ASSISTING DEVELOPMENT IN THE SMALLHOLDER RUBBER SECTOR CIRAD EXPERIENCE

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Introduction

In some countries, such as Indonesia, the smallholder rubber sector is developing spontaneously; development projects have been involved in less than 20% of rubber smallholdings. The production potential of most of the plantations created is therefore limited, mainly because seeds are used for lack of budded plants. In 2002, the average yields in Indonesian smallholder plantations were around 600 kg/ha (IRRI 2005). Yet, the "clonal revolution" has been decisive in the success of rubber smallholdings in Malaysia, Thailand, and many other producing countries. Developing an efficient smallholder rubber sector takes real political determination. The examples of countries such as Thailand or India clearly illustrate that. Operations providing support to growers have been varied.

This paper is based on CIRAD experience and sets out the decisive elements for ensuring sustainable development in an efficient smallholder rubber sector, and then proposes a research programme to assist in the development of smallholder rubber plantations.

1 What are the key elements for sustainable development in an efficient smallholder sector?

Four elements are decisive for sustainable development of smallholder rubber plantations.

1.1 Use of quality budded planting material

In rubber growing, the use of plants budded with a recommended clone is a basic requirement for the future productivity of smallholder plantations. Budded planting material needs to be easily accessible to growers. In particular, it must be:

- available when smallholders decide to set up a plantation,
- produced near smallholders to facilitate transport between the production site and the plantation, and reduce transport costs,
- at an affordable price for smallholders.

To satisfy those conditions, the planting material needs to be produced by:

- smallholders themselves, after training; the advantage is to limit financial investment for growers by using family labour,
- private nurserymen in villages; these are people, be they farmers or not, who are specialized in the production of planting material intended for sale,
- nurseries managed by development projects, but such projects usually have a limited lifespan; it is therefore reasonable to question the availability of planting material after the end of the project,
- nurseries managed by agro industries, provided they are sited near smallholder plantations. Moreover, experience has shown that planting material is produced first and foremost for estates; smallholdings appear to be secondary.

In all cases, great care needs to be paid to the quality of the planting material produced. After identifying clones adapted to the agronomic and socio-economic conditions of the smallholdings to be developed, budwood gardens have to be set up. Those budwood gardens can be collective, where plants are produced by the smallholders themselves, or individual (private nurserymen). Their establishment needs to be technically supervised by skilled people present when important operations are being carried out. The very nature of the vegetative propagation processes, and the handling of the planting material they entail, induce a degree of error which one seeks to minimize, but which cannot be totally avoided. Budwood gardens lie at the heart of the process. In order to optimize the result of using budded clones, it is necessary to check in the budwood gardens that the clones are genetically true-to-type. Such checks can be carried out using two efficient techniques, for which CIRAD has defined standardization conditions and established reference databases. Isozyme electrophoresis (Leconte *et al.* 1994) focuses on enzymes that can easily be destroyed at ambient temperature. This technique therefore usually has to be used at the control site itself; it means training technicians and buying the equipment required for local implementation. Microsatellite analysis (Seguin *et al.* 1996), which is shortly due to be brought into service at CIRAD, involves the DNA molecule, which is highly stable, meaning that leaf samples can be sent by normal mail to a central laboratory for analysis. In principle, this technical difference makes microsatellite analysis more competitive than isozyme electrophoresis.

Smallholder plantation support programmes have a major role to play in setting up budwood gardens and in training farmers and nurserymen in budded planting material production techniques, and in quality matters. Farmers producing their own planting material, or private nurserymen, need to be made aware and trained, in order to guarantee the clonal purity of the plants produced (avoid mixes).

1.2 Promoting intercrops with rubber

Maintaining monoculture plantations on smallholdings has been questioned for more than 10 years. This technical model, which was for a long time transferred to smallholdings through various development projects, is usually unsuited to conditions on small farms. Indeed, interrow upkeep in immature plantations is difficult to ensure; retarded growth is often seen, leading to a delay in tree opening. In order to overcome that problem, farmers spontaneously plant intercrops in the interrows of their immature rubber plantations. In Indonesia, many farmers who have benefited from a development programme have reintroduced agroforestry practices in plots that were initially set up as monocultures (Chambon 2001). Planting food crops in the interrows of immature rubber plantings provides farmers with produce for their own consumption or for sale. Numerous studies have shown that rubber tree growth with intercrops is identical to that with cover crops, if not better (Keli *et al*. 1992; Nguema *et al*. 1997).

Generally speaking, it is therefore worth promoting temporary intercropping in immature rubber smallholdings. However, the benefits and the types of plants to be intercropped with rubber trees depend on local conditions specific to each smallholder rubber development zone.

