EVALUATION OF LOW FREQUENCY TAPPING SYSTEMS WITH STIMULATION ON HEVEA IN TRADITIONAL AREA OF CAMBODIA

Phen Phearun¹*, Mak Sopheaveasna¹, Chhek Chan¹, Eric Gohet³ and Régis Lacote²,³

¹. CRRI - P.O. Box: 1337, Phnom Penh, Cambodia
². CIRAD - HRPP, Kasetsart University – 10900 Bangkok
³. CIRAD, UPR Systèmes de Pérennes. F-34398 Montpellier, France
* Corresponding author: phearun_phen@yahoo.com
INTRODUCTION

• In 2018, the total rubber area in Cambodia was 436,682 ha in which 201,949 ha was under tapping

• Some areas are now untapped due to labor shortage. High cost of skilled tappers and tapper shortage are new issues for Cambodia

• The common tapping systems for almost all plantations in Cambodia are S/2 d3 for downward and S/4 d3 for upward tapping.

• Low frequency tapping systems (LFT) combined with proper ethephon stimulation might be the solution to solve these problems (Gohet et al., 1991, Soumahin et al., 2009; Kudaligama et al., 2010; Prasanna et al., 2010; Soumahin et al., 2010)
INTRODUCTION

• The objective of the experiment is to:

  i. evaluate the efficiency of LFT systems with ethephon stimulation on yield and labor productivity and their effect on some physiological parameters,

  ii. identify the tapping systems showing the best efficiency.
MATERIALS AND METHODS

Experimental site

- The experiment was carried out at the CRRI research station located in Tbong Khmum province on a level plain set in red basaltic latosols.

- The climate is governed by the Asian monsoon, which produces two distinct seasons: a rainy season (May to Oct) and a dry season (Nov to Apr).
Experimental design

- Clone RRIM 600 was used in the experiment
- Planting pattern: 6 m x 3 m (555 trees/ha)
- Girth at opening was 50 cm
- The trials were opened in 2013
- Tapping systems were S/2 d3 7d/7, S/2 d4 7d/7, d5 7d/7 and d6 7d/7.
- Experimental design: RCBD with 4 treatments comprising 3 replications. There were 120 trees per plot, on total area of 4 ha.
MATERIALS AND METHODS (cont.)

Treatments

Table 1. Details of experimental treatment

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Length of cut</th>
<th>Frequency of tapping</th>
<th>Stimulation (year 1-3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T0</td>
<td>S/2</td>
<td>d3 7d/7</td>
<td>ET 2.5% Pa1(1) 4/y</td>
</tr>
<tr>
<td>T1</td>
<td>S/2</td>
<td>d4 7d/7</td>
<td>ET 2.5% Pa1(1) 5/y</td>
</tr>
<tr>
<td>T2</td>
<td>S/2</td>
<td>d5 7d/7</td>
<td>ET 3.3% Pa1(1) 6/y</td>
</tr>
<tr>
<td>T3</td>
<td>S/2</td>
<td>d6 7d/7</td>
<td>ET 3.3% Pa1(1) 10/y</td>
</tr>
</tbody>
</table>
MATERIALS AND METHODS (cont.)

Data measurements

- The latex yield was weighed every tapping day
- The cup lump was weighed the day after
- The girth was measured at 1.70 m above the ground once a year
- Tree dryness was observed for all plots every year in December
- Latex diagnosis (LD) analysis was done in October-November.
# RESULTS AND DISCUSSION

Table 2. Yearly average dry rubber yield (g/t, g/t/t and kg/ha) after 3 years of tapping.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>g/t</th>
<th>%</th>
<th>g/t/t</th>
<th>%</th>
<th>kg/ha</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>T0: S/2 d3 7d/7 ET 2.5% Pa1(1) 4/y</td>
<td>3794 a</td>
<td>100</td>
<td>43.71 d</td>
<td>100</td>
<td>1716 a</td>
<td>100</td>
</tr>
<tr>
<td>T1: S/2 d4 7d/7 ET 2.5% Pa1(1) 5/y</td>
<td>3581 b</td>
<td>94</td>
<td>48.57 c</td>
<td>111</td>
<td>1662 a</td>
<td>97</td>
</tr>
<tr>
<td>T2: S/2 d5 7d/7 ET 3.3% Pa1(1) 6/y</td>
<td>3443 bc</td>
<td>91</td>
<td>56.01 b</td>
<td>128</td>
<td>1560 b</td>
<td>91</td>
</tr>
<tr>
<td>T3: S/2 d6 7d/7 ET 3.3% Pa1(1) 10/y</td>
<td>3368 c</td>
<td>89</td>
<td>64.68 a</td>
<td>148</td>
<td>1520 b</td>
<td>89</td>
</tr>
<tr>
<td>P value</td>
<td>0.001</td>
<td></td>
<td>0.000</td>
<td></td>
<td>0.000</td>
<td></td>
</tr>
</tbody>
</table>
Dry rubber yield per tree per tapping (g/t/t) of LFT systems with ethephon stimulation was significantly higher than that of S/2 d3 tapping system (T0) which is widely used in Cambodia.

