



Global Platform for Sustainable Natural Rubber



Rubber agroforestry systems (RAS) for a sustainable agriculture.

A GPSNR workshop with smallholders in Cambodia: main features and conclusions

Held in CRRRI Kompong Cham in October 2022



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1 Introduction: a Rubber Agroforestry Systems (RAS) training session in Cambodia

1.1 Objectives

The global objectives of this session with Cambodian rubber smallholders are the following:

- To share technical information on current existing RAS in the world to illustrate examples of what is feasible in the specific climatic and soils conditions of Cambodia
- To provide information to farmers and profit as well of their own experience and RAS if any in particular intercropping
- To Identify constraints and opportunities to develop RAS in various socio-economic environment and impact of local markets in designing potential RAS
- To Identify RAS cropping patterns suitable to local farmers
- To identify conditions for further potential actions (demo-plots, On-Farm Trials)
- To share farmers perceptions on RAS and conditions to develop opportunities

For GPSNR, the objectives are the following;

- To collect global, country, and region-specific best-evidence and best-practice materials on agroforestry for natural rubber systems
- Where feasible, collated material to be disseminated to GPSNR smallholder members and their communities even where workshops are not planned for in 2022
- To conduct pilot workshops for GPSNR smallholder members and their communities to introduce agroforestry concepts and practices, and provide guidance and answers for the following questions:
 - a. What is possible to grow in your region or specific location, and how can this be achieved?
 - b. What is the market availability and demand of particular products in your region?
 - c. How can agroforestry investments benefit smallholders economically, environmentally, and socially?

The 2 original target countries are Indonesia and Cambodia. In Indonesia: agroforestry possibilities and practices would vary widely across the country's major rubber-producing regions; there is strong interest from smallholders as well; critical to blend or merge more traditional concepts such as jungle rubber with evidenced-based and structured forms of agroforestry.

In Cambodia, there is no historical RAS developed by local farmers except some intercropping during immature period. In most rubber areas, there is few other perennial crop opportunities (pepper, banana; cashew nut...). Meanwhile, there is also severe climatic constraints with 3-5 dry month season leading to a potential severe water

competition between rubber and associated trees. In other words , all RAS patterns should take into account that constraints, also linked with the current climatic change.

The program of the workshop is detailed in annex 1. A consent form has been distributed to all participants (annex 2)

After 2 presentations for agroforestry practices in immature period and then mature period, 2 sessions of discussions occurred to discuss possibilities in the context of Indonesia.

One can find the 2 powerpoint slides for translation in the Google Drive: https://drive.google.com/drive/folders/1eZW2_DWauzDOC1kPXoNpv2V5e2rdUCmw?usp=sharing

This pilot Agroforestry Workshop has been held at CRRI Research Station in Tbong Khmum, in October 2022

2 The pilot Agroforestry Workshop

2.1 Composition of Participants

Geography: We had a total of 18 smallholder participants: 8 from Pech Chreada (Mondolkiri Province), 4 from Keo Seima (Mondolkiri Province), 3 from Kampong Cham Province, and 3 from Tbong Khmum Province. In addition to the 18 smallholders, we had 3 extension officers, one from each Province.

Minorities: 5 smallholders were indigenous.

Gender: 4 smallholders were female.

Cooperatives: 9 smallholders were members of (rubber) cooperatives.

Local partners: From WWF-Cambodia, we had 2 female staff members from the main office and 2 male staff members from the Mondolkiri office who worked closely with the smallholders and stayed with them throughout the workshop. From CRRI, we had in attendance 5 male staff members (Head of Breeding, Head of Physiology and Exploitation, the Head, Deputy Head and a staff member (interpreter role) of Crop Planting and Protection. Thirdly, we also had two faculty members from Royal University of Agriculture (RUA).

Observers: Eric Gohet (CIRAD, currently based at CRRI office), Tsubasa and Chiaki (WWF-Japan Forest Team, who were in Cambodia the same week for another event in Mondolkiri).

