Smallholder Rubber Agroforestry Options for Improving Livelihood and Conservation

World Agroforestry Centre
TRANSFORMING LIVES AND LANDSCAPES

Correspondence:
Laxman Joshi (L.Joshi@cgiar.org)

Laxman Joshi, Gede Wibawa and Suseno Budidarsono

Lembaga Riset Perkebunan Indonesia
INDONESIAN RESEARCH INSTITUTE FOR ESTATE CROP

Introduction

Indonesia has the largest area (3.5 million ha) of cultivated rubber (*Hevea brasiliensis*) in the world and produced 2.7 million tonnes of natural rubber in 2007. Smallholder rubber farmers (with < 5 ha plots) constitute 84% of rubber area and provide about 68% of total natural rubber production in the country. A large majority of these farmers still practice traditional agroforestry systems using unselected rubber seedlings. Most new technologies have been developed for estate plantations and less appropriate for smallholder farmers. Rubber Agroforestry System (RAS) (Penot, 1997) has been developed in which improved rubber clones are adopted for traditional practices. The tradition of growing rice in the first year or two is maintained; weeding is limited to a narrow strip along rubber rows; space between rubber rows is not weeded while naturally regenerating valuable timber, fruit and other trees are protected.

Approach

Three types of RAS were designed and field tested in West Kalimantan, Jambi and West Sumatra Provinces of Indonesia for over a decade - 200 research-training-demonstration plots established and monitored. Other technical support and trainings were provided to farmers and government officials.

RAS1: similar to traditional "jungle rubber" system: rubber seedlings are replaced by high yielding clones, reduced weeding.

RAS2: is a complex agroforestry system in which rubber and perennial timber and fruit trees are mixed.

RAS3: to rehabilitate Imperata grassland, mixed with other fast growing trees.

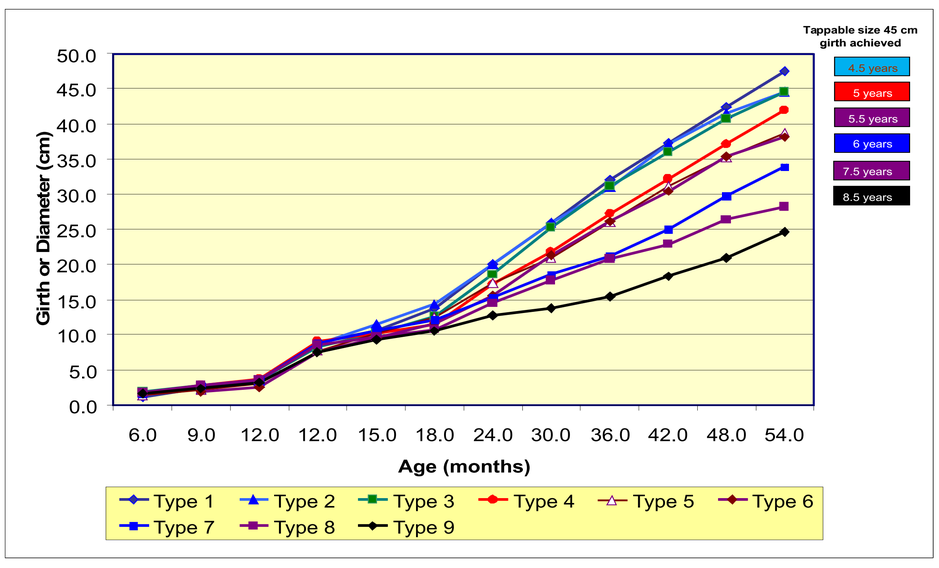

Figure 1. Rubber tree growth - 9 distinct types observed in the field; result was influenced more by farmer management intensity than by technology.

Plant biodiversity and RAS plots

There is much concern about the rapidly disappearing biodiversity in Sumatra and Kalimantan mainly due to on-going rapid deforestation. It is normally agreed that agroforestry practices have a low impact on the forest landscape. In a study conducted in West Kalimantan, plant diversity inside RAS1 plots was found to be relatively high and the succession of the vegetation was close to that of natural secondary forest the species when they are not deliberately removed (Ihalainen, 2007). The surrounding vegetation has a significant effect on current biodiversity. However, the pre-existing vegetation does not have a significant effect on the biodiversity of the rubber inter-row vegetation. Similarly, 15 plant species of medicinal value that farmers use were encountered inside RAS plots (Sitepu, 2006).

Natural vegetation re-growth in the inter-rows between rubber rows under RAS1 system.

RAS3 plot in production stage.

Table 1. Ten most common woody species inside RAS1 plots.

