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Weekly Tapping of Rubber Trees: Agronomical, Physiological and Economic Aspects

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The change from full-spiral twice a week to half-spiral stimulated aims to decrease tapping intensity and increase productivity of the tapper. The best way of doing this is to decrease the tapping frequency and increase stimulation to maintain satisfactory yield per tree.

This paper summarises the results obtained with weekly tapping frequency of d/6 6d/7 compared with a twice-weekly frequency of d/3 6d/7 on several clones in the Ivory Coast.

In spite of increased stimulation, yields obtained were very often inferior, i.e. *about 10% less than those obtained with two tappings per week. Not all clones react in the same way to a decrease in tapping intensity.*

Secondary characteristics such as dry rubber content, sucrose content and incidence of dry trees were better than with half-weekly tapping in spite of the number of stimulations being twice as high.

From an economic view-point, weekly tapping greatly reduces the need for labour. The break-even point which depends on the market price and the cost of labour, if not already reached in the Ivory Coast on existing estates, has every chance of being so in view of the socio-economic advances in the developing countries.

Hevea latex collection is labour-consuming; shortage of and high-priced labour dictate the need for research efforts on labour-saving exploitation systems capable of maintaining a good level of production per hectare[1,2,3]. Stimulation, recommended for thirty years is the usual exploitation method[4] in the Ivory Coast and it allowed tapping intensity to be considerably decreased by replacing full-spirals (S) with half-spirals (½S) while maintaining a good level of production especially since ethephon was used[5, 6].

However, it is the reduction in tapping frequency that allowed labour requirements to be decreased. During the last decade, a weekly tapping system with ½S (d/6 6d/7) has been compared with a twice-weekly tapping control system with ½S (d/3 6d/7). Preliminary results have already been published[7]; this paper reviews the results obtained on various clones and sites for several years.

MATERIAL AND METHODS

The experiments classified according to the clone and the year the experiments commenced are shown in *Table 1.* Seven clones were examined on a total of three sites. The experiments started in 1976, on trees at opening or already exploited trees, according to a split or one-tree plot block statistical design. The international notation of tapping systems is shown in *Appendix A.*

Details of the experimental treatments are shown in *Tables 2–5.* For trees at opening, 5% ethephon was applied. The supporting substance of ethephon was palm oil and various application methods were used: 1 cm on the panel for trees at opening and 2 cm on scraped bark for older trees.

For *Experiments 1C, 1D* and *2C,* latex and coagulated latex (cuplump) production for each

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TABLE 1. DETAILS OF EXPERIMENTS

Clone	Experiment	Commencement	Design (trees per treatment)
GT 1	1 A	7th year of tapping	Block (300)
	1 B	5th year of tapping	Block (360)
	1 C	At opening	Block (400)
	1 D	At opening	Block (560)
PR 107	2 A	7th year of tapping	Block (320)
	2 B	7th year of tapping	Block (300)
	2 C	12th year of tapping	Block (1680)
PB 235	3 A	At opening	Split-plot (320)
	3 B	At opening	One-tree (33)
	3 C	At opening	Block (460)
PB 217	4 A	At opening	One-tree (33)
	4 B	At opening	Block (400)
PR 261	5 A	At opening	One-tree (33)
	5 B	At opening	Block (400)
AVROS 2037	6	At opening	Block (360)
PB 5/51	7	3rd year of tapping	Block (320)

plot was measured and at every tapping, dry rubber content (d.r.c.) was determined. For *Experiments 3C, 4B* and *5B,* cuplump production was measured on a weekly basis. The d.r.c. of cuplump was estimated at 50%. For the other experiments, latex production from several tappings was measured every four weeks. The d.r.c. of the coagula of each treatment was measured at each control to determine dry rubber weight.

Latex analyses to measure d.r.c. and sucrose content were carried out on all the latex collected in one tapping.

The number of trees producing no more latex (dry trees) was counted each year and the percentage of diseased cut length was expressed according to the total cut length, for each treatment (dryness, percentage cut length).

RESULTS

Clone GT 1

The results obtained for GT 1 are shown in *Table 2* and *Figure 1.* For trees at opening *(Experiments 1C* and *1D)* on *Panels BO-1* and *BO-2,* latex production obtained with one weekly tapping (d/7) was always lower than that obtained with twice-weekly tappings (d/3 6d/7), although the number of stimulations was two to three times higher. Response to stimulation was slightly better on scraped bark and with ten stimulations; the cumulative production obtained was 82% of that of the control. With twelve stimulations on the panel, 85% of the production of the control was obtained.