Interpretation: Our Cambodian partners took turns to interpret at various times. Particularly helpful were the faculty members of RUA who were the most familiar with

rubber agroforestry concepts and terms; thus were able to engage participants and conduct simultaneous interpretation. WWF staff were excellent at facilitating group discussion and energizing the participants. During smallholder discussions, WWF staff helped to translate from Khmer to English for the non-Khmer speaking observers/organizers. One key lesson from this workshop was the key role an interpreter plays, not only to smoothly and accurately translate to a level suitable for the audience but also to facilitate engagement/interaction among participants. Thus, we are very thankful to N. Sophea (RUA), Kimchhin (RUA), Sokleng (WWF) Lily (WWF), and Bunnarith (CRRRI) for taking on this role at various times.

Participant engagement

Compared to the Indonesia workshop, the Cambodian smallholders were more quiet and reserved, but had clear interest in the subject matter. Most farmers have no experience in permanent RAS but some have limited experience with intercropping during immature period. Many took notes during talks. One or two older smallholders were more confident in expressing their opinions without prompting.

The WWF team suggested that it was because this was the first time the smallholders have heard about agroforestry and can discuss freely about it; hence it takes some time for them to understand the concepts with a good understanding of RAS in order to ask questions. The extension officers and WWF Team also helped to prompt discussion by smallholders, and made jokes to help smallholders feel comfortable. The global discussion was open and very efficient.

2.2 Farmers discussions during the workshop

2.2.1 Day 1: Sustainability and RAS presentation

The question of “what is sustainability?” was posed to the participants. 1 participant volunteered that he meant through the concept of “stability”. When asked, “what is agroforestry?”, only 2 offered a clear definition of agroforestry. 6 farmers had planted annual crops during immature period, but none planted trees during mature period. One farmer expressed scepticism about intercropping during mature rubber, citing high shade and low soil fertility low would make it impossible to grow crops. We explained that his presentations later will show how it is possible and in which conditions.

Sustainability is considered as “stability” through “stable income” and “stable environment” The main constraints are: i) Price of rubber: very since nine years, ii) Hence, income diversification is critical to increase agricultural income while continuing production of rubber and iii) appropriate RAS techniques are required to maintain rubber yield and develop associated trees production. The concept is quite clear for most farmers.

Discussion on Cassava

A WWF staff explained that many farmers planted cassava during rubber immature period out of necessity, as they would have no income otherwise.

Recommendations for intercropping cassava with rubber to reduce risk of disease, root competition: i) 1m between rubber line and cassava and ii) preferably plant cassava in year 2 and 3 so rubber has time to establish roots and iii) Harvest cassava before the cassava is 12 months old

Group discussion

- A farmer chose to grow grass in their rubber farm because the grass can be used to feed buffalo/ compost
- SOCFIN plantation was brought up – they implement intercropping there (e.g. spontaneous chili plants?)
- Agarwood in Cambodia has been planted with jackfruit in coastal area, and in the North

2.2.2 Day 2: CRRRI Field trip

We visited the CRRRI experimental plots of rubber intercropped with different timber trees; rubber with different cover crops; and double row of rubber with large interspacing with various crops. This visit allowed participants to see how intercropping could be done in practice, the different levels of shade the rubber trees provide with different inter--spacings, compare different cover crops, and the growth of different timber trees. Lastly, we also visited the rubber clone evaluation plot, where CRRRI was evaluating the growth and production of new Cambodian clones in comparison to a few other typically used clones from around the world. The new Cambodian clones were adapted to Cambodian context and were performing better than the other clones. This was something that CRRRI staff were clearly proud of, and the smallholders also shared their enthusiasm.

A discussion was held after fieldtrip and Eric's presentation on agroforestry during mature period:

One smallholder was interested in planting timber trees.

Another smallholder already planted castor nut, maybe they will try with timber.



RAS double spacing with *Hopea* spp



Idem with *Dipterocarpaceae*



RAS double spacing with Teak



Idem with *Dalbergia* spp



RAS double spacing with mango



RAS trials

Agroforestry Spacing Design

The final item was an explanation by Eric Gohet about how agroforestry spacing design makes more efficient use of land compared to monoculture, using drawings on a white board to illustrate the spacing designs and density of rubber and associated trees in a monoculture vs agroforestry. Participants and extension officers took a strong interest in this. Visual aids are very useful.