LFT system combining reduction of tapping frequency with ethephon stimulation increase the duration of latex flow after tapping, with the reduction of latex coagulation and the activation of the latex cell metabolism (Jacob et al., 1989; d’Auzac et al., 1997). Therefore, more latex is collected at each tapping. Moreover, it was confirmed possible to compensate the reduction of tapping frequency when using ethephon stimulation.

LFT systems (S/2 d4, S/2 d5 and S/2 d6) caused dry rubber yield loss in g/t and kg/ha as compared to d3 tapping system, but this loss was not significant for S/2 d4. This was clearly related to the number of tapping per year.
RESULTS AND DISCUSSION (cont.)

• In our local condition, the reduction of tapping frequency with suitable stimulation could compensate the cumulative yield per tree with higher yield per tapping. These results confirmed previous works (Gohet et al., 1991, Rodrigo et al., 2011, Njukeng and Gobina, 2007), mentioning that LFT must be combined with proper stimulant to increase potential yield (g/t/t) at each tapping.
Table 3. Average of Suc, Pi and RSH in the third year of tapping

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Suc (mM.l⁻¹)</th>
<th>Pi (mM.l⁻¹)</th>
<th>RSH (mM.l⁻¹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T0: S/2 d3 7d/7 ET 2.5% 4/y</td>
<td>5.50</td>
<td>18.74 a</td>
<td>0.21</td>
</tr>
<tr>
<td>T1: S/2 d4 7d/7 ET 2.5% 5/y</td>
<td>6.83</td>
<td>17.75 a</td>
<td>0.20</td>
</tr>
<tr>
<td>T2: S/2 d5 7d/7 ET 3.3% 6/y</td>
<td>5.51</td>
<td>13.66 b</td>
<td>0.23</td>
</tr>
<tr>
<td>T3: S/2 d6 7d/7 ET 3.3% 10/y</td>
<td>5.19</td>
<td>15.27 ab</td>
<td>0.22</td>
</tr>
<tr>
<td>P- value</td>
<td>0.217</td>
<td>0.031</td>
<td>0.520</td>
</tr>
</tbody>
</table>
RESULTS AND DISCUSSION (cont.)

- Suc and RSH contents of all treatments were not significantly different but Pi content was significantly different depending on the tapping system.

- The effect of stimulation is well known by the use of RSH as scavengers to protect the stability of the membranes of the vacuo-lysosomal system in the latex cells (Jacob et al., 1989; d’Auzac et al., 1997).

- The differences in Suc and RSH contents were not different among treatments.

- Pi levels were lower for S/2 d5 and S/2 d6, confirming a lower metabolic activity and a lower production expressed in g/t.
Although not significantly different, lower levels of Suc observed in those 2 systems S/2 d5 and S/2 d6 could be related to this lower metabolic activity, probably limiting the active importation of Suc into the latex. It could be related as well to the increase in g/t/t.

As a matter of fact, an increase in g/t/t increases the need for Suc importation after each tapping (Jacob et al., 1989, Gohet et al., 1996, Lacote et al., 2010) to sustain latex regeneration.
Figure 1: Average of girth increment (cm) after three years of tapping.
Girth increment did not show any difference between treatments. Nugawela et al. (2000) found that LFT system with stimulation did not show negative effect on the growth of rubber trees.

In our experiment, combining LFT with higher ethephon stimulation increased significantly the yield at each tapping while not significantly reducing the growth of the trees.
The rate of tapping panel dryness (TPD) was found similar for all treatments, while Obouayeba et al. (2009) reported that the rate of TPD was related to the intensity of tapping.
CONCLUSION

- After the first three 3 years of tapping, LFT system S/2 d6 with ethephon application (T3) provided the highest dry rubber yield (g/t/t) but the lowest yield in g/t and kg/ha.

- As compared to d3, LFT systems (S/2 d4, S/2 d5 and S/2 d6) caused dry rubber yield loss in kg/ha by respectively 3, 9 and 11% but resulted in increased labor productivity (g/t/t) by respectively 11, 28 and 48%. Therefore, the increase in labor productivity (g/t/t) was much higher than the loss in land productivity (kg/ha).

- Girth increment was not significantly different between treatments.

- Suc and RSH contents of all treatments were not significantly different but Pi content was significantly different depending on the tapping system.
CONCLUSION (cont.)

- Tapping panel dryness was similar for all treatments after three years of tapping.

- The results highlight that, in the traditional rubber growing zone of Cambodia, it is possible to use ethephon stimulation to increase the potential yield of the trees at each tapping (g/t/t). Therefore, LFT systems can be applied with proper stimulation to sustain the yield when reducing the tapping frequency.
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