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Panel Management in Rubber (Hevea brasiliensis) *Tapping and Impact on Yield, Growth, and Latex Diagnosis*

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This study investigates the impact of four tapping-panel management strategies on cumulative yield, growth and laticifer physiology of trees. These strategies were applied to clones PB 260, GT 1, PB 217, and AF 261, belonging to fast, moderate and low metabolic activity, during nine years in south-eastern Côte d'Ivoire. The reaction of clones to tapping systems was often dependent on their class of metabolic activity. For all clones, panel management strongly influenced the annual yield. After nine years, however, the cumulative rubber yield did not vary with panel strategy for PB 260, GT 1, and PB 217. Only clone AF 261, a low-yielding clone not recommended for planting, showed different behaviour. Panel management did not influence the girth increment of trees at nine years for all clones, except for GT 1. For this clone, no panel changing management was more favourable to girth increment than the other strategies. The yield and growth results confirm the known negative relationship between yield and girth increment of the trunk. Physiology of the latex cell was influenced by the panel-management strategies for each period of tapping. Latex diagnosis could be used for monitoring year-to-year consecutive tapping on the same panel, to decide whether to change to the other panel if any important physiological stress was detected.

Key words: *Hevea brasiliensis*; latex yield; latex physiology; growth; latex diagnosis; tapping panel; dryness; PB 260; GT 1; PB 217; AF 261; Côte d'Ivoire

Latex is extracted from rubber trees by a multi-annual tapping system that may last over 30 years[1,2]. In Côte d'Ivoire, farmers use a half-spiral downward system (½S) with a frequency of two tappings every week (d/3 2d/7), or three tappings every two weeks (d/4 3d/14). A minimum of ten years of downward tapping is possibly followed by a quarter-spiral (¼S) upward system[2]. Panel changing is generally considered useful for reducing the physiological stress generated in a panel by tapping[3]. Panel changing after the first two tapping years has been generalised on clones in Côte d'Ivoire. The tapping system technology has been backed by in-depth research on the physiology of laticifer tissue[4–7]; this research has led to the development of latex diagnosis[8] and clonal metabolic typology[9–11].

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Field trials were set up to adapt panel management for each metabolic type of clone. This study compared four panel management strategies differing by the number of panel changes over nine years. These treatments were applied to four clones: PB 260, GT 1, PB 217, and AF 261. The objective is to determine the impact of these strategies on the cumulated yield after different periods, on the growth of the trees, and on laticifer physiology. The experimental study was conducted over a nine-year period.

METHODS

Plant Material

Clones PB 260, GT 1, PB 217, and AF 261 were studied in the CNRA research station of Bimbresso in Côte d'Ivoire. They were opened for tapping at the standard girth on the trunk (50 cm) at 1.2 m from the ground. Tapping began in year 1988 for PB 217, and in 1990 for the three other clones. The tapping system was ½S d/3 6d/7 12m/12 ET 2.5% Pa 1(1). The experimental design was the one-tree plot design with 33 trees per treatment and a total randomisation of all the trees. Trees with equal size were selected at the beginning of each trial. The four treatments presented hereafter (*Figure 1*) involved up to seven panel changes over nine years.