With the decision to keep maximum 550 total trees /ha to maintain the same water consumption as rubber traditional monoculture, it is quite clear that in these conditions, only double spacing systems can be developed in Cambodia with a large inter rubber row between 15 and 25 m and between 400 to 450 rubber trees/ha and around 100 associated trees/ha.

2.2.3 Day 3: Discussion by smallholders

We arranged the chairs in the room into a U-shape, and asked all smallholder participants if they were interested in agroforestry and what their plans are to implement it. The main outputs were the following:

Associated potential trees and topics by farmers;

- n° 1- Durian, timber (beng tree)
- n° 2- Timber
- n° 3- it might be considered as difficult to do AF in small plot of land, but most want to learn more about AF
- n° 4- AF is not possible without understanding climate issues, local context, market. Therefore, smallholders should consider different choices, and not just follow popular trends, if any. Farmer cannot escape local crop boom, if any (such as oil palm in Indonesia). RAS must be adapted to climatic conditions.
- N° 5- (older farmer from TK/KC) interested in double row with larger interspacing (15m), double row might be better for rain and shade than single row, considering betel nut or coconut in association to rubber .

Sokleng (WWF) asked: where would they survey market to get info?

The smallholder answered: Look at what are the major type of crops ppl are growing. 10 years ago, a lot of people planted rubber. Then when pepper prices rose, a lot of people planted pepper, foresee a surplus in the next 4-5 years. Durian prices in next 2-3 year may decrease like in Thailand.

- n° 6- (not recorded)
- n° 7-From Keo Seima. Interested in double row + large spacing design. He received advice from a Vietnamese contact about a market for pumpkin seeds in Vietnam. Might also consider rosewood.

Another smallholder shared experience about growing pumpkin, as it didn't do so well on his farm

Sokleng (WWF) suggested making a Telegram group – suggestion was well received. Some smallholders don't have the app installed or don't have smartphones would need additional assistance.

- n° 8- Double row intercropping is new knowledge for him, he likes the idea. Based on the demonstration, he could see that it can work. He also has cows so may consider planting grass.
- n° 9- Interested in durian and double row intercropping. He has 3 ha.
- n° 10- new thing he learned is – he never thought of having fruit trees in rubber plot. His rubber trees are 2 years old. Interested in growing a type of mandarin orange with green skin– local market only. His house is close to crowded area with coffee shop which sells fresh fruits. Eric P. recommended double row with mandarin trees. Mandarin tree don't have many branches making it suitable for intercropping.
- n° 11-Double row not new to him, because he has observed companies do it, but didn't know the reason. So now he will share this information with farmers in his area. Considering integrating some teak trees.
- n° 12-already started 3ha plot with single row design. Can try 2ha with double row, try with rambutan and longan. He has good irrigation.
- n° 13-From Keo Seima. Integrated farming/AF, he observed for many years, and thought about it. After training he want to apply it, but with the long dry season, he will need to dig 7m deep to get water. Rambutan, longan, betel nut.
- n° 14- (female, Mondolkiri) – Previously was not sure what she wanted to do with her plot. Now she has a clearer idea. For rubber already planted, plant grass. 3ha unplanted land available, try double row with probably timber.
- n°15- (female, Mondolkiri) – newly heard about double row. Only seen double-row in SOCFIN plantation. Will consult with her dad about implementing double row, not sure what can be planted, her farm has a problem with water shortage, need to think about context/water/market.
- n° 16- female farmer (Kampong Cham) – interested in double row with 13m interspacing. Her land and soil conditions are not suitable for fruit tree. Will consider grass and teak.
- n°17-female farmer (TK) – already planted rubber on 1ha. May consider teak and dipterocarpus, as her land is on sandy soil. Eric recommended a maximum of 100 intercropped trees to avoid competition on sandy soils.

- n°18-farmer – 3 row of rubber + 1 row of timber trees. Raised an issue: will government allow him to cut timber grown on his plantation to sell to market?