For older trees *(Experiments 1A* and *1B)* on Panels *BI-1* and *BI-2,* relative productions were

TABLE 2. COMPARISON OF WEEKLY AND TWICE-WEEKLY TAPPINGS ON GT 1

Experiment (duration)	Treatment		Production			Dry extract (%)	Sucrose (mm serum)	Dryness	
			Total (g/tree)	Mean (g/tree/year)	Control (%)			Dry trees (%)	Cut length (%)
1 A (9 years)	½S d/3 6d/7 ET 5% Ba 2 (2)	4/y	58 585	6 695	100	39.4	24.6	0.5	2.2
	½S d/6 6d/7 ET 5% Ba Pa 2 (1 + 1)	8/y	52 270	5 974	89	43.1[a]	42.2[a]	1.3	4.6
	½S d/6 6d/7 ET 5% Ba Pa 2 (1 + 1)	10/y	56 278	6 432	96	40.9[a]	42.1[a]	0.4	2.6
1 B (8 years)	½S d/3 6d/7 ET 5% Ba 2 (2)	4/y	45 735	5 901	100	37.3	11.2	14.0	51.0
	½S d/6 6d/7 ET 5% Ba Pa 2 (1 + 1)	8/y	41 985	5 417	92	41.3[a]	20.7[a]	10.0	35.0[a]
	½S d/6 6d/7 ET 5% Ba Pa 2 (1 + 1)	10/y	43 320	5 590	95	35.7	20.6[a]	13.0	33.0[a]
1 C (3 years)	½S d/3 6d/7 ET 5% Ba 2 (2)	4/y	20 152	4 478	100	—	—	7.8	—
	½S d/6 6d/7 ET 5% Pa 1 (1)	8/y	17 151	3 811	85	—	—	5.1	—
1 D (4 years)	½S d/3 6d/7 ET 5% Pa 1 (1)	6/y	16 124	4 031	100	32.2	—	3.6	—
	½S d/6 6d/7 ET 5% Ba 1 (1)	6/y	12 951[a]	3 238[a]	81	34.7[a]	—	0.6	—
	½S d/6 6d/7 ET 5% Ba 1 (1)	8/y	12 800[a]	3 200[a]	80	34.4[a]	—	1.8	—
	½S d/6 6d/7 ET 5% Ba 1 (1)	10/y	13 284[a]	3 321[a]	82	34.0[a]	—	0.4	—
	½S d/6 6d/7 ET 5% Pa 1 (1)	8/y	12 593[a]	3 148[a]	78	35.1[a]	—	1.6	—
	½S d/6 6d/7 ET 5% Pa 1 (1)	10/y	12 422[a]	3 106[a]	77	33.6[a]	—	2.8	—
	½S d/6 6d/7 ET 5% Pa 1 (1)	12/y	13 742[a]	3 436[a]	85	32.5	—	1.5	—

[a]Significantly different from the control at the 0.05 level

TABLE 3. COMPARISON OF WEEKLY AND TWICE-WEEKLY TAPPINGS ON PR 107

Experiment (duration)	Treatment		Production			Dry extract (%)	Sucrose (mm serum)	Dryness	
			Total (g/tree)	Mean (g/tree/year)	Control (%)			Dry trees (%)	Cut length (%)
2 A (9 years)	½S d/3 6d/7 ET 5% Ba 2 (2)	4/y	52 354	5 983	100	34.0	32.8	0.6	4.2
	½S d/6 6d/7 ET 5% Ba Pa 2 (1+1)	8/y	43 833[a]	5 009[a]	84	40.9[a]	32.5	2.1	6.9
	½S d/6 6d/7 ET 5% Ba Pa 2 (1+1)	10/y	48 652	5 560	93	42.0[a]	29.7	0.7	3.7
2 B (2 years)	½S d/3 6d/7 ET 5% Ba 2 (2)	4/y	11 646	5 823	100	34.9	9.6	1.0	9.6
	½S d/6 6d/7 ET 5% Ba Pa 2 (1+1)	10/y	10 445	5 223	90	38.8	8.0	2.3	7.4
2 C (5 years)	½S d/3 6d/7 ET 2.5% Ba 2 (2)	4/y	32 946	6 589	100	38.6	—	10.7	—
	½S d/6 6d/7 ET 4% Ba 1 (1)	10/y	29 535	5 907	90	39.2	—	8.6	—
	½S d/6 6d/7 ET 8% Ba 1 (1)	10/y	31 185	6 237	95	37.2	—	6.9	—
	½S d/6 6d/7 ET 8% Ba 1 (1)	10/y	31 822	6 364	97	37.5	—	8.1	—