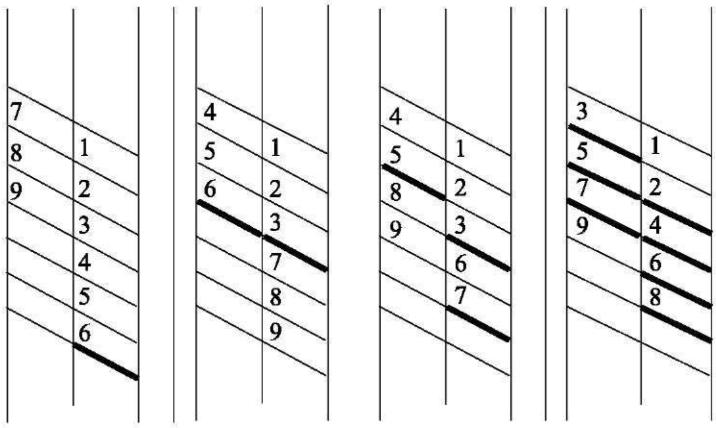
Clonal Typology and Latex Diagnosis

The four clones represent main types in the clonal typology of the laticiferous metabolism established by CIRAD and CNRA[9,10]. This clonal typology is based on measurements issued from latex diagnosis[8,12], especially sucrose content (Suc, in mM per litre of latex), inorganic phosphorus content (Pi, in mM per litre of latex) and thiols ratio (R-SH, in mM of latex). Suc reflects the balance between the consumption of sucrose by the laticifers (for the production of energy and for rubber biosynthesis) and the loading of sucrose from the apoplasm into the laticifers. Pi indicates the intensity of the metabolic activity of the laticifers. R-SH indicates the efficiency of scavengers counteracting oxidative stress. Within this framework, PB 260 is considered an active clone, which is reflected by a high Pi and a low Suc; GT 1, with a medium Pi and a medium Suc, has a good response to stimulation; PB 217, with a medium Pi and a high Suc, can be activated by intensive stimulation and has a very good yield response; AF 261, with a low Pi and a high Suc, can hardly be activated by intensive stimulation and has only a medium yield response.

In these trials, the number of stimulation per year for clones PB 260, GT 1, PB 217, and AF 261 were 2, 6, 8, and 8 during tapping year 1 and 2, and then 4, 8, 10, and 10 during tapping year 3 to 9, respectively.

Measurements and Data Processing

To measure latex yield per tree, the cumulative coagulated rubber production of each tree was weighed every four weeks. Total solid content was measured for a bulk in each treatment in order to convert yields into grams of dry rubber per tree. The girth of the trees were measured every year at 1.70 m above ground level. One latex diagnosis per treatment and per clone was carried out, tree by tree, every year between September and December (data of the first 2 years were not available for clone PB 217). The biochemical parameters were analysed using methods developed by CIRAD and CNRA[8] adapted in 1995 by IRRDB[13]. Statistical analysis of latex yield, girth, and girth increment was done by the SAS statistical



Treatment	A	B	C	D
Number of panel changes	One panel change after year 6	Two panel changes after year 3 and 6	Three panel changes after year 3, 5 and 7	Seven panel changes after year 2, 3, 4, 5, 6, 7 and 8
At year 3	0	0	0	1
At year 6	0	1	2	4
At year 9	1	2	3	7

Figure 1. The four panel management systems.
Numbers of panel changes are indicated according to each period of tapping as follows: years 1–3, 4–6 and 7–9.
A : No panel change (1PC) on Panel BO-1 *and* BO-2 *opened in year 7 at 1.40 m;*
B : Triennial panel change, i.e., *two panel changes (2PC) after 3 and 6 years;*
C : Biennial panel change after three years on Panel BO-1, i.e. *three panel changes (3PC) after 3, 5 and 7 years;*
D : Annual panel change after two years on BO-1 *(control),* i.e. *seven panel changes (7PC) after 2, 3, 4, 5, 6, 7 and 8 years.*

software[14] with the Student-Newman-Keuls test, at $P < 0.05$.

RESULTS

Latex Yield

Table 1 shows the cumulative latex yield of the four clones after 3, 6, and 9 years (Cy3, Cy6, and Cy9, respectively). The average Cy9 (over the four treatments) of PB 260 was higher than that of GT 1, PB 217 (+ 16%) and AF 261 (+ 67%); the Cy9 of AF 261 was much lower than that of GT 1 and PB 217 (–30%).

After a three-year tapping period, Cy3 of *Treatments A, B,* and *C*, with no panel change, had similar yield. The yield of *Treatment A* was lower than that of *Treatment D*, with 1 panel

TABLE 1. CUMULATIVE YIELD (KG/TREE) AFTER THREE, SIX, AND NINE YEARS OF TAPPING ACCORDING TO PANEL CHANGING FREQUENCY FOR EACH CLONE

