Predicting economic benefits from farming practices using the OLYMPE approach:

A case from rubber agroforestry system in West Kalimantan, Indonesia

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Background

Natural rubber is a major export commodity and a big source of foreign currency for Indonesia. Over 1.3 million households get their income from smallholder rubber 'gardens' (<5 ha) and produce 73% of the national production (DGE, 1996). Most smallholder farmers practice the traditional low-input-low-output system. More intensive systems with higher latex productivity are being promoted in rubber producing provinces in the country. The Rubber Agroforestry System (RAS) technologies, require less capital and labor and are appropriate for smallholder farmers with limited resources (Joshi et al.).

For smallholders to assess the range of rubber-based systems, a careful analysis of input and potential output from these systems is essential. Furthermore, it is also necessary to understand the potential impact of price and policy changes on their economic performance.

A range of rubber-based systems currently practised in Sanggau District, West Kalimantan were included in the current analysis. The farming system modeling software "Olympe" developed jointly by INRA/CIRAD/IAMM, was used to construct farm budget, analyze and model farming systems performance. The tool enables a comprehensive overview of farmer situation and links to technical innovations and practices.

DIFFERENT RAS TECHNOLOGIES

RAS 1: Natural vegetation re-growth outside
weed-free strip

RAS 2: Fruit trees planted between rubber rows;
annual crops in inter-rows

RAS 3: Shrubs, cover crops or fast growing trees grown in between rubber rows to shade out Imperata cylindrica

Methodology

Input-output data collected from

- On-farm demonstration plots of different RAS types
- Farmer interviews
- Secondary sources and literature

Data Analysis

- Development of farm characteristics based on survey data, 2005 (60 RAS farmers)
- Construction and analysis of farm budgeting using Olympe software

Type of Data:

- Origin of different sources of income
- Cost of production of all farming systems (farm inputs - fertilizer, agro-chemicals and labour)
- Outputs and yields
- Prices
- Other externalities

OLYMPE Farming Systems Modelling

Olympe enables the modeling of farming systems in order to characterize them, to identify typologies as well as allows prospective analysis according to price and yield evolution. It also permits the analysis at the level of farmer groups. The software helps build scenarios according to price, climatic events or various types of risks. Impact assessment at the regional level on various groups of farms is possible.

One of the main outputs of such approach is to assess impact of technical alternatives or choices at the farming systems level – both economical and environmental. Olympe uses data from farming systems surveys and provides key information in terms of diagnosis as well as prospective analysis.

Output examples from Olympe:

- annual and perennial cropping systems and technology;
- comparison between different cultivation system, cost, productivity and resource need;
- farmer typology based on local condition to see global overview in order to develop recommendations for each farmer group.

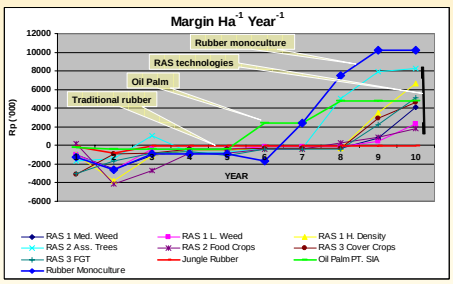
Findings

Attributes of RAS farmers (project participants)

- Average land holding: 5.74 ha/household
- Rubber area covers about 55% of total farm area
- Average household size was 4.7 individuals
- Family labour used on the farm: 2.7 individuals (709 person-days/year).

Farming Systems	Area (ha)		
	Max	Min	Average
Irrigated Field	2.00	0.00	0.32
Upland Field	2.50	0.00	0.52
Rubber Area Non-RAS	16.50	0.00	2.34
RAS Area	1.50	0.27	0.52
Oil Palm	6.00	0.00	1.04
Tembawang/ Mixed Fruit Garden	3.00	0.00	0.16
Total farm area (ha)	20.50	1.31	4.90

In the first ten years, RAS technologies shows much higher margin compared to traditional systems but lower than that of monoculture systems. RAS technologies require lower capital and inputs.



Profitability of Rubber Agroforestry Systems

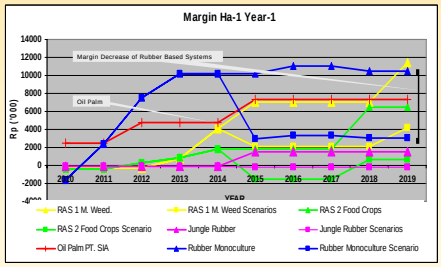
Coupling the Olympe with Net Present Value (NPV) measurement to see 'discount factor' consequence of long investment.

FARMING SYSTEMS	NPV (Rp'000/ha)	YPC (years)	EST. COST (Rp'000/ha)	Return to Labor (Rp /Ps-days)
Jungle Rubber	(1,073)	-	13,629	17,907
RAS 1 Low Mgmt.	10,087	13	10,874	40,838
RAS 1 Medium Mgmt.	11,197	14	14,318	47,629
RAS 1 High Density	13,496	12	12,657	47,629
RAS 2 Food Crops	4,116	18	21,834	25,113
RAS 2 Ass.Trees	18,316	10	15,373	42,749
RAS 3 Cover Crops	2,864	13	19,427	23,189
RAS 3 FGT	7,127	14	18,513	27,683
Rubber Monoculture	18,567	10	19,035	35,683
Monoculture SRDP	8,045	14	20,192	29,477

Note: 1 US$=9000 IDR

An example of scenario analysis – volatility of price of commodities

Assuming rubber price goes below 50% in years 2015 to 2019, while the oil palm prices is constant →



Labor Requirement of Rubber Agroforestry Systems

Farming systems	Life (yrs)	Years to Positive cash flow	Labour (person-days)		
			Establish. (ha^{-1})	Operation ($ha^{-1}year^{-1}$)	Total (ha^{-1})
Jungle Rubber	40	-	2,986	-	73
RAS 1 Low M.	28	13	582	76	62
RAS 1 Medium M.	28	14	828	91	76
RAS 1 High Density	28	10	552	62	55
RAS 2 Food Crops	28	18	1,525	84	84
RAS 2 Ass. Trees	28	10	729	85	81
RAS 3 Cover Crops	28	13	1,649	175	135
RAS 3 FGT	28	14	1,377	154	127
Rubber Monoculture	30	10	1,085	165	147
Monoculture SRDP	30	14	1,263	124	109

Conclusions

- While RAS technology requires more capital input than traditional system, returns to labour and return to land are significantly higher
- While monoculture rubber offers better rubber productivity, it requires high capital and input that is beyond reach for most smallholders, especially during the immature period.
- RAS approach allows income diversification with food crops, timber and other NTFPs.
- Olympe software is extremely informative and useful for analysis using real farm data; but is rather data-hungry.
- Olympe output is easily customisable and can cater for most economic analysis.
- Although we used the tools in rubber agroforestry context, the software is easily adaptable to other farming practices.

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