[a]Significantly different from the control at the 0.05 level

TABLE 4. COMPARISON OF WEEKLY AND TWICE-WEEKLY TAPPINGS ON PB 235

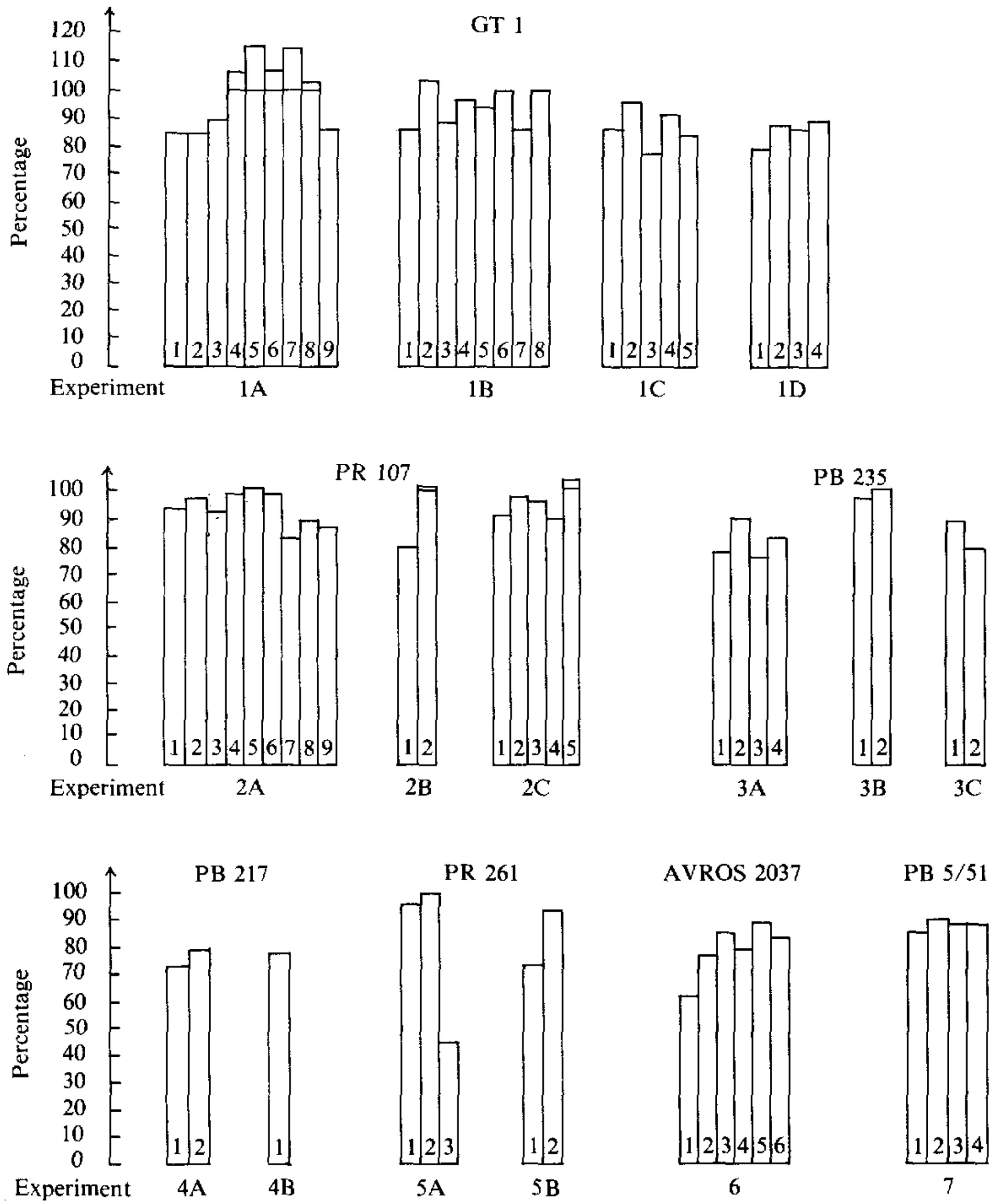
Experiment (duration)	Treatment		Production			Dry extract (%)	Sucrose (mm serum)	Dryness	
			Total (g/tree)	Mean (g/tree/year)	Control (%)			Dry trees (%)	Cut length (%)
3 A (4 years)	½S d/3 6d/7 ET 2.5% Ba 2 (2)	2/y	14 513	3 628	100	33.1	5.5	4.1	20.1
	½S d/6 6d/7 ET 2.5% Pa 1 (1)	4/y	10 795[a]	2 699[a]	74	43.4[a]	9.1[a]	0.0	4.1[a]
	½S d/6 6d/7 ET 2.5% Pa 1 (1)	8/y	11 171[a]	2 793[a]	77	40.7[a]	11.1[a]	0.3	6.8[a]
	½S d/6 6d/7 ET 2.5% Pa 1 (1)	12/y	11 878[a]	2 970[a]	82	39.2[a]	6.3[a]	0.8	8.1[a]
3 B (2 years)	½S d/3 6d/7 Not stimulated		6 289	3 145	100	36.9	10.4	—	3.3
	½S d/6 6d/7 ET 2.5% Pa 1 (1)	4/y	6 216	3 108	99	42.7[a]	7.4[a]	—	10.3
	½S d/6 6d/7 ET 2.5% Ba 2 (2)	2/y	6 632	3 316	100	—	—	9.4	27.7
	½S d/6 6d/7 ET 2.5% Pa (1)	4/y	5 488[a]	2 744[a]	83	—	—	5.2	14.8

