Towards Optimizing Smallholders’ Yield and Productivity through Adoption of Appropriate Latex Harvesting Technology

... about technics

E. Gohet, B. Chambon and R. Lacote

CIRAD - Département PERSYST Research Unit « Performance of Tree Crop-Based Systems »
TA B34/02 – Avenue Agropolis, F-34398 Montpellier Cedex 5, France http://www.cirad.fr/ur/systemes_de_perennes

MRB – IRRDB
International Workshop On Soil Fertility, Good Agricultural Practices And Productivity)

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The situation

Where are the bottlenecks for an efficient LHT TOT to the smallholders?

- Technology gaps between smallholdings and the most advanced agro-industries usually increase when tapping starts...

- This is mostly the cause of an important yield gap between the two types of plantations.

- Latex Harvesting Technologies to achieve the same productivity levels in smallholdings as in agro-industries already exist.

- But Latex Harvesting GAPs (good agricultural practices) are scarcely adopted by smallholders.
Where are the bottlenecks? (1)

Differences between agro-industries and smallholdings regarding the risk management.

The trust of smallholders is not automatic but must be obtained by demonstration.
Where are the bottlenecks? (2)

Differences between agro-industries and smallholdings regarding the efficiency of TOT

- Agro-industries usually have a greater proximity to the R&D structures
- Smallholdings have less access and proximity to these structures.

The TOT efficiency to smallholdings depends on the availability of an efficient Extension Service Body
Where are the bottlenecks? (3)

Sometimes, lack of knowledge / awareness by the Trainers themselves on the newest latex harvesting technologies

• Transfer of knowledge must be regular and efficient...

• “Train the Trainers” regular seminars for updating...

• Knowledge on “Technical packages of possibilities” to improve particular situations...
Sometimes, **lack of research** dedicated to the smallholdings specificities

- Lack of knowledge of farmers’ practices and priorities according to their targets and their socio-economic and agro ecological conditions – socio economics address

- Possible technology packages to answer the smallholders targets and possibilities – socio economics address - technical packages

**Where are the bottlenecks ? (4)**
Where are the bottlenecks? (5)

Different conditions = Different possible solutions

There cannot be a universal recommendation, because the smallholders cannot endeavor the same level of risk as agro-industries...
The technical solutions

• Latex harvesting technologies to achieve the same productivity levels in smallholdings as in agro-industries already exist.

… some basics

• 6 main LHT solutions…

  – Respect of tapping quality standards
  – Respect of opening norms
  – Overall panel management, including Upward Tapping
  – Tapping stop during wintering
  – Rainguarding in high rainfall areas
  – Reduced tapping frequencies
The technical solutions

- Respect of opening standards (minimum girth and age)
- Any early opening of trees (less than 5 years old and girth below 45 cm at 1m from the ground) results in non reversible losses of production

Cirad standards

- S/2 d2 (150 tappings per year) : opening of BO-1 at 1.50 m from the ground
- S/2 d3 (100 tappings per year) : opening of BO-1 at 1,30 m from the ground
- S/2 d4 (75 tappings per year) : opening of BO-1 at 1,20 m from the ground
- S/2 d5 (60 tappings per year) : opening of BO-1 at 1,20 m from the ground
- S/2 d6 (50 tappings per year) : opening of BO-1 at 1,10 m from the ground

- Opening when 50% of trees reach a 50 cm girth measured at 1m from the ground (or 45 cm at 1.50m from the ground), with a minimum age of 5 years.
The technical solutions

• Respect standards of bark consumption

Cirad standards for downward tapping

• S/2 d2 (150 tappings per year) : 22-25 cm vertical consumption per year
  – Scrub 1.0-1.2mm
• S/2 d3 (100 tappings per year) : 15-18 cm vertical consumption per year
  – Scrub 1.3-1.5 mm
• S/2 d4 (75 tappings per year) : 12-15 cm vertical consumption per year
  – Scrub 1.5-1.8 mm
• S/2 d5 (60 tappings per year) : 12-15 cm vertical consumption per year
  – Scrub 1.8-2.0 mm
• S/2 d6 (50 tappings per year) : 10-12 cm vertical consumption per year
  – Scrub 1.8-2.0 mm

Any consumption outside these standards results in production losses.
Respect standards of tapping depth to limit bark wounding

An optimal tapping depth at 1.5 mm from the cambium should be aimed at all times (optimal sugar translocation through the phloem enhancing latex regeneration potential and avoidance of wounds).
• Respect of an overall panel management schedule

All tapping cuts in same position, (same panel, same height) =

All trees, in similar physiological functioning mode, will react the same way to the LHT systems parameters.
Introduction of upward tapping practice in smallholdings

Upward tapping and tailored use of stimulation
• Respect a tapping stop during wintering

- A tapping stop during refoliation and dry wintering season is always beneficial to the physiology of trees, whatever the conditions of climate.