Diversifying production is a worthwhile strategy for limiting risks and guaranteeing the income needed for the family to survive and to reproduce the farm. Production diversification is all the more important as a cash crop is involved whose price and outlets largely depend on markets (national and international). To diversify production and income from farms in the long term, improve the productivity of the land and the returns on the work invested, intercropping rubber trees with other tree crops is undoubtedly an interesting alternative. Such perennial intercropping has been much less studied than intercropping with temporary crops.

1.3 Creating an environment suitable for natural rubber production

- Technical supervision

Throughout the life cycle of their plantations, farmers need technical support to achieve high production levels. They need to be trained in the different rubber growing techniques:

- setting up plantations: choice of clone, planting technique, planting density,
- upkeep: fertilization, upkeep in the planting row, interrow management, phytosanitary control,
- exploitation: tapping frequency, stimulation.

To develop an efficient smallholder rubber sector, it is therefore essential to set up an efficient and durable extension and technical supervision structure. That structure and its activities need to continue functioning after producer support programmes have come to an end.

- Product marketing

Marketing is a key element for development of the smallholder rubber sector. Farmers will only plant rubber trees if it is guaranteed that they will be able to sell what they produce, meaning the existence of a market. Experience in Cameroon (Southwest Province) shows that the excessively long time taken for the only factory buying rubber to pay farmers for their production has a negative impact; plantations are under-exploited and farmers' incomes are reduced.

Natural rubber price levels are also an important factor in the development of smallholder rubber plantations. Farmers are interested in crops that enable them to generate a high income. At the moment, natural rubber prices are good and they ought to remain so. The context is therefore favourable for rubber growing.

- Development of infrastructures

The development of smallholder rubber plantations needs to go hand in hand with the development of infrastructures, to facilitate access to plantations and the collection of production.

1.4 Facilitating investment funding

Setting up and maintaining a plantation until the trees are opened requires financial investment, even though it can be limited by appropriate crop management sequences and the mobilization of manpower. Given the level of investment and the economic conditions on family farms, it is not always possible to set up plantations using savings alone. Consequently, farmers sometimes have to seek outside funding to guarantee the quality of the plantation created. It is therefore important for farmers to have access to credit adapted to their needs, but which remains sufficiently limited to avoid their becoming too indebted, over excessively long periods.

1.5 Supporting the emergence of producer groups

For research, development organizations and donors, the merits of producer groups for family farms are widely accepted.

For rubber smallholders, some agricultural activities such as the production of budded planting material or the post-harvest processing could be implemented within structured organizations. Rubber smallholders often complain about the way prices are fixed by the buyers, and the dry rubber contain applied for its calculation. If farmers were grouped in an organization, they would have more negotiating power. Another problem for rubber growers is the lack of information, particularly technical, but also on FOB price. If producers were organized, it should facilitate the production and circulation of information not only between smallholders, but also between producers and the outside. Lastly, funding agencies are increasingly turning to producer groups and no longer to individuals. Consequently, in the absence of structuring, rubber growers are excluded from certain funding sources.

Development of the smallholder rubber sector therefore presupposes the existence of a programme of support to farmers, at least to initiate and supervise the emergence of smallholder plantations, and create a suitable environment for rubber production. Applied research has an important role to play in improving the efficiency of these development programmes.

2. Which assistance programme?

Targeted research can provide support to smallholder rubber development programmes by studying the diversity of farms in the corresponding zones, so as to more precisely define the

support to be provided, developing appropriate crop management sequences with the farmers, and monitoring what becomes of the innovations introduced into the smallholder sector, so as to revise the technical support provided wherever necessary.

2.1 Establishing the diversity of farms in the targeted zone so as to determine what support to provide

Before implementing a development programme, brief studies are conducted to gain a clearer picture of the farms and of the agroecological and socio-economic environment in which they operate. Such studies should lead to:

- zoning of agricultural situations
- a typology of farms.

The diversity of agricultural situations is studied by highlighting different agroecological situations, then by interviews with groups of farmers who are representative of the different social groups. These collective interviews are designed to analyse the background of the village, spatial use and the socio-economic environment of the farms. The study should lead to zoning of the agricultural situations at the sites selected for the implementation of development projects.

The approach taken to analyse farms is systemic, because all operations carried out on the farm are linked; production factors (land, labour, capital) are shared between the different activities and crops. The farm environment (natural environment, access to agricultural inputs, including improved planting material, access to capital, to technical information, and to markets, competition with other lucrative activities, etc.) greatly influence the decisions taken by farmers in terms of the practices they apply from a plot level right up to overall farm management.