[a]Significantly different from the control at the 0.05 level

TABLE 5. COMPARISON OF WEEKLY AND TWICE-WEEKLY TAPPINGS ON SEVERAL CLONES

Clone	Experiment (duration)	Treatment		Production			Dry extract (%)	Sucrose (mm serum)	Dryness	
				Total (g/tree)	Mean (g/tree/year)	Control (%)			Dry trees (%)	Cut length (%)
PB 217	4 A	½S d/3 6d/7 ET 2.5% Ba 2 (2)	4/y	6 238	3 119	100	31.2	28.4	—	0.6
	(2 years)	½S d/6 6d/7 ET 2.5% Pa 1 (1)	8/y	4 489[a]	2 427[a]	72	39.7[a]	19.7[a]	—	1.3
		½S d/6 6d/7 ET 2.5% Pa 1 (1)	12/y	4 853[a]	2 427[a]	78	37.7[a]	22.4[a]	—	3.3
	4 B	½S d/3 6d/7 ET 2.5% Ba 2 (2)	2/y	2 752	2 752	100	—	—	0.7	—
	(1 year)	½S d/6 6d/7 ET 2.5% Pa 1 (1)	6/y	2 113[a]	2 113[a]	77	—	—	0.2	—
PR 261	5 A	½S d/3 6d/7 ET 2.5% Ba 2 (2)	4/y	6 600	2 200	100	35.0	28.0	—	0.8
	(3 years)	½S d/6 6d/7 ET 2.5% Pa 1 (1)	8/y	4 147[a]	1 382[a]	63	42.7[a]	30.0	—	0.0
		½S d/6 6d/7 ET 2.5% Pa 1 (1)	12/y	4 923[a]	1 641[a]	75	41.2[a]	27.2	—	2.1
	5 B	½S d/3 6d/7 ET 2.5% Ba 2 (2)	3/y	3 179	1 907	100	—	—	1.4	—
	(2 years)	½S d/6 6d/7 ET 2.5% Pa 1 (1)	8/y	2 708[a]	1 624[a]	85	—	—	1.6	—
AVROS 2037	6	½S d/3 6d/7 ET 5% Ba 2 (2)	4/y	26 723	4 647	100	—	—	16.0	19.4
	(6 years)	½S d/6 6d/7 ET 5% Pa 1 (1)	10/y	21 789[a]	3 789[a]	82	—	—	7.0[a]	10.1[a]
PB 5/51	7	½S d/3 6d/7 ET 5% Ba 2 (2)	4/y	19 948	4 987	100	36.5	4.2	—	—
	(4 years)	½S d/6 6d/7 ET 5% Ba 2 (1)	6/y	17 504[a]	4 376[a]	88	37.1	4.2	—	—

[a]Significantly different from the control at the 0.05 level



The number at the bottom of each column indicates the number of years after the beginning of the experiment.

Figure 1. Production of weekly tapping (d/6 6d/7) as a percentage of twice-weekly tapping (d/3 6d/7).

higher and amounted to 95% to 96% of that of the control; they were better because the number of stimulations was high. *Figure 1* showed better production of trials on d/7 frequency from the fourth to the eighth year in *Experiment 1A*. The control was at the bottom of the panel while d/7, with a lower bark consumption, was less prone to the phenomenon of panel brake and exhibited better response to stimulation.

During the last trial, upward tapping with ½S on *Panel HO-1* was carried out and the control treatment recovered its advantage.

Latex analyses showed that the percentage of dry extract was usually above that of the control, especially for trees tapped on d/7 frequency which were the least often stimulated. In all the cases, sucrose contents were twice as high as that of trees tapped on d/7 frequency.

It was observed that decreased frequency of tapping had a favourable effect on percentage incidence of dry trees and diseased cut length. On old trees, the percentage was negligible with upward ½S system *(Experiment 1A)* and relatively high with downward ½S system *(Experiment 1B)*.

Clone PR 107

The results of the three experiments carried out on PR 107 *(Table 3* and *Figure 1)* showed that production obtained with ½S d/3 6d/7 was rarely achieved with ½S d/7. A significant effect of the number of stimulations on production was observed over nine years *(Experiment 2A)*.

An effect of the concentration of the stimulant was also observed *(Experiment 2C)*, the best production being obtained with 8% active ingredient. Efficacy was identical with the panel or scraped bark methods of application. With ten annual applications, production obtained with tapping on d/7 was 90% to 97% of that on d/3 6d/7 frequency under four annual stimulations.

Latex d.r.c. were equal to or higher than that obtained with the control. On the other hand, no significant difference in sucrose contents was observed between the two treatments.

Similarly, the percentage of dry trees or diseased cut length was not affected by decreased frequency of tapping.

Clone PB 235

With clone PB 235, preliminary results obtained *(Table 4* and *Figure 1)* showed a significant effect of the number of stimulations on the production obtained with the ½S d/7 system. With twelve annual stimulations, against two for the control, hardly 82% of the production obtained on d/3 frequency was achieved. When the control was not stimulated *(Experiment 3B)*, four annual stimulations led to a production identical to that of the control.

For treatments on lower frequency, d.r.c. were significantly higher. Sucrose contents were significantly higher than in the stimulated control *(Experiment 3A)* and significantly lower than in the non-stimulated control *(Experiment 3B)*.

Similarly, the percentage of dry trees due to bark dryness and the percentage of diseased cut length were lower for trees tapped on d/7 frequency than for trees tapped on d/3 frequency under stimulation.

Other Clones

Recent experiments on PB 217 showed that the relative production values of d/7 were lower than those of d/3 6d/7 by 80%. Dry extract was significantly higher and sucrose contents were significantly lower. Again, there was a very small percentage of diseased or dry trees *(Table 5)*.

The same applied to PR 261, which seemed ill-adapted to reduced frequencies, especially in the third year of tapping where only 45% of the production of d/3 6d/7 was obtained *(Figure 1)*.

For AVROS 2037, an increase in the relative production value of d/7 was observed compared to the production of d/3 6d/7 which stabilised around 85% and had a much lower bark dryness rate.

On the other hand, this relative value for PB 5/51 did not vary and amounted to 88%. Latex characteristics were identical for both treatments.

DISCUSSION

Generally, productions obtained with ½S d/7 were lower than those obtained with ½S d/3 6d/7 by 5% to 30%. Despite a higher number of stimulations, it was impossible to offset the decrease in production observed with decreased frequency.