Clone/Panel change			Yield A (1PC) One panel change after year 6	B (2PC) Triennial panel change	C (3PC) Biennial panel change after year 3	D (7PC) Annual panel change after year 2	Average
PB 260	Cy3:	Year 1 to 3	12.9 b	12.5 b	13.5 ab	13.9 a	13.20
	Cy6:	Year 1 to 6	25.4 b	31.3 ab	32.9 a	34 a	30.90
	Cy9:	Year 1 to 9	52.8 a	45.2 b	54.1 a	53 a	51.28
GT 1	Cy3:	Year 1 to 3	9.7 b	10 ab	10.5 ab	10.6 a	10.20
	Cy6:	Year 1 to 6	23.4 b	29.4 a	29.8 a	28.7 a	27.83
	Cy9:	Year 1 to 9	49.1 a	42.6 ab	44.3 ab	41.9 b	44.48
PB 217	Cy3:	Year 1 to 3	9.3 a	9.3 a	9.1 a	9.1 a	9.20
	Cy6:	Year 1 to 6	22.2 b	23 b	24.2 ab	25 a	23.60
	Cy9:	Year 1 to 9	44.4 a	42.4 b	42.8 ab	45 a	43.65
AF 261	Cy3:	Year 1 to 3	7.7 a	7.4 a	7.5 a	6.1 b	7.18
	Cy6:	Year 1 to 6	20.3 a	15.7 b	18.2 ab	17.2 b	17.85
	Cy9:	Year 1 to 9	31.4 a	30.4 a	30 a	31 a	30.70
Average	Cy3:	Year 1 to 3	9.9	9.8	10.2	9.9	
	Cy6:	Year 4 to 6	22.8	24.9	26.3	26.2	
	Cy9:	Year 7 to 9	44.4	40.2	42.8	42.7	

Mean affected by the same letter are not significant (P<0.05)

change, for clones PB 260 and GT 1 (–7% and –8%, respectively). *Treatments A, B,* and *C* were equivalent to *Treatment D* for clone PB 217. Yield of *Treatment A, B,* and *C* was higher than yield of *Treatment D* for clone AF 261.

After a six-year tapping period, Cy6 of *Treatment A*, with no panel change, had lower yield than that of *Treatment D*, with four panel changes, for clones PB 260, GT 1, and PB 217. The yield increase of *Treatment D* over *Treatment A* was 34% for PB 260, 23% for GT 1, and only 13% for PB 217. Conversely, *Treatment A* was a higher producer than *Treatment D* for clone AF 261 (+18%).

After a nine-year tapping period, the yield of *Treatment A* was equivalent to *Treatments C* and *D* with clones PB 260, PB 217, and AF 261 or even higher than for clone GT 1 (+17%). *Treatment A* had higher yield than *Treatment B* for clones PB 260 and PB 217 (+17% and +5%, respectively) while the yield of *Treatment B* was lower than *Treatment C* for clone PB 260 (–16%). With *Treatments C* and D, Cy9 did not differ whatever the clone.

Figure 2 shows the evolution of the yield per tree per year from year one to year nine. For PB 260 and GT 1, *Treatment A* yield was low in the second tapping period (year four to six), and high in the third tapping period (year seven to nine). This trend was less pronounced for PB 217. For AF 261, the trend was reversed.

Considering *Treatment B*, a drop in yield was observed during years eight and nine, particularly for PB 260, when the base of *Panel BO-1* was tapped.

Girth Increments

Table 2 shows girth increments Gi2-3, Gi4-6, and Gi7-9 corresponding to the three tapping periods, year two to three, year four to six and year seven to nine (no data available for year one), as well as the total girth increments Gi2-9 over year two to nine. The average increments Gi2-3, Gi4-6, Gi7-9, and consequently Gi2-9 of PB 217 and of AF 261 were comparable and higher than those of GT 1 and of PB 260, which were equivalent.

For GT 1 only, Gi2-3 of *Treatment A* was significantly higher than that of *Treatment D*. For PB 260 and GT 1, Gi4-6 of *Treatment A* was higher than that of *Treatment B*. Moreover, for GT 1, Gi4-6 of *Treatment A* was also higher than that of *Treatments C* and *D*. For PB 260, Gi7-9 of *Treatment A* was lower than that of *Treatment D*. For AF 261, Gi7-9 of *Treatment A* was higher than that of *Treatment B*. For Gi2-9, there was no difference between the four treatments except for GT 1. For this clone, Gi2-9 of *Treatment A*, was statistically comparable to that of *Treatment B* and was higher than that of *Treatments C* and *D*, their cumulative girth increments (Gi2-9) however, were comparable.