A CRRI staff shared his experience: he used to plant acacia 5 years ago, he didn't know that he needed to inform local authority esp forest administration, even if the timber is on his own land. That process needs to be done through local authority, to inform/get permission. No money needed for permit, but the forestry administration needs to know to confirm that the timber tree not come from forest.

Suggestion to ask the forest administration to give a talk to smallholders about this process. The forestry administration can provide seedlings for free. One smallholder has done this process 4 times in the past.

- n° 19-(younger farmer)-learned some new idea. Don't leave the space between rows empty, as intercropping with fruit trees etc. can bring economic. He would like to try planting sweet bamboo (bamboo shoots), 7-8m high, as he has good irrigation. Eric warned about the risk of water competition, but perhaps competition may be avoided if they harvest only the shoot, and regularly to prevent bamboo growth.
- n° 20-officer: Had written his thesis on double row, is interested to apply learning to his own farm but doesn't have much land. If he acquires land, he'd like to try a design of double row rubber with 13m interspacing to plant limes.
- n° 21-officer: interested in double row intercropping, but has no rubber, just banana. Would consider acacia+banana. He will consult with CRRI team to see if the soil is suitable for rubber. Also interested to plant the new clone developed by CRRI.

A smallholder commented: If his farm is prone to flooding, he should not plant rubber, as rubber trees experience bark explosion for rubber trees during flooding

- n° 22-officer: he knows the theories and application of agroforestry, but when working with farmer, without demonstration or evidence, farmer would not follow new ideas.

Good for farmers to visit and see plots. He has seen some farmers applying double row design, sometimes rubber is not ready (too thin) for first tapping, which leads to delayed production. (Eric P: Recommended to open tapping at 50cm for good production over the lifespan of rubber. If open at 30cm, production will be reduced.)

He doesn't think durian price will drop in next few years. If the quality of durian is high for export, the price will be the same or higher. Thai imported durian is low quality (so price

decreased). In his own experience planting durian with rubber, durian requires intensive techniques. Advised not to plant too many durian trees as it requires intensive management. Focus on quality rather than quantity.

Final recommendation: Even the new minister of Agriculture advised that farmers should consider cutting inputs cost, reduce reliance on labour force, use machine to clear weeds, to maintain same level of production at reduced cost. Follow modernization of agriculture. Need to follow new technology now, so don't play catch up.

CRRRI staff: has published on rubber agroforestry and rubber practices. Hope to share with more farmers. To respond to the smallholder who talked about choosing the right clone, it is important to CRRRI to provide a suitable clone. In the 2000s, CRRRI had a breeding nursery but the plan disappeared, but it is important to revive it. Those who have nurseries should apply to and inform CRRRI, to get good information. Information is a key issue, but even at the province level, they don't have info about nurseries in the area. So it's easy for farmer to choose the wrong clone. The farmers have not asked how they can profit from existing rubber. How to maintain health and productivity, good agricultural practices (GAP). If they don't take care of rubber, it will cause problems in future. Another step to maintain long term sustainability of NR.

Another NGO named F&N that is helping farmers is encouraging farmers to try agroforestry and not rely on monoculture. For new farmers, suggest the clones to pick for planting. CRRRI is happy to share the process on picking best clone, provide own nursery plan, and GAP ranging from premature to mature period of rubber. Some farmers might pick the cheapest clone but don't know that the clone will cause problems. Hope that there will be more trainings, get more suggestion from farmers to advance rubber industry. Hope that our farmers can absorb new knowledge to advance their cultivation.