Hevea production depends, on the one hand, on flow duration, which mainly depends on cut length and stimulation, and on the other hand, on latex regeneration capacity between two tappings, which is a function of frequency of tapping.

Without stimulation, the yield in gramme per tapper per tree of trees tapped on d/7 was higher than that of trees tapped on d/3 6d/7[8]. A suitable stimulation, which extends latex flow, should make it possible to obtain a yield identical to that of trees tapped on d/3: the lower the tapping intensity is, the better are the sucrose contents[9] and response to stimulation[10].

For GT 1, the best productions on d/7, compared with those of d/3 6d/7 were obtained on old trees *(Experiments 1A* and *1B)* where the total dose of active ingredient supplied was slightly higher than double of that supplied to the control, contrary to the experiments carried out on trees at opening where the doses supplied were lower.

The best physiological status of the trees tapped on d/7 (higher d.r.c. and sucrose content, lower bark dryness) compared with trees tapped on d/3 6d/7, seemed to indicate that these trees were under-exploited. Some experiments had been altered to obtain a production per tree identical to that of the control.

In the case of GT 1, where panel brake played a major role, production was better since the tapping cut was supplied with a higher dose of active ingredient. With d/7 frequency, bark consumption was lower than with d/3 6d/7 and the height of renewed bark above the tapping cut was lower. The decrease in production of d/3 was much quicker than that of d/7, leading the latter to a production that was equal or higher than that of d/3 *(Experiment 1A).* This phenomenon disappeared when the tapping cut was under upward tapping or panel upchanging system.

As far as the other clones are concerned, production increased with stimulation intensity. *Figure 2* shows that for all clones, there was a good correlation between the ratios of production and amount of active ingredient supplied on d/7 compared with d/3 6d/7. The amount of active ingredient had to be four times higher on d/7 to obtain a production equal to that obtained on d/3 under stimulation.

Besides increasing production per day considerably, tapping on d/7 also had the advantage of leading to a lower bark consumption, which is appreciably panel-saving. This is particularly important in the case of upward tapping. Panel-saving extends the duration of tapping and allows renewed bark to be less often exploited.

Increased production per tapping, due to extended latex flow, increased the amount of secondary rubber and required more frequent second collections as well as more adaptable collecting containers. The hazards of loss due to rain are also higher. However, the disadvantages that can be solved technically are greatly compensated for by the economic advantages of tapping on d/7.

The choice of a tapping system depends on a compromise between production per hectare and that of productivity per tapper. A high production per hectare will maximise the revenue and a high production per tree and per tapping will minimise the costs. The results of the experiments show that the first objective was achieved with tapping on d/3 6d/7 and the second with d/7.

