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After plywood, rubber is Indonesia's second most important non-petroleum export commodity. About 12.5 million people in the country are involved in the production, processing and marketing of rubber. Rubber is also the main source of income for smallholder farmers on the low-lying and infertile plains on the islands of Sumatra and Kalimantan. Smallholders produce 73% of Indonesia's total output of rubber, and approximately 1.3 million farm households rely on rubber production for their income. More than two-thirds of these households still grow 'jungle rubber' (*Hevea brasiliensis*) in an extensive agroforestry system that covers more than 2.5 million hectares. But farmers' average yield of rubber in this system is low—593 kg per hectare compared with 1065 on private rubber estates and 1311 kg in government estates (DGE 1993). The low production is caused by lack of improved planting material. Farmers still use jungle rubber—unselected rubber seedlings and germplasm they get from the natural forest. The majority do not have access to improved or high-yielding planting material, technical information or credit, all of which have been included in technical development packages of the past two decades (Gouyon 1989).


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Smallholder rubber 'cup-lumps' from West Kalimantan in Indonesia—the raw material tends to be contaminated and of poor quality.

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Tyre industries, which use 70% of the total natural rubber produced, have rigorous standards that buyers apply when purchasing rubber from producers. Raw rubber must be clean, correctly coagulated and conserved, sufficiently dry and have a good consistency before it is processed into rubber that will be able to compete on the international market. More productive rubber systems will help the smallholders meet these standards, and benefit from a quality pricing policy (Gouyon and others 1989).

In general, low labour costs in Indonesia enable the country to compete well with Malaysia and Thailand, two other rubber-producing countries where improved planting material has been made available to farmers but where wage levels are higher. However, the low productivity of the jungle rubber and the quality of the rubber produced in these systems are major issues for farmers who manage jungle rubber agroforestry systems in Indonesia (Gouyon and others 1993).

Jungle rubber agroforestry

The jungle rubber system is a low-input agroforestry system in which rubber competes with the regrowth of the natural forest. In the past, people who grew perennials on land could lay claim to it, so rubber agroforestry systems were a means of acquiring land. Furthermore, the system is inexpensive and requires little labour to establish and maintain (Gouyon 1993).

After an area is cleared by slashing and burning, rice is planted for the first year or two. After that, rubber is planted along with a variety of other useful trees that produce fruit, nuts, timber and rattan. The secondary forest associated with rubber is biologically diverse, and the forest-like environment makes for good soil fertility and quality and watershed management (de Foresta 1992a). On the whole, the rubber agroforestry systems are sustainable alternatives to the original slash-and-burn process. The sources of income—rubber, fruit, nuts and other tree products—are diverse and the system can easily be replaced by a new plantation when it surpasses maturity. It can also be converted into a pure-standing rubber plantation or it can be managed as a fruit and timber agroforest, such as the *tengbawang* system in western Kalimantan.

The main challenge for researchers is to test various kinds of improved planting material to see which grow and produce best in the agroforestry systems, and which are most appropriate and affordable for smallholders (Barlow 1993).

Improved planting material comes in two forms. There are the clones that have been selected by cross-breeding or chosen from one superior tree and multiplied by grafting. These homogeneous and high-yielding clones are costly,

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An immature rubber plot: the agroforestry system begins with 3 years of upland rice, after which famers intercrop rubber and other trees.

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A mature jungle rubber agroforestry system in West Kalimantan, Indonesia.

about USD 0.30 per plant in 1994.They also require more labour for maintenance. However, clônes double or even triple latex production over the unimproved rubber trees.

There are also the improved seedlings—clonal or polyclonal. Clonal seedlings are obtained from seeds collected under clonal rubber trees; polyclonal seedlings are those collected in a specific clonal garden with a variety of selected clones. These are relatively cheap, ranging from USD 0.01 to 0.04 per seed, but their production potential must be tested in the agroforestry environment.

Supplying certified clonal planting material to smallholders is a major undertaking. The goals are to raise rubber production from 500 kg per hectare in smallholder agroforestry systems 2- or 3-fold, as well as to increase yields of associated perennial crops in the systems, such as wood, fruit and rattan. Testing of improved planting material also includes assessment of rubber production with and without fertilizer. Our research aims to use improved planting material to improve productivity of the rubber agroforestry systems, which can be established in pioneer and buffer zones, as well as in zones where replanting is required.