Other elements of the discussion:

Intercropping during immature period

- 6 smallholders planted crops during immature period
- Planted associated trees during mature period: none (does not currently exist in Cambodia)

Mixing a lot of crops with rubber will require added fertilizer to compensate for the associated crops:

- If you bring sufficient fertilizer, and adopt good practices adapted to soil and climatic conditions, there will be no change to rubber yield in the RAS
- We can learn from other countries on some specific conditions

If you have RAS, a full plot (eg. 2 ha) can maintain high density of rubber across the plot:

- If you reduce the number of trees, possible that yield can increase
- With correct associated crops, there will not be competition for rubber tree growth due to lower density
- Overall absolute lower number of rubber trees compensated by high production per tree and presence of associated crops

Impact of the middle-men:

- Double spacing (400 trees): 10% lower production
 - Compensated well by selling of associated crops
 - Very important to choose the right associated crops
 - Depends on the market and each individual situation
 - Isolated place: better to go rice
 - Close to road or city: coffee

It seems important that smallholders are well aware and have full information of the tradeoffs and possible consequences:

- Lower overall yield volume
- Impact on soil quality
- Increased disease risk

Cambodian farmers are aware of the need for 1m radius for each rubber tree without any crop whatsoever (e.g, soybean cannot be planted right around the tree)

Animals: goats are not suitable as they eat the bark. Animal production is not particularly adapted to RAS.

Animation and feedback about workshop

To get feedback from farmers about the workshop, we were recommended by the WWF team to not do written feedback (as we did in Indonesia) because some farmers were illiterate.

The WWF team led a group activity to energize/relax the participants while getting feedback. We played a “pass the ball and stop the music game”. When the music stops, the person holding the ball must answer the question and/or perform a certain task like singing or dancing. The participants had a lot of fun and two WWF staff took notes of what the participants said (the activity was done entirely in Khmer).

Conclusion

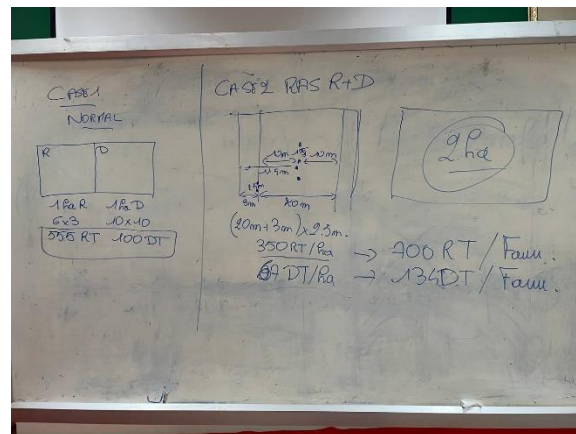
The main features out of this very fruitful discussion with farmers:

- Intercropping is favoured as it provides an agricultural income during immature period.
- Double row with large spacing from 13 to 20 meters is more adapted in order to maintain total number of trees to 550 per hectare.
- Associated trees favoured are respectively: durian, other fruit (longan, rambutan, betel nut, coconut etc..) and some timber trees (teak).
- Timber trees are currently considered as potentially economically interested as there is a good local market and a good demand.

RAS patterns seems to be interesting in order to boost income diversification for most local smallholders.