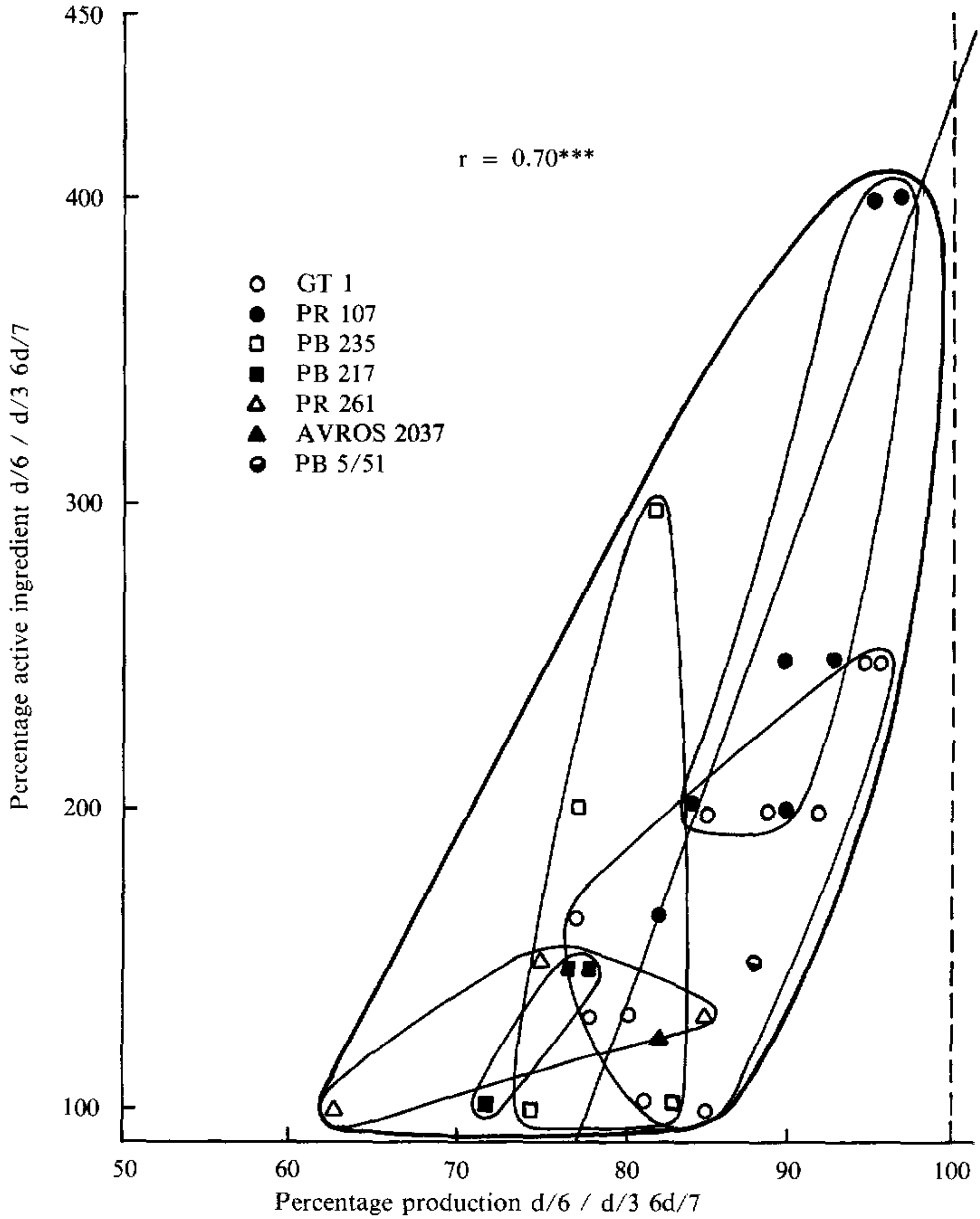


Figure 2. Production and amount of active ingredient supplied by stimulation.

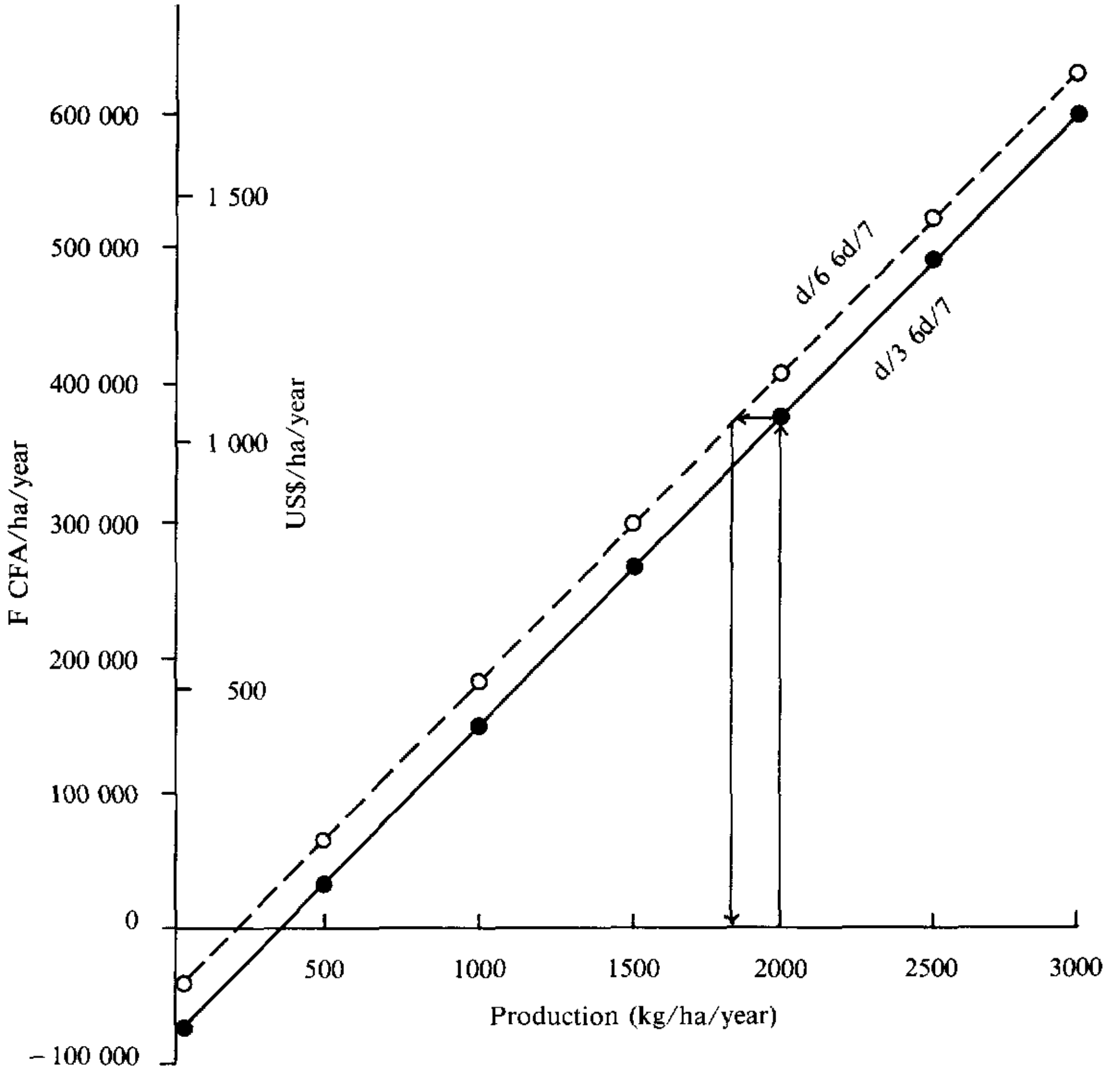


Figure 3. Comparison of profitability of conventional and weekly tapping according to production potential.

