




Low Tapping Frequency to Increase Productivity in Thailand


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- ✚ Thailand represents 23% of the total area under *Hevea* in the world, and 35.5% of total natural rubber production, with 4.75 million tons (2018)**
- ✚ Rubber producers are mainly smallholders who represent more than 85% of the total rubber area in the country**

 **Continuous decrease in the size of Thai rubber plantations has led to the general adoption of very intensive tapping systems**


 **Resulting in possible overexploitation, high TPD rates, short life-cycles of the plantations and rather low productivity**




Main physiological and practical causes for low yield

-  **insufficient time for latex regeneration between consecutive tappings because of too high tapping frequencies,**
-  **reduces output per tree per tapping**

(Jacob et al., 1988, 1995, d'Auzac et al., 1997)

-  **prevents the use of ethephon stimulation because of insufficient latex sugar content**

(Tupy and Primot, 1976, Low and Gomez, 1982)

-  **high tapping panel dryness rate occurs with such intensive tapping systems** (Anekachai, 1989)

Improve rubber productivity

**Reduced tapping frequency tapping system
(RTF; S/2 d3) compensated by ethephon
stimulation**



(Abraham, 1970, Paardekooper et al., 1975, Eschbach and Tonnelier, 1984, Eschbach and Banchi, 1985, Eschbach, 1986, Gohet, 1996, Gohet et al., 1991, 1996, 1997)

Objective

To assess tapping systems to increase productivity according to low rubber price, lack of skill tapper and prolong lifespan

Materials and methods

- **Chachoengsao Rubber Research Center since 2016**
- **Experimental design: Split plot design in RCB**
- **Main plots 3 (clone): RRIT 251, PB 235 and RRIM 600**
- **4 subplots (Tapping systems, A to D) and 4 replications**

climate is subtropical, characterized by temperature 25°C to 35°C, a high humidity (80% to 90%) and rainfall of up to 1,200 mm

| Treatments | 1 st &2 nd years of tapping | | | 3 rd year of tapping | | |
|--|---|-------------|--------|---------------------------------|-------------|--------|
| | RRIT 251 | RRIM 600 | PB 235 | RRIT 251 | RRIM 600 | PB 235 |
| A. S/2 d1 d2 7d/7 9m/12 | - | - | - | - | - | - |
| B. S/3 d1 2d3 7d/7 9m/12 | - | - | - | - | - | - |
| C. S/2 d3 7d/7 9m/12 ET 2.5% Pa 0.7 (1) | 5 | 5 | 4 | 6 | 6 | 5 |
| D. S/2 d3 7d/7 9m/12 ET 2.5% Pa 0.7 (1) 4/Y 7d/7 9m/12 Recovery of tapping days | 4 | 4 | 3 | 5 | 5 | 4 |

Tr. C S/3 d3 ET2.5% 4-5/y

| | freq | Mo | Tu | Wed | Thu | Fri | Sat | Sun | Mo | Tu | Wed |
|----|------|----|----|-----|-----|-----|-----|-----|----|----|-----|
| T3 | d3 | x | | | x | | | x | | | x |

Tr. D S/3 d3 ET2.5% 3-4/y, Recover tapping day

| | freq | Mo | Tu | Wed | Thu | Fri | Sat | Sun | Mo | Tu | Wed |
|----|------|----|----|-----|------|-----|-----|-----|----|----|-----|
| T4 | d3 | x | | | Rain | x | | x | | | x |

RESULTS



First year of tapping

Rubber clones and tapping systems on yield (g/t/t)

| Tapping system | Tapping day | Yield (g/t/t) | | | average |
|--|----------------|---------------|----------|---------|---------|
| | | RRIT 251 | RRIM 600 | PB 235 | |
| A. S/2 d2 | 107 | 38.39 b | 26.05 c | 32.38 b | 32.38 b |
| B. S/3 d1 2d/3 | 138 | 28.98 c | 21.11 c | 23.82 c | 24.64 c |
| C. S/2 d3 ET 2.5 % 4-5/y | 71 | 55.24 a | 34.58 b | 44.63 a | 44.82 a |
| D. S/2 d3 ET 2.5 % 3-4/y recover tapping day | 81 | 50.56 a | 33.49 b | 41.70 a | 41.92 a |
| average | | 43.29 a | 28.81 c | 35.63 b | |
| CV a (%) = 12.5 | | CV b (%) = | 12.2 | | |