Family	Species	Type	Found in % of plots (n=125)
Melastomataceae	*Melastoma malabathricum*	Shrub	96
Lamiaceae	*Vitex pinnata*	Tree	73
Compositae	*Chromolaena odorata*	Shrub	70
Euphorbiaceae	*Macaranga trichocarpa*	Tree	37
Moraceae	*Ficus grossularoides*	Tree	19
Ulmaceae	*Trema tomentosa*	Tree	14
Euphorbiaceae	*Breynia racemosa*	Tree	14
Moraceae	*Artocarpus sericicarpus*	Tree	12
Melastomataceae	*Eurya nitida*	Tree	11
Sterculiaceae	*Commersonia bartramia*	Tree	6

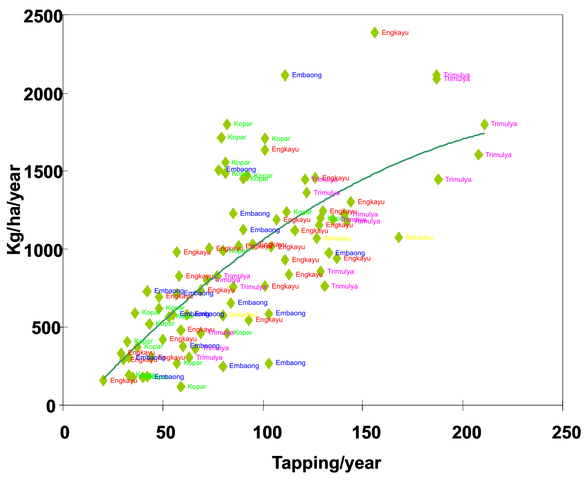

Figure 2. Rubber production in RAS plots in West Kalimantan. Production of over 2000 kg with less than 180 days of tapping is possible under smallholder farmer management.

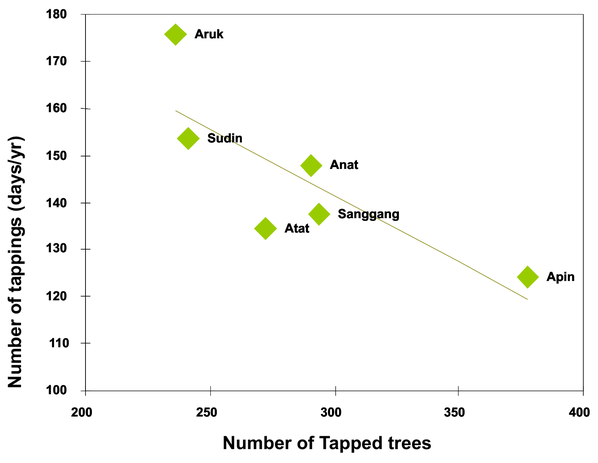

Figure 3. It appears farmers increase tapping frequency to compensate for low number of tapped trees/ha

Table 2. Production data from on-farm field trial (3rd year of tapping) from different clones and seedlings.

Description	PB 260	RRIC 100	BPM 1	RRIM 600	Seedling
Yield gm/tree/tapping	32	29	28	27	15
Yield kg/tree/year	4.2	3.9	3.8	3.6	1.5
Nb. tappings/year	135	134	134	136	120
Nb. trees/ha	422	371	371	375	339
Yield kg/ha/year	1794	1508	1430	1442	518

Basis for RAS technology

- Annual intercrops: rice in 1st year
- Intensity of rubber row weeding: medium, Low
- Application of fertilizers: basic Fertilizers, some additional fertilizers
- Natural vegetation in rubber rows: slashed (height kept below that of rubber) and well maintained
- In RAS3 - planting of valuable tree species

Profitabiility analysis of RAS technology

Economic analysis of 9 types of RAS (evolved) indicated a wide range of values for common profitability indicators (Net Present Value, Internal Rate of Return and Returns to Labour. RAS technologies are much more profitable than traditional system, and comparable to intensive smallholder monoculture rubber, mainly due to reduced labour for weeding and other input without significantly affecting latex production.

Table 3. Profitability indicators for RAS types.
Key assumption include agricultural labor wage of IDR 30,000 per person day; an interest rate of 20% and price of rubber at farm gate is IDR 12,000/kg (100% Dry Rubber Content). Exchange rate of IDR 10,000 per US$.

System	NPV	IRR	Returns to labor
	Rp (000)/ha	%	Rp/ps-d
RAS Type 1	21,967	36.2%	55,000
RAS Type 2	25,820	42.1%	65,500
RAS Type 3	25,486	41.7%	63,800
RAS Type 4	19,209	35.3%	59,200
RAS Type 5	23,715	38.9%	66,900
RAS Type 6	12,203	30.0%	45,500
RAS Type 7	10,238	28.4%	47,700
RAS Type 8	7,568	26.7%	44,400
RAS Type 9	1,412	21.4%	33,000
Traditional Jungle Rubber	(852)	13.4%	25,700
Smallholder monoculture rubber	8,746	25.2%	38,800

Conclusions

- Improved RAS options were adapted by participant farmers to suit their needs and resources (weed management, tapping, fertilizer application, intercrops).
- In general, farmers did not follow protocols, however, this was useful for ex-post analysis of various options.
- Farmer management intensity determined productivity; "technology" including RAS types were less significant
- Rubber trees reached tappable size (45 cm girth at breast height) 4.5 - 8.5 years after planting.
- Good growth of clonal rubber trees is possible in smallholder agroforestry management.
- Latex yield in the early stages indicated RAS alternatives are feasible and comparable to monoculture.
- Ex-ante profitability analysis indicates RAS options are more profitable than traditional systems and intensive monoculture rubber systems.
- Valuable plant biodiversity regenerate and can be maintained in RAS plots without significant impact on rubber growth.
- RAS can provide both economic and environmental benefits.

References

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