The analysis is positioned on a "family farm" level. Indeed, the development of small and medium-sized farms is closely linked to family developments and; the family is also strongly involved in agricultural activities, often making up most of the work force. Where rubber plantations exist already, the rubber cropping systems[1] are studied in detail.

[1] The cropping system is defined as being "a set of plots farmed in a uniform way and, in particular, subjected to the same crop succession" (Jouve 1984).

When the rubber farm functioning analysis is not linked to an existing development project (study prior to a project, or independent from any project), its purpose is to carry out a diagnosis of farms and identify the assets and constraints for smallholder rubber development (Courbet *et al.* 1997, Tran Van Canh *et al.* 2002).

If it is part of the applied research of an ongoing development project, an analysis of the functioning of a few rubber farms benefiting from the project has a dual objective:

- provide a characterization of the farms, so as to establish a reference that would make it possible to measure the impact of the project on farm functioning and the income generated (Boulakia *et al.* 2001),
- describe the true practices of the farmers in terms of rubber plantation management, and quantify the associated costs so as to more effectively adapt project recommendations where necessary.

In both cases, characterization of the rubber farms makes it possible to establish farm typologies based on a certain number of socio-economic and structural characteristics of the production units: area, labour, socio-professional origin of the head of the farm, makeup of the farming system (Chambon 2004). Such typologies reveal the diversity of farms; they can be used to more precisely define the specific support to be provided to the different groups of farms, in order to develop rubber plantations, or to improve production and income conditions (Feintrenie 2004; Chambon and Michels 2004).

2.2 Testing new techniques or new types of production organization with farmers

In order to improve or optimize production conditions on rubber farms, on-farm trials are set up under new agroecological and socio-economic conditions to test the feasibility and conditions for implementing techniques and/or types of organization that have already been tried and tested in other contexts and in other countries, either on research stations or on farms. Their main purpose is not to develop new techniques or types of production organization. It is more a matter of:

- analysing with farmers their technical, economic and social impact on farm functioning,
- studying what farmers think of these new techniques and/or types of organization,
- determining how acceptable they are and how they are taken on board by farmers.

Over the last five years, CIRAD has thus helped to develop several experiments designed to determine the most appropriate techniques for rubber growers, based on various themes, as shown in table 1.

Table 1: Number of on-farm rubber trials per country and per study theme.

	Indonesia	Vietnam	Cambodia	Ghana
Planting row and interrow upkeep	25	-		
Planting material: clones and seedlings	10	13	27	11
Intercrops in the interrow	56	-	15	14
Planting techniques: bags, stumps	-	-	7	5
Fertilizers: types, quantities, frequencies	1	5	23	33
Root disease control	-	-		2
Tapping frequency and stimulation	-	3		10
Total	92	21	72	75

Some results are already available (Penot *et al.* 2003, Yin Song *et al.* 2003) and could be used by other countries involved in research to improve smallholder practices in rubber plantations.

2.3 Monitoring adoption and what becomes of techniques

At the same time as the on-farm trials are set up, a network of reference farms is created. CIRAD has helped to set up reference farm networks in various countries (Indonesia, Ghana, Cameroon).

A network of reference farms is made up of voluntary farmers who are representative of the farming situations or farms we are interested in. It is characterized by the development of symmetrical and close relations between the farmers and technicians/researchers around processes such as diagnosis, creating innovations and advice. It constitutes a lasting framework of collaboration with producers; it provides them with the opportunity to play a major role in research-development programmes and/or in deliberations on the support to be provided to agriculture.

Depending on the contexts in which they are developed, and on the objectives sought, the networks of reference farms may have various functions: produce knowledge on how farms function, identify smallholder innovations, or validate proposals put forward by research, support in drawing up smallholder projects, etc.

The aims and specific expected results are as follows:

- test and validate techniques and/or types of organization existing elsewhere, in order to make technical recommendations (technical/economic references) adapted to different types of rubber farms,
- study how farmers adopt and take on board new techniques and types of organization, along with their impact on farms; this should make it possible to determine the degree of adoption/appropriation by the different types of farms, and identify how they can be disseminated,
- monitor how the functioning of rubber farms changes, to enable a dynamic characterization of farms, which would be useful for defining possible farmer support policies.

Conclusion

This paper provides a glimpse of the key elements for developing a smallholder rubber sector, and puts forward a proposal for a research programme in support of development operations.

The elements described are based on experience acquired by CIRAD during its operations in several countries, in both Africa and Asia. Improvements/clarifications could no doubt be made with knowledge of the specific conditions in Laos.

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