| Tapping system | Tapping day | Yield (kg/t/y) | | | average ^e |
|---|----------------|----------------|-------------|--------|----------------------|
| | | RRIT 251 | RRIM 600 | PB 235 | |
| A. S/2 d2 | 107 | 4.11 | 2.79 | 3.46 | 3.45 |
| B. S/3 d1 2d/3 | 138 | 4.00 | 2.91 | 3.29 | 3.40 |
| C. S/2 d3 ET 2.5 % 4- 5/y | 71 | 3.92 | 2.45 | 3.17 | 3.18 |
| D. S/2 d3 ET 2.5 % 3- 4/y recover tapping day | 81 | 4.10 | 2.71 | 3.38 | 3.40 |
| average | | 4.03 a | 2.72 c | 3.32 b | |
| <hr/> | | | | | |
| CV a (%) = 16.1 | 36 and 67 days | CV b (%) = | 11.6 | | |

| Tapping system | Tapping day | Yield (kg/ha/y) | | | average |
|-----------------------------|-------------|-----------------|----------|--------|---------|
| | | RRIT 251 | RRIM 600 | PB 235 | |
| A. S/2 d2 | 107 | 1,926 | 1,307 | 1,624 | 1,619 |
| B. S/3 d1 2d/3 | 138 | 1,875 | 1,366 | 1,541 | 1,594 |
| C. S/2 d3 ET 2.5 % 4-5/y | 71 | 1,839 | 1,151 | 1,485 | 1,492 |
| D. S/2 d3 ET 2.5 % 3-4/y RD | 81 | 1,920 | 1,272 | 1,583 | 1,592 |
| average | | 1,890 | 1,274 | 1,558 | |
| | | a | c | b | |
| CV a (%) = 13.2 | | CV b (%) | 9.8 | | |

| Tapping system | DRC (Dry rubber content, %) | | | average |
|-----------------------------|-----------------------------|----------|---------|---------|
| | RRIT 251 | RRIM 600 | PB 235 | |
| A. S/2 d2 | 43.25 | 43.28 | 37.61 | 41.37 b |
| B. S/3 d1 2d/3 | 50.73 | 42.68 | 39.95 | 44.46 a |
| C. S/2 d3 ET 2.5 % 4-5/y | 46.42 | 39.77 | 39.41 | 41.87 b |
| D. S/2 d3 ET 2.5 % 3-4/y RD | 42.23 | 36.11 | 37.58 | 38.64 b |
| average | 45.65 a | 40.46 b | 38.64 c | |

| Tapping system | Sucrose ([Suc], mM/l) | | | average |
|-----------------------------|-----------------------|----------|---------|---------|
| | RRIT 251 | RRIM 600 | PB 235 | |
| A. S/2 d2 | 8.82 | 6.93 | 11.66 | 9.13 |
| B. S/3 d1 2d/3 | 8.87 | 7.01 | 12.04 | 9.31 |
| C. S/2 d3 ET 2.5 % 4-5/y | 7.21 | 6.49 | 10.03 | 7.91 |
| D. S/2 d3 ET 2.5 % 3-4/y RD | 9.05 | 7.60 | 11.66 | 9.44 |
| average | 8.48 b | 7.00 b | 11.34 a | |

| Tapping system | Inorganic phosphorus (Pi, mM/l) | | | average |
|-----------------------------|---------------------------------|----------|---------|---------|
| | RRIT 251 | RRIM 600 | PB 235 | |
| A. S/2 d2 | 23.61 | 10.66 | 19.39 | 17.89 |
| B. S/3 d1 2d/3 | 25.53 | 9.98 | 18.26 | 17.92 |
| C. S/2 d3 ET 2.5 % 4-5/y | 27.00 | 11.83 | 19.33 | 19.39 |
| D. S/2 d3 ET 2.5 % 3-4/y RD | 26.45 | 13.30 | 19.66 | 19.80 |
| average | 25.65 a | 11.44 c | 19.15 b | |

| Tapping system | Thiol ([RSH] mM/l) | | | average |
|-----------------------------|--------------------|----------|--------|---------|
| | RRIT 251 | RRIM 600 | PB 235 | |
| A. S/2 d2 | 0.38 | 0.37 | 0.17 | 0.31 |
| B. S/3 d1 2d/3 | 0.29 | 0.31 | 0.25 | 0.29 |
| C. S/2 d3 ET 2.5 % 4-5/y | 0.29 | 0.35 | 0.27 | 0.30 |
| D. S/2 d3 ET 2.5 % 3-4/y RD | 0.20 | 0.30 | 0.21 | 0.24 |
| average | 0.29 a | 0.33 a | 0.22 b | |