- Tapping stop during wintering avoids to share simultaneously the carbohydrates and the water in two priority sinks, the refoliation and the latex regeneration.

- Maintaining the tapping during refoliation leads to a very poor yield per tapping during the period and to a slower refoliation completion. In rainy areas without true dry season, this significantly favors the onset of SLF.

- As a consequence, a tapping stop during wintering has no negative effect on the total annual yield, but improves the tree and labor productivity during the tapping months, whatever the agro-ecologic conditions.

- Its duration should be proportional to the length and intensity of the dry season (from 3 weeks-1month in wet areas as Peninsular Malaysia, North Sumatra or central Africa) to 3 months in driest conditions (North East Thailand)...

The technical solutions

- Respect of an overall panel management schedule

Panel management
CIRAD Recommendations for d3, d4 and d5
Years 1-24 (conventional tapping, virgin bark)

Option 1
(Short Cycle)

d3 : Opening 1.30m
d4 : Opening 1.20m
d5 : Opening 1.20m

Option 2
(Longer Cycle)

d3 : Opening 1.30m
d4 : Opening 1.20m
d5 : Opening 1.20m

Example: Cirad panel management recommendations for d3, d4 or d5 frequencies
Land productivity and labor productivity

How to get the highest yield at each tapping?

How to increase the kg / day / tapper?

Reducing tapping frequency
## RESEARCH - Latex harvesting: tapping frequency and hormonal stimulation

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Average yield</th>
<th>Cumulative yield</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>g/t/t</td>
<td>%</td>
</tr>
<tr>
<td>T1: S/3 d1 2d/3</td>
<td>46.57d</td>
<td>100</td>
</tr>
<tr>
<td>T2: S/2 d2</td>
<td>62.88c</td>
<td>135.0</td>
</tr>
<tr>
<td>T3: S/2 d3 ET 2.5% Pa1(1) 8/y (m)</td>
<td>78.32a</td>
<td>168.2</td>
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<tr>
<td>T4: S/3 d2 ET 2.5% Pa1(1) 4/y (m)</td>
<td>61.22c</td>
<td>131.5</td>
</tr>
<tr>
<td>T5: S/3 d3 ET 2.5% Pa1(1) 12/y (m)</td>
<td>71.31b</td>
<td>153.1</td>
</tr>
<tr>
<td>F-test</td>
<td>**</td>
<td>**</td>
</tr>
<tr>
<td>C.V. (%)</td>
<td>15.05</td>
<td>16.83</td>
</tr>
</tbody>
</table>

PSU, Thepa Research Station

Reduced tapping frequency and stimulation, case of smallholders Thailand.

The technical solutions

Reducing tapping frequency

Labor productivity. Area possibly tapped by one tapper
(Example of a tapping task of 1.3 ha)

- d2
- d3 + stim
- d4 + stim
- d5 + stim
- d6 + stim

Area:
- 2.6 Ha
- 3.9 Ha
- 5.2 Ha
- 6.5 Ha
- 7.8 Ha
The technical solutions

• Reduced tapping frequency and stimulation

<table>
<thead>
<tr>
<th></th>
<th>S/2 d2 6d/7</th>
<th>S/2 d3 6d/7 + Stim</th>
<th>S/2 d4 6d/7 + Stim</th>
<th>S/2 d5 6d/7 + Stim</th>
<th>S/2 d6 6d/7 + Stim</th>
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</thead>
<tbody>
<tr>
<td>g/t/year</td>
<td>4685</td>
<td>4835</td>
<td>4787</td>
<td>4478</td>
<td>4122</td>
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<tr>
<td>%</td>
<td>100%</td>
<td>103%</td>
<td>102%</td>
<td>96%</td>
<td>88%</td>
</tr>
<tr>
<td>kg/ha/year</td>
<td>2083</td>
<td>2177</td>
<td>2111</td>
<td>2015</td>
<td>1834</td>
</tr>
<tr>
<td>%</td>
<td>100%</td>
<td>105%</td>
<td>101%</td>
<td>97%</td>
<td>88%</td>
</tr>
<tr>
<td>kg/tapper/day</td>
<td>17.0</td>
<td>26.5</td>
<td>34.9</td>
<td>39.1</td>
<td>45.3</td>
</tr>
<tr>
<td>%</td>
<td>100%</td>
<td>156%</td>
<td>205%</td>
<td>230%</td>
<td>267%</td>
</tr>
</tbody>
</table>

An improved latex physiological profile when the tapping frequency decreases, even if the stimulation intensity increases accordingly, as well as a decreasing rate of tapping panel bark dryness.