This economic study is limited to the case of an existing plantation (where all the infrastructures are established). Revenue *(R)* is dependent mainly on selling price of rubber and costs *(C)* of daily wages *(Appendix B)*.

Figure 3 which compares profitability of tappings on d/3 6d/7 and d/7 according to production potential shows that with 2 *T* per hectare on d/3 6d/7, a minimum of 1.86 *T* per hectare on d/7 is necessary for this system of exploitation to be profitable *(Appendix C)*.

The profitability threshold of d/7 is reached when the difference between revenue and costs is equal for both systems of exploitation. *Figure 4* shows the percentage of production obtained with d/3 6d/7 according to the daily

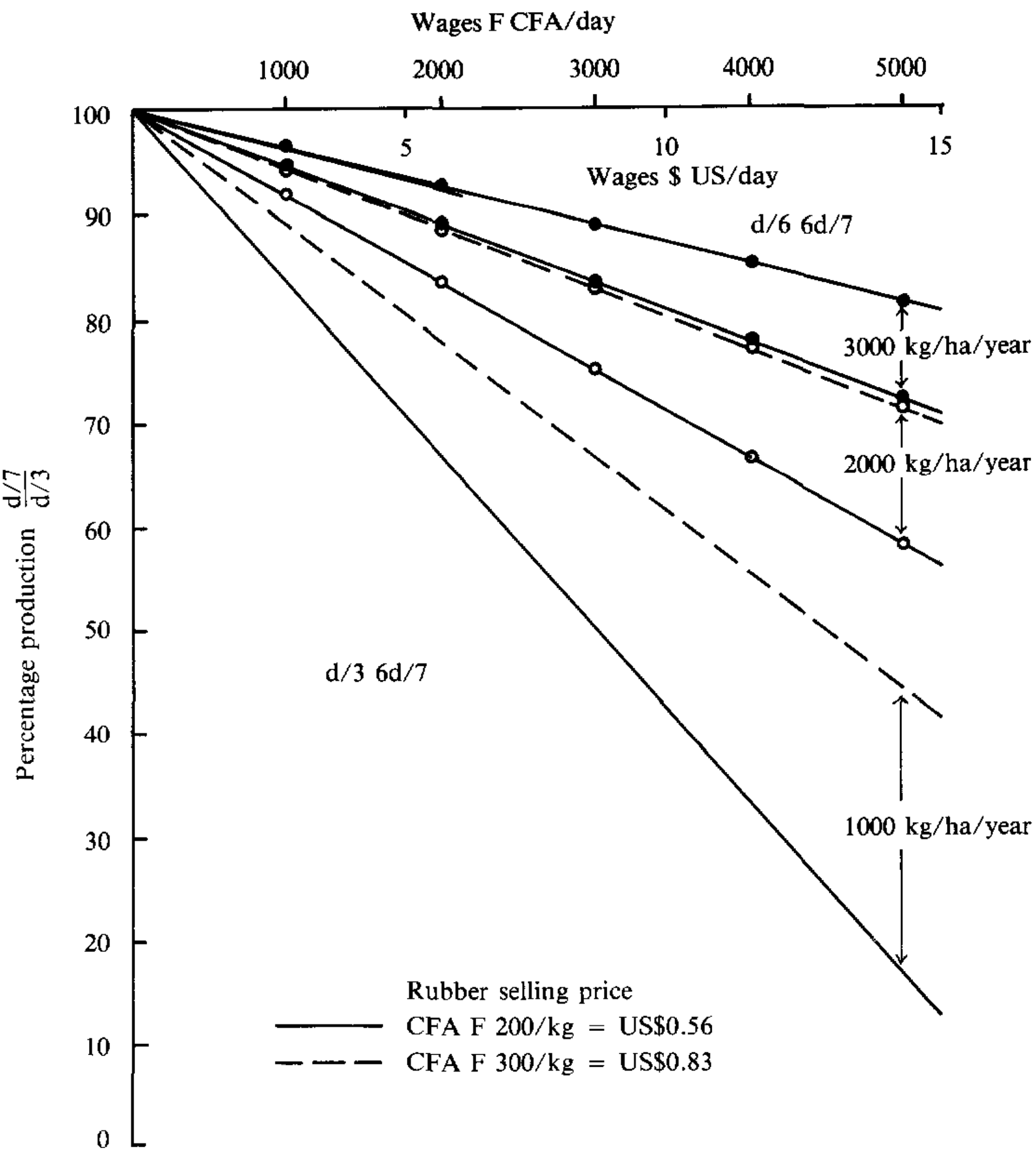


Figure 4. Profitability threshold of weekly tapping (d/6 6d/7) for various production values of conventional tapping (d/3 6d/7) according to the daily wages of one tapper and two hypotheses of prices for the rubber delivered to the factory.

wages of one tapper and to various hypotheses of price for the rubber delivered to the factory to reach the profitability threshold.

The threshold will be easier to reach since the production difference $Y_3 - Y_7$ is large. This production difference increases and the Y_7/Y_3 ratio decreases when the tapper's daily wages increase and the price of rubber decreases.

Figure 4 shows that the higher the cost of labour is, the lower the profitability threshold gets. Thus, with a production of 1000 kg per hectare per year with d/3 6d/7, d/6 6d/7 is more profitable than d/3 6d/7 if its production amounts to at least 83% of the production of the latter, when labour costs are CFA F 1000 per day (*i.e.* US$2.78). If labour cost equals CFA F 3000 (*i.e.* US$8.33), d/6 6d/7 will be more profitable than d/3 if its production amounts to at least 50% of the production of the latter.

The profitability threshold is lower when the price of latex is lower and the more the level of production of d/3 is important, the more important will be the relative production of d/7 *versus* d/3.

In the Ivory Coast the thresholds are 86%, 93% and 95% for yields of 1000 kg, 2000 kg and 3000 kg per hectare per year on the d/3 6d/7 system.

CONCLUSION

Weekly tapping, as currently carried out in the Ivory Coast, does not give the same yield in kilogrammes per hectare as twice-weekly tapping.

Latex properties and tree physiological conditions are better than those obtained with tapping on d/3 6d/7: the trees are under-exploited, as stimulation intensity is not high enough to compensate for the decrease in production due to the reduction in tapping frequency.

The decrease in labour requirements per hectare together with a drop in bark consumption can, under some conditions, make this system of tapping economically more interesting than the conventional one, especially if labour is rare and expensive.

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APPENDIX A

INTERNATIONAL NOTATION OF TAPPING SYSTEMS

Tapping parameter	Variation in parameters	Significance
Tapping cut	Length	S (full-spiral), ½S (half-spiral),. ¼S (quarter) ...
	Direction	½S $\uparrow$ (upward half-spiral)
	Combination of cuts	½S + ¼S $\uparrow$ (2 cuts tapped the same day)
		½S, ⅓S $\uparrow$ (2 cuts tapped alternately)
Frequency and annual number of tappings	Theoretical	d/3 (tapping every 3 days)
	Practical	d/3 6d/7 (tapping every 3 days out of 6 tapping days a week, *i.e.* alternate frequency 3 days/4 days)
	Periodicity	10m/12 (10 months tapping followed by two months rest)
Panel	Position of the cut on the trunk	H (above the height of opening)
		B (below the height of opening)
	Type of bark	O, I, II (virgin bark, first or second renewed bark)
	Rotation around the trunk	1,2,3,4 (1st, 2nd, 3rd, 4th panel exploited clockwise)
Stimulant	Active ingredient	ET (Ethephon)
	Concentration	2.5% (concentration of active ingredient)
	Amount of mixture	4/2 (4g per tree on a width of 2 cm)
	Application method	Pa (on the panel, above the cut)
		Ba (on scraped bark)
		Ga (on the cut, with removal of lace)
		La (on the cut, without removal of lace)
	Number of stimulations per year and frequency	1/t (once per tapping)
		4/y (4 applications a year)
		12/y (4 w) (12 times a year every 4 weeks)
Particular case of periodic tapping	Number	4: (4 injections per band)
	Placing	PI (on a vertical band)
		PS (on a spiral band)
	Size of the band	50 (2) band of 50 cm in length and 2 cm in width

Example of notation: ½S $\downarrow$ d/3 6d/7 10m/12 (2xy) ET 5% Ba 2/2 4/y

Significance: downward half-spiral
tapping every 3 days with 6 working days, *i.e.* d/3 d/4
tapping 10 months out of 12 (with 2 months rest)
annual
ethephon stimulation at 5% active ingredient
application of 2 g of stimulant mixture per tree on scraped bark on a 2 cm band
four applications of stimulant a year.

APPENDIX B

NET REVENUE PER HECTARE PER YEAR

Net revenue = Gross revenue − Exploitation costs

Gross revenue: $R = Y\,[(1 - z)(P_1 - a) + zP_2 + d]$

where Y = yield per hectare per year

z = percentage of lower grades

P_1 = price of latex grade

P_2 = price of lower grade

a = incentive rate for latex

d = transport costs to the factory

Exploitation costs: Tapping + Stimulation + Second collection cost

$$C = W.\,N.\,\frac{D}{T} + S + B$$

where W = daily wages (including premiums, social charges, supervision)

N = annual number of tappings per hectare

D = density of tappable trees per hectare

S = stimulation costs per hectare per year

B = cost of second latex collection

T = task (trees per tapper)

APPENDIX C

EXAMPLES OF REVENUE AND COSTS OF WAGES IN THE IVORY COAST

Assuming that:

z	=	30%
a	=	US$0.017 per kilogramme dry rubber
d	=	US$0.023 per kilogramme dry rubber
D	=	350 trees per hectare
T	=	550 trees per tapper
N_3	=	104 days for d/3 6d/7
N_7	=	52 days for d/6 6d/7
S_3	=	US$18.4 per hectare per year for ET 5% 2 (2) 4/y
S_7	=	US$17.0 per hectare per year for ET 5% 1 (1) 10/y
B_3	=	US$1.75 per hectare per year (d/3, 4 second collection)
B_7	=	US$4.36 per hectare per year (d/7, 10 second collection)

Today for: P_1 = US$0.714 per kilogramme and W = US$2.86 per day

P_2 = US$0.591 per kilogramme

$R_3 - C_3$ = 0.688 Y_3 − US$209.4

$R_7 - C_7$ = 0.688 Y_7 − US$116.0

$Y_3 - Y_7$ = 136 kg per hectare per year

if Y_3 = 2000 then Y_7 = 1864 kg per hectare per year