Powerpoint presentation with farmers



Presentation of Eric Gohet about double RAS spacing systems

Annexes

List of participants

	Name (Khmer)	Gender	Institution	Ethnicity	Pilot	Agricultural Cooperative (AC)	Commune	District
1	Sreng Chantha ស្រីង ចាន់ថា	F	Smallholder-Mondolkiri			AC	Srea Ampum	Pech Chreada
2	Im Srey Mai អ៊ឹម ស្រីម៉ៃ	F	Smallholder-Mondolkiri	indigenous		AC	Busra	Pech Chreada
3	Sok Nhor សុខ ញ៉	M	Smallholder-Mondolkiri	indigenous	chicken		Busra	Pech Chreada
4	Khleang Dam ឃ្លាំង ដាំ	M	Smallholder-Mondolkiri		chicken		Busra	Pech Chreada
5	Pyak Kok ផ្សំ កោក	M	Smallholder-Mondolkiri	indigenous	chicken	AC	Puchrey	Pech Chreada
6	Nhroh Saampout ញ្រៀន សំពូត	M	Smallholder-Mondolkiri	indigenous	chicken	AC	Puchrey	Pech Chreada
7	Meul Ngev មើល ងែវ	M	Smallholder-Mondolkiri			AC	Busra	Pech Chreada
8	Nge Nam ងេ ណាំ	M	Smallholder-Mondolkiri	indigenouse		AC	Pulu	Chreada
9	Sok Meng សុខ ម៉េង	M	Smallholder-Mondolkiri				O Am	Keo Seima
10	Von Vit វ៉ន វិត	M	Smallholder-Mondolkiri				Tra Peang -E	Keo Seima
11	Yila យី ឡា	M	Smallholder-Mondolkiri				Tra Peang -E	Keo Seima
12	Keat Sok គាត់							
12	Khoeun ខុន ហឿន	M	Smallholder-Mondolkiri				Tra Peang -E	Keo Seima
13	CHORN Net	M	Smallholder			rice coop	Donty	Tbong Khmum Provin
14	CHIN Yeab	F	Smallholder			rice coop	Donty	Tbong Khmum Provin
15	TOCH LeangHorn	F	Smallholder			rice coop	Donty	Tbong Khmum Provin
16	PO Sophea	M	Smallholder			Trotrungkasekor	Oumlu	Kampong Cham Provi
17	POL Sethra	M	Smallholder			Trotrungkasekor	Oumlu	Kampong Cham Provi
18	YERNG Sea	M	Smallholder			Trotrungkasekor	Oumlu	Kampong Cham Provi
21	POK Bunat	M	Dept of Agriculture Extension Officer					Tbong Khmum Provin
22	YEUNG Sokong	M	Dept of Agriculture Extension Officer					Kampong Cham Provi
23	TENG Bunchhay	M	Dept of Agriculture Extension Officer					Mondolkiri Province

24	LEANG Samrech	M	WWF-Mondolkiri
25	ORN Dechha	M	WWF-Mondolkiri
26	KHEANG Sokleng	F	WWF-KHM
27	CHEA Lily	F	WWF-KHM
28	PHEAN Chettha	M	CRRI - Head of Breeding CRRI - Head of Physiology and
29	PHEN Phearun	M	Exploitation CRRI - Head of Crop
30	YUNG Vannak	M	Planting and Protection CRRI - Deputy Head of Crop Planting and
31	PRAK Sann	M	Protection CRRI - Staff of Crop Planting and Protection
32	CHHIV Bunnarith	M	(Interpreter)
33	SOK Kimchhin	M	RUA
34	NHEAN Sophea	M	RUA
35	Eric GOHET	M	CIRAD
36	IWABUCHI Tsubasa	M	WWF-Japan
37	FURUSAWA Chiaki	M	WWF-Japan
38	YEO Si Yuan	M	GPSNR
39	Eric PENOT	M	Consultant/CIRAD
40	Maria WANG	F	Consultant

List of intercropping and AF systems

	Name	ha of Rubber	ha of other crop			
			pepper	banana	cashew	other
1	IM Srey Mai	1.5ha immature	1	2	0	
2	Sreng Chomtha	1 ha mature	1	0,5	0	60 durian tree
3	KEAT Sokheuru	3ha immature	0	3	2	
4	VORN Vet	2ha mature, 3ha immature	0	0	0	
5	YI LaSrun	9ha mature, 3ha immature	2	0	2	40 durian tree
6	Sok Meng	2ha mature, 3ha immature	0	0	6	
7	NRES Samput	1ha mature, 1ha Immature	0	0	0	
8	TOCH LeangHorn	1.5ha mature	0	0	0	
9	CHIN Yeab	1ha mature	0	0	0	
10	CHORN Net	1ha mature	0	0	1,25	
11	SOK Nhor	2.5ha mature, 1ha immature	0	0	0	1 ha coffee
12	PYOR Kork	2 ha mature	0,5	0	2	
13	NGES Nam	2.7 ha mature, 3ha immature	0	0,5	0	2 ha coffee
14	KLANG Dam	2 ha mature, 1.5ha immature	0	0	0	100 chicken
15	MERL Ngev	4.8ha mature, 3ha immature	0	0	0	1 ha coffee
16	YERNG Sea		0	0	6	
17	POL Sethra	3 ha mature, 2 ha immature	0	0	2	
18	PO Sophea		0	0	2	