2nd year of tapping

| Tapping system | Yield (g/t/t) | | | avg | |
|-----------------------------|---------------|------------|----------|----------|---------|
| | day | RRIT 251 | RRIM 600 | | PB 235 |
| A. S/2 d2 | 97 | 52.48 a | 26.05 c | 32.38 b | 39.70 a |
| B. S/3 d1 2d/3 | 130 | 38.92 b | 21.11 c | 23.82 c | 29.80 b |
| C. S/2 d3 ET 2.5 % 4-5/y | 67 | 63.87 a | 34.58 b | 44.63 ab | 47.80 a |
| D. S/2 d3 ET 2.5 % 3-4/y RD | 72 | 60.34 a | 33.49 b | 41.70 ab | 46.42 a |
| average | | 53.90 a | 28.81 c | 35.63 b | |
| CV a (%) = 13.5 | | CV b (%) = | 12.1 | | |

| Tapping system | Tapping g day | Yield (kg/t/y) | | | average |
|---|---------------------|----------------|---------------|---------------|---------|
| | | RRIT 251 | RRIM 600 | PB 235 | |
| A. S/2 d2 | 97 | 5.09 a | 3.00 b | 3.46 b | 3.85 |
| B. S/3 d1 2d/3 | 130 | 5.06 a | 3.23 b | 3.33 b | 3.87 |
| C. S/2 d3 ET 2.5 % 4-5/y | 67 | 4.28 a | 2.31 c | 3.02 b | 3.20 |
| D. S/2 d3 ET 2.5 % 3-4/y recover tapping day average | 72 | 4.34 a | 2.50 c | 3.19 b | 3.34 |
| | | 4.69 a | 2.76 c | 3.25 b | |
| CV a (%) = 15.9 | | CV b (%) | 13.6 | | |
| | | = | | | |

| Tapping system | Tapping g day | Yield (kg/ha/y) | | | average |
|--|---------------------|-----------------|-------------|---------|---------|
| | | RRIT 251 | RRIM 600 | PB 235 | |
| A. S/2 d2 | 97 | 2,386 a | 1,409 b | 1,621 b | 1,805 |
| B. S/3 d1 2d/3 | 130 | 2,371 a | 1,516 b | 1,560 b | 1,816 |
| C. S/2 d3 ET 2.5 % 4-5/y | 67 | 2,006 a | 1,082 c | 1,416 b | 1,501 |
| D. S/2 d3 ET 2.5 % 3-4/y recover tapping day | 72 | 2,037 a | 1,171 c | 1,493 b | 1,567 |
| average | | 2,200 a | 1,294 c | 1,523 b | |
| CV a (%) = 14.2 | | CV b (%) | 10.8 | | |

| Tapping system | DRC (Dry rubber content, %) | | | average |
|-----------------------------|-----------------------------|----------|--------|---------|
| | RRIT 251 | RRIM 600 | PB 235 | |
| A. S/2 d2 | 47.73 | 42.04 | 45.54 | 45.10 |
| B. S/3 d1 2d/3 | 45.22 | 47.91 | 44.16 | 45.76 |
| C. S/2 d3 ET 2.5 % 4-5/y | 45.46 | 45.69 | 47.02 | 46.05 |
| D. S/2 d3 ET 2.5 % 3-4/y RD | 47.02 | 44.49 | 45.26 | 45.59 |
| average | 46.35 | 45.03 | 45.49 | |

| Tapping system | Sucrose ([Suc], mM/l) | | | average |
|-----------------------------|-----------------------|----------|---------|---------|
| | RRIT 251 | RRIM 600 | PB 235 | |
| A. S/2 d2 | 7.49 b | 9.79 b | 7.23 b | 8.17 |
| B. S/3 d1 2d/3 | 11.28 a | 8.35 b | 11.34 a | 10.32 |
| C. S/2 d3 ET 2.5 % 4-5/y | 12.43 a | 8.29 b | 9.22 b | 9.98 |
| D. S/2 d3 ET 2.5 % 3-4/y RD | 13.00 a | 8.34 b | 12.58 a | 10.30 |
| average | 11.05 a | 7.94 b | 10.09 a | |