Under such conditions, the main economic yield parameter of the plantations is not anymore the rubber production per area (kg/ha/year) but becomes the productivity per tapper (kg/tapper/day), as the manpower costs represent the main input costs.
### The technical solutions

Physiological basis for tapping systems recommendations (tapping frequency, stimulation)

<table>
<thead>
<tr>
<th>Low Metabolism Met-</th>
<th>Low-Medium Metabolism Met -=</th>
<th>Medium Metabolism Met =</th>
<th>Medium-High Metabolism Met +=</th>
<th>High Metabolism Met +</th>
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</thead>
<tbody>
<tr>
<td><strong>Low Sugar Loading (Suc -)</strong></td>
<td><strong>Typology c1</strong></td>
<td><strong>Typology c3</strong></td>
<td><strong>Typology c6</strong></td>
<td><strong>Typology c9</strong></td>
</tr>
<tr>
<td>AVROS 2037</td>
<td>FDR5597</td>
<td>CDC36</td>
<td>(\text{Met} -= \text{Suc} -)</td>
<td>(\text{Met} -= \text{Suc} -)</td>
</tr>
<tr>
<td><strong>Medium Sugar Loading (Suc =)</strong></td>
<td><strong>Typology c2</strong></td>
<td><strong>Typology c4</strong></td>
<td><strong>Typology c7</strong></td>
<td><strong>Typology c10</strong></td>
</tr>
<tr>
<td>AF 261</td>
<td>PB 86</td>
<td>GT1</td>
<td>IRCA840</td>
<td>RRIM 600</td>
</tr>
<tr>
<td>FDR5283</td>
<td>PR 107</td>
<td>PB 254</td>
<td>IRCA18</td>
<td>BPM 1</td>
</tr>
<tr>
<td>MDX624</td>
<td>FDR5665</td>
<td>CDC312</td>
<td>RRIC 100</td>
<td>BPM 24</td>
</tr>
<tr>
<td>MDX607</td>
<td>FDR5802</td>
<td></td>
<td></td>
<td>RRIC 110</td>
</tr>
<tr>
<td><strong>High Sugar Loading (Suc +)</strong></td>
<td><strong>Typology c5</strong></td>
<td><strong>Typology c8</strong></td>
<td><strong>Typology c11</strong></td>
<td><strong>Typology c13</strong></td>
</tr>
<tr>
<td>PB 217</td>
<td>RRIC 121</td>
<td>IRCA19</td>
<td>IRCA109</td>
<td>PB 255</td>
</tr>
<tr>
<td>(\text{Low probability})</td>
<td>(\text{Met} -= \text{Suc} -)</td>
<td>(\text{Met} -= \text{Suc} -)</td>
<td>(\text{Met} -= \text{Suc} -)</td>
<td>(\text{Met} -= \text{Suc} -)</td>
</tr>
</tbody>
</table>

**In Bold, Cirad recommended clones for industrial plantings**

**In Blue, CMS Clones**

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Diagonals of the \([5,\text{Met} \times 3,\text{Suc}]\) matrix : Homogenous stimulation recommendations
Towards an efficient LHT TOT

**Conditions for LHT TOT efficiency**

- It is important to identify, among the total package of available **technical solutions**, **which ones can help the smallholders** to solve their main difficulties and to address their actual priorities.

- It is therefore important to understand **which are those targets**, priorities (more income, more free time available for other activities and economic diversification, less manpower, less costs, less inputs...) and constraints.

- Characterization of the rubber farms is necessary to establish **farm typologies** based on a number of socioeconomic and structural characteristics of the production units;

- Such typologies reveal the diversity of the farms and can be used to define specific technical supports to be provided to each social group in each main agroecological area.
Towards an efficient LHT TOT

- Conditions for LHT TOT efficiency: INOVATION PLATFORMS

  – ON FARM DEMONSTRATION: Test and validate techniques in order to make technical recommendations (technical/economic references) adapted to each different type of rubber farms.

  – MONITORING:
    How farmers adopt and take on board the new techniques, along with their impact on farms; this should make possible to determine the degree of adoption/appropriation (or even modification) by the different types of farms, and identify how they can be disseminated.

    How the functioning of rubber farms changes, to enable a dynamic characterization of farms, which should be useful for defining possible farmer support policies.

- CONSTANT CONCERTATION among all stakeholders in order to identify the possible solutions, acceptable at both farm and community scales.
Towards an efficient LHT TOT

• Conditions for LHT TOT efficiency

AN EXAMPLE, REDUCTION OF TAPPING FREQUENCY?

More global considerations must be as well envisaged and to be backed by political and decision making authorities

• A technical and scientifically sounded recommendation at farm level may be unacceptable at the larger scale of the community (village, district or province) if it has large scale effects on the employment or the economic status inside the said community.

• Adoption of innovations and their political backing therefore requires constant concertation among all stakeholders in order to identify the possible solutions, acceptable at both farm and community scales
Sustainability of Natural Rubber

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THANK YOU FOR ATTENTION

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eric.gohet@cirad.fr
benedicte.chambon@cirad.fr
rlacote@cirad.fr