We are using a participatory approach to do on-farm experimentation with three kinds of rubber agroforestry system (RAS). Each is being tested for its suitability to local conditions, for labour and cost requirements and to determine the best level of intensification. The first (RAS 1) is similar to the current jungle rubber system in which unselected rubber seedlings are replaced by adapted clones. These clones must be able to compete with the natural secondary forest growth; various planting densities and weeding protocols will be tested. This will identify the minimum amount of management needed for the system, a key factor for farmers.

The second, RAS 2, is a complex agroforestry system (de Foresta 1992b) in which rubber and perennial timber and fruit trees are established after slashing and burning, at a density of 550 rubber and 250 other perennial trees per hectare. It is very intensive, with annual crops being intercropped during the first 3–4 years, with emphasis on improved upland varieties of rice with various levels of fertilization.

The third system we are testing is also a complex agroforestry system with rubber and other trees planted at the same density; the difference is that it is established on degraded lands covered by *Imperata cylindrica*, or alang-alang grass. As the grass precludes the growth of annual crops, cover crops (mucuna, flemingia, orok, setaria and chromolaena) or multipurpose trees (leucaena, calliandra, secang, gmelina) are established. The objective here is to eliminate the weeding protocol by providing a favourable environment for rubber and the associated trees to grow, supplanting and then preventing imperata growth.

A network of farmer-managed trials is under way in Jambi Province, Sumatra, and in West Kalimantan Province, Borneo. By the end of this year, about 30 hectares of trials involving 60 farmers will have begun and eventually this will be expanded.

These experiments take into account the limited resources of smallholders; labour is one of the main factors being considered in assessing a system's suitability. In addition, the range of trees that can be grown in association with rubber in agroforestry associations and the market potential of their products are being examined—*tekam, meranti* and *sunghai* trees for timber; durian, *rambutan, duku, langsat, cempedak, petai* and *jengkol* for fruit.

Most rubber development projects to increase rubber production for smallholders have been based on a monoculture technological package for rubber, comparable with that used by the large estates. These projects are relatively expensive to implement, involving credit, clonal material and labour-intensive management of the rubber plots. These projects have reached only about 13% of the smallholder rubber producers in the country. That leaves the majority of farmers still farming jungle rubber.

Agroforestry systems such as RAS may eventually be able to produce twice as much rubber as they do now, without losing any of the other advantages of these diverse agroforestry systems that generate income for so many of Indonesia's smallholders. The secret lies in finding the right balance between the farmers' needs and in taking the 'jungle' out of the rubber, without destroying the very nature of this agroforestry system (Penot 1994).

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References

Barlow C. 1993. Towards a planting material policy for Indonesia rubber smallholdings: lessons from past projects. Unpublished paper.

de Foresta H. 1992a. Botany contribution to the understanding of smallholder rubber plantations in Indonesia: an example from South Sumatra. Symposium Sumatra Lingkungan dan Pembangunan. Bogor, Indonesia: BIOTROP.

de Foresta H. 1992b. Complex agroforestry systems and conservation of biological diversity: for a larger use of traditional agroforestry trees as timber in Indonesia, a link between environmental conservation and economic development. Proceedings of an international conference on the conservation of tropical biodiversity. *Malayan Nature Journal.*

DGE. 1993. *Statistik karet.* Jakarta, Indonesia: Ministry of Agriculture.

Gouyon A. 1989. Increasing the productivity of rubber smallholders in Indonesia: a study of agro-economic constraints and proposals. Rubber Growers Conference. RIM, Malacca.

Gouyon A. 1993. Les Plaines de Sumatra-sud: de la forêt aux hévéas. *Revue Tiersmonde* 36(135).

Gouyon A, de Foresta H and Levang P. 1993. Does 'jungle rubber' deserve its name? an analysis of rubber agroforestry systems in southeast Sumatra. *Agroforestry Systems* 22(3):181–206.

Gouyon A, Nancy C, Anwar C and Negri M. 1989. Perspectives d'amélioration de la filière et comportement des agents. Séminaire 'economie des filières en région chaude'. Montpellier, France: MESRU/CIRAD.

Penot E. 1994. The non-project rubber smallholder sector in Indonesia: rubber agroforestry systems (RAS) as a challenge for the improvement of rubber productivity, rubber-based systems sustainability, biodiversity and environment. ICRAF Working Paper, Nairobi: ICRAF.