| Tapping system | Inorganic phosphorus (Pi, mM/l) | | | average |
|-----------------------------|---------------------------------|----------|--------|---------|
| | RRIT 251 | RRIM 600 | PB 235 | |
| A. S/2 d2 | 12.72 | 16.48 | 21.02 | 16.74 |
| B. S/3 d1 2d/3 | 15.30 | 13.38 | 19.68 | 16.12 |
| C. S/2 d3 ET 2.5 % 4-5/y | 18.01 | 16.48 | 19.22 | 17.90 |
| D. S/2 d3 ET 2.5 % 3-4/y RD | 14.59 | 16.67 | 12.83 | 14.70 |
| average | 15.16 | 15.75 | 18.19 | |

| Tapping system | Thiol ([RSH] mM/l) | | | average |
|-----------------------------|--------------------|----------|--------|---------|
| | RRIT 251 | RRIM 600 | PB 235 | |
| A. S/2 d2 | 0.39 | 0.49 | 0.59 | 0.49 |
| B. S/3 d1 2d/3 | 0.55 | 0.48 | 0.52 | 0.52 |
| C. S/2 d3 ET 2.5 % 4-5/y | 0.56 | 0.46 | 0.50 | 0.51 |
| D. S/2 d3 ET 2.5 % 3-4/y RD | 0.75 | 0.55 | 0.48 | 0.59 |
| average | 0.56 | 0.50 | 0.52 | |

the 3rd year of tapping

| Tapping system | Tapping day | Yield (g/t/t) | | | average |
|--|----------------|----------------|----------|---------|----------------|
| | | RRIT 251 | RRIM 600 | PB 235 | |
| A. S/2 d2 | 98 | 48.22 b | 34.70 c | 37.62 b | 40.18 a |
| B. S/3 d1 2d/3 | 134 | 34.77 c | 25.26 d | 34.36 c | 29.35 b |
| C. S/2 d3 ET 2.5 % 5-6/y | 71 | 62.45 a | 32.75 c | 39.36 b | 44.85 a |
| D. S/2 d3 ET 2.5 % 4-5/y recover tapping day | 80 | 55.79 a | 31.89 c | 42.02 b | 43.23 a |
| average | | 50.31 a | 31.15 c | 36.75 b | |

| Tapping system | Tapping g day | Yield (kg/t/y) | | | average |
|--|---------------------|----------------|-------------|--------|---------|
| | | RRIT 251 | RRIM 600 | PB 235 | |
| A. S/2 d2 | 98 | 4.73 a | 3.40 b | 3.69 b | 3.94 |
| B. S/3 d1 2d/3 | 134 | 4.66 a | 3.38 b | 3.75 b | 3.93 |
| C. S/2 d3 ET 2.5 % 5-6/y | 71 | 4.43 a | 2.33 c | 2.79 b | 3.18 |
| D. S/2 d3 ET 2.5 % 4-5/y recover tapping day | 80 | 4.46 a | 2.55 c | 3.36 b | 3.46 |
| average 21 and 63 days | | 4.57 a | 2.92 c | 3.40 b | |

| Tapping system | Tapping day | Yield (kg/ha/y) | | | average |
|--|----------------|-----------------|----------|----------|----------|
| | | RRIT 251 | RRIM 600 | PB 235 | |
| A. S/2 d2 | 98 | 2,215 a | 1,594 b | 1,728 b | 1,846 a |
| B. S/3 d1 2d/3 | 134 | 2,184 a | 1,586 b | 1,760 b | 1,843 a |
| C. S/2 d3 ET 2.5 % 5-6/y | 71 | 2,078 a | 1,090 c | 1,310 bc | 1,493 b |
| D. S/2 d3 ET 2.5 % 4-5/y recover tapping day | 80 | 2,092 a | 1,196 c | 1,576 b | 1,621 ab |
| average | | 2,142 a | 1,367 c | 1,593 c | - |


| Tapping system | DRC (Dry rubber content, %) | | | Average |
|-----------------------------|-----------------------------|----------|--------|---------|
| | RRIT 251 | RRIM 600 | PB 235 | |
| A. S/2 d2 | 48.33 | 44.18 | 47.23 | 46.58 |
| B. S/3 d1 2d/3 | 38.29 | 48.40 | 45.50 | 44.06 |
| C. S/2 d3 ET 2.5 % 5-6/y | 41.30 | 45.18 | 46.49 | 44.32 |
| D. S/2 d3 ET 2.5 % 4-5/y RD | 47.76 | 47.06 | 42.89 | 45.90 |
| average | 43.92 | 46.20 | 45.53 | |


