Agriculture & Développement* (16): 3-17.

Laffort, J. and Jouanneau R. 1998. *Deux systèmes agraires de la province de Phongsaly*. Paris: CCL. 262 p.

LAO PDR. 2003. *National Poverty Eradication Programme (NPEP)*. Vientiane: Lao PDR. 161 p.

MAF – Ministry of Agriculture & Forestry. 1999. *The Government's strategic vision for the agricultural sector: A discussion paper prepared for the Donor Round Table Conference*. Vientiane: Ministry of Agriculture & Forestry. 74 p.

MAF – Ministry of Agriculture & Forestry. 2002. *Agricultural Marketing in Lao PDR*. Vientiane: Ministry of Agriculture & Forestry, Department of Agriculture. 59 p.

Moa, B., Valentin, C. *et al.* 2002. "Flow Discharge and Sediment Yield from a Cultivated Catchment in the Northern Lao PDR." *The Lao Journal of Agriculture and Forestry* (5): 11-23.

NAFRI and CIRAD. 2003. *Développement rural en République Démocratique Populaire Lao - Positionnement du Programme National Agroécologie*. Vientiane: NAFRI – CIRAD. 12 p.

Pelliard, D. 1998. *La diversité du plateau des Bolovens. Etude de deux agrosystèmes villageois entre Paksong et Laongam (Sud-Laos)*. Montpellier: ENESAD/CNEARC/ESAT. Mémoire d'Ingénieur. 135 p.

Ramakrishnan, P. S. 1992. *Shifting Agriculture and Sustainable Development*. Paris: Unesco. Man and the Biosphere Series. 424 p.

Roder, W., Ed. 2001. *Slash-and-Burn Rice Systems in the Hills of Northern Lao PDR: Description, Challenges, and Opportunities*. Manila: IRRI. 201 p.

Saint-Pierre, C. 1998. *Les produits végétaux paysans de Phongsaly et le marché chinois*. Montpellier: CCL – PDDP. 29 p.

Saint-Pierre, C. 2003. *Développer les produits végétaux paysans du district de Phongsaly et améliorer leur mise en marché*. Montpellier: Tercia - CCL – PDDP. 44 p.

UNDP. 1995. *Country Strategy Note (draft)*. Vientiane: UNDP. 38 p.

UNDP. 2002. *National Human Development Report Lao PDR 2001: Advancing Rural Development*. Vientiane: UNDP. 189 p.

Van Keer, K. 2003. *On-farm agronomic diagnosis of transitional upland rice swidden cropping systems in northern Thailand*. Leuven: Faculteit Landbouwkundige en Toegepaste Biologische Wetenschappen - Katholieke Universiteit Leuven. PhD thesis. 220 p.

Vorakhoun, P. 2003. "Planted trees hit export market for the first time". *Vientiane Times 30/5-2/6/2003*. Vientiane: 1-2.

Watershed. 2000. "Aspects of forestry management in the Lao PDR.". *Wathershed* 5(3): 57-64.

Zaifu, X. 1998. *From shifting cultivation to agroforestry in the mountain areas of Yunnan tropics*. Ottawa: IDRC. 7 p.

Zhaohua, Z. *et al.* 1998. *Overall study on agroforestry systems in China*. Ottawa: IDRC. 15 p.

Zhou, S. 1993. "Cultivation of Amomum villosum in tropical forests." *Forest Ecology and Management* (60): 157-162.

Zhou, S. *et al.* 1999. *A study on land suitability and site selection for Chinese cardamom cultivation in Phongsaly district, Phongsaly province of Laos*. Menglun: Xhishuangbanna Tropical Botanical Garden (XTBG), Chinese Academy of Sciences. 26 p.