Relationship of Yield and Girth Increment

In most cases, high production indexes were associated with low girth increment indexes, and *vice versa*. *Figure 3* shows the significant negative relationship (with alpha threshold of 0.05) between the 48 yield indexes and the 48 trunk girth increment indexes (df = 46, r = –0.77). The correlation coefficients for each clone (with df = 10) were –0.88 for PB 260, –0.94 for GT 1, –0.61 for PB 217, and –0.63 for AF 261.

Figure 4 shows the relation between girth of trunk after six years of tapping (G6), and the cumulative yield of the following third tapping period (Y7-9) for the four treatments and for the four clones. Four dots were separated from the main linear trend. One dot corresponds to *Treatment B* for PB 260: a very low relative yield was associated with a girth of high level; this case seems to be specific of the interaction between this clone and this treatment. The three other dots correspond to *Treatments B*, *C*, and *D* for AF 261: relatively high yields were associated with a high girth level. Apart from those four dots, G6 and of Y7-9 were strongly correlated. This relationship is mainly due to the difference between *Treatment A* and *Treatment D* for PB 260, and to the difference between *Treatment A* and *Treatments B*, *C*, and *D* for GT 1. In these cases, the higher the trunk girth after 6 years, the higher the yield in the next tapping period.

Latex Diagnosis

Figures 5, *6*, and *7* show the evolution of the annual sucrose (Suc), inorganic phosphorus (Pi) and thiols (R-SH) contents. Note the low content of Suc for PB 260, the high content of Suc for PB 217, and the low content of Pi for AF 261.

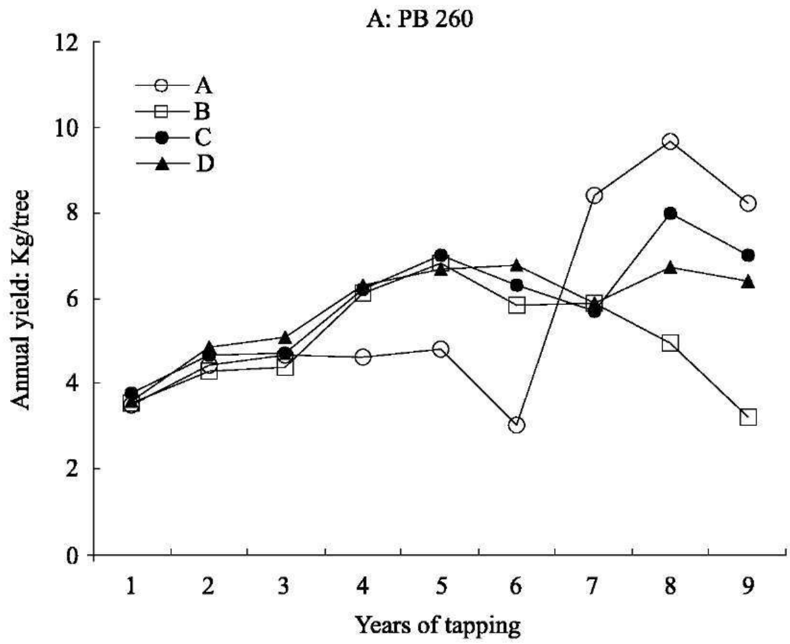
TABLE 2. GIRTH INCREMENT (CM/YEAR) IN THE 3 PERIODS OF TRIENNIAL TAPPING, ACCORDING TO PANEL CHANGING FREQUENCY FOR EACH CLONE

Clone/Panel change		Girth increment A (1PC) One panel change after year 6	B (2PC) Triennial panel changing	C (3PC) Biennial panel change after year 3	D (7PC) Annual panel change after year 2	Average
PB 260	Gi2-3: Year 2 to 3	6.94 a	6.62 a	7.05 a	6.60 a	6.80
	Gi4-6: Year 4 to 6	8.87 a	5.90 b	7.20 ab	7.38 ab	7.34
	Gi7-9: Year 7 to 9	2.97 b	4.20 ab	3.83 ab	4.56 a	3.89
	Gi2-9: Year 2 to 9	18.78 a	16.72 a	18.08 a	18.54 a	18.03
GT 1	Gi2-3: Year 2 to 3	9.89 a	8.11 ab	7.51 ab	6.39 b	7.98
	Gi4-6: Year 4 to 6	8.27 a	4.92 b	4.48 b	5.13 b	5.70
	Gi7-9: Year 7 to 9	4.21 a	5.76 a	5.33 a	4.77 a	5.02
	Gi2-9: Year 2 to 9	22.37 a	18.79 ab	17.32 b	16.29 b	18.69
PB 217	Gi2-3: Year 2 to 3	8.67 a	8.89 a	8.68 a	8.94 a	8.80
	Gi4-6: Year 4 to 6	8.70 a	8.22 a	7.48 a	8.93 a	8.33
	Gi7-9: Year 7 to 9	6.61 a	6.70 a	7.70 a	8.45 a	7.36
	Gi2-9: Year 2 to 9	23. 98 a	23.81 a	23.86 a	26.32 a	24.5
AF 261	Gi2-3: Year 2 to 3	9.37 a	7.93 a	8.49 a	8.63 a	8.61
	Gi4-6: Year 4 to 6	9.24 a	8.33 a	8.24 a	8.48 a	8.57
	Gi7-9: Year 7 to 9	8.31 a	4.96 b	6.70 ab	6.46 ab	6.61
	Gi2-9: Year 2 to 9	26.92 a	21.22 a	23.43 a	23.57 a	23.79
Average	Gi2-3: Year 2 to 3	6.94 a	6.62 a	7.05 a	6.60 a	6.80
	Gi4-6: Year 4 to 6	8.87 a	5.90 b	7.20 ab	7.38 ab	7.34
	Gi7-9: Year 7 to 9	2.97 b	4.20 ab	3.83 ab	4.56 a	3.89
	Gi2-9: Year 2 to 9	18.78 a	16.72 a	18.08 a	18.54 a	18.03

Mean affected by the same letter are not significant (P<0.05)

The sucrose content of the latex was sensitive to panel changes (*Figure 5*). Consecutive tapping years on *Panel BO-1* were detrimental to the sucrose content for all clones. Each change over on *Panel BO-2* was favourable to the sucrose content. As previously seen for annual yield, an opposite trend was observed between *Treatment A* and *Treatment B*, except for AF 261 in year 7, 8, and 9. For all clones, the sucrose content of *Treatment A* was the highest at the opening of *Panel BO-2* in year 7.

With clones PB 260 and GT 1 , *Treatment A* had a lower Pi content in year 4, 5, and 6, followed by a sharp increase in the 7th year for clones PB 260, PB 217 and GT 1 with the high level only for PB 260, consecutive to the opening of *Panel BO-2* (*Figure 6*). The trend



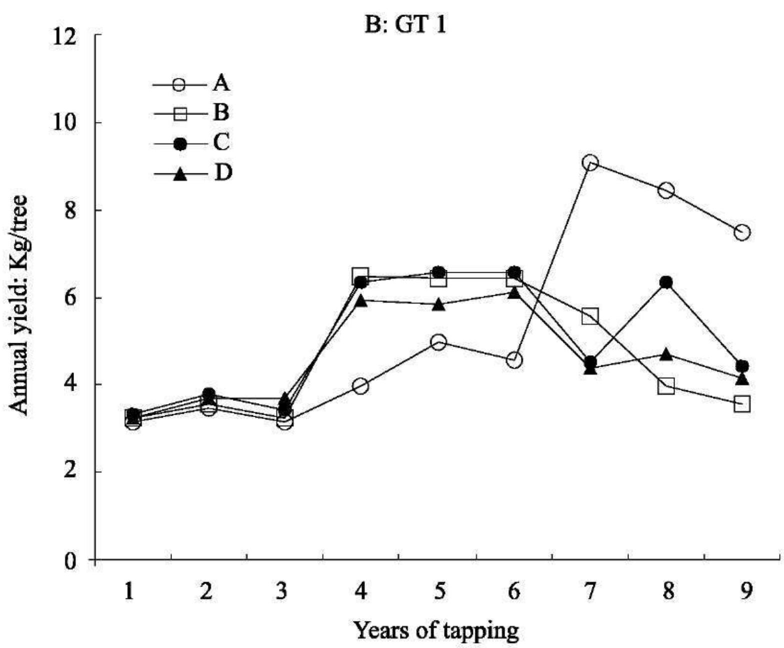