| Tapping system | Sucrose ([Suc], mM/l) | | | average |
|-----------------------------|-----------------------|----------|---------|---------|
| | RRIT 251 | RRIM 600 | PB 235 | |
| A. S/2 d2 | 7.89 b | 4.99 c | 8.83 ab | 7.24 |
| B. S/3 d1 2d/3 | 10.69 a | 7.12 b | 12.25 a | 10.02 |
| C. S/2 d3 ET 2.5 % 5-6/y | 9.77 a | 6.17 b | 12.04 a | 9.33 |
| D. S/2 d3 ET 2.5 % 4-5/y RD | 8.86 ab | 7.19 b | 10.58 a | 8.88 |
| average | 9.30 a | 6.37 b | 10.93 a | |

| Tapping system | Inorganic phosphorus (Pi, mM/l) | | | average |
|-----------------------------|---------------------------------|----------|--------|---------|
| | RRIT 251 | RRIM 600 | PB 235 | |
| A. S/2 d2 | 23.91 | 21.20 | 23.09 | 22.73 |
| B. S/3 d1 2d/3 | 22.81 | 21.43 | 29.48 | 24.58 |
| C. S/2 d3 ET 2.5 % 5-6/y | 25.73 | 17.45 | 27.80 | 23.66 |
| D. S/2 d3 ET 2.5 % 4-5/y RD | 23.59 | 21.76 | 24.26 | 23.20 |
| average | 24.01 | 20.46 | 26.16 | |

| Tapping system | Thiol ([RSH] mM/l) | | | average |
|----------------------------|--------------------|----------|--------|---------|
| | RRIT 251 | RRIM 600 | PB 235 | |
| A. S/2 d2 | 0.18 | 0.15 | 0.19 | 0.17 |
| B. S/3 d1 2d/3 | 0.19 | 0.19 | 0.26 | 0.21 |
| C. S/2 d3 ET 2.5 % 5-6/y | 0.20 | 0.15 | 0.19 | 0.18 |
| D. S/2 d3 ET 2.5 % 4-5/yRD | 0.23 | 0.14 | 0.13 | 0.16 |
| average | 0.20 | 0.16 | 0.19 | |

Discussion & Conclusion

 Actually A. S/2 d2 and B. S/3 d1 2d3 are RRIT recommendations for Thai smallholders

 On this experiment, the first three years of tapping showed S/2 d3 tapping system (C. S/2 d3 and D. S/2 d3 with recovery tapping days) could increase the average yield (g/t/t, labor productivity per tapping)


Conclusion

■ produced the same cumulative yield in terms of kg/t/y and kg/ha/y, although the number of yearly tapping days was significantly less than d1 2d3 (67 and 57 days) and less than d2 (26 and 36 days respectively)

Conclusion

- **All treatments were not different regarding latex diagnosis parameters, proving that they reached a similar metabolic status**
- **Clones RRIT 251 and PB 235 obtained a significant higher yield than RRIM 600 and responded better than RRIM600 to the tapping frequency reduction with stimulation, especially in years 2 and 3**

Conclusion

 Such tapping systems with reduced tapping frequency, like S/2 d3, with or without recovery of lost tapping days, are to be more studied in Thailand

 they could be the way to maintain the yield per land and to increase the labor productivity

Conclusion

- This would in particular permit the adaptation to
- ❑ a possible shortage of tappers, even under the Thai smallholders context of share-cropping
 - ❑ or the development of other on-farms activity (diversification) in order to mitigate the effect of low rubber prices
 - ❑ reducing the time spent in plantation by tappers to produce the same quantity of rubber and releasing time to do something else.

A photograph of a factory or industrial setting. In the foreground, a worker in a dark shirt and cap is leaning over a large, rectangular tray filled with a white, foamy substance, possibly a liquid or slurry. The tray is supported by a metal frame with a corrugated metal surface. In the background, several other workers are visible at similar workstations. The walls are blue with perforated sections, and there are windows and a chalkboard visible. The overall scene depicts a busy industrial environment.

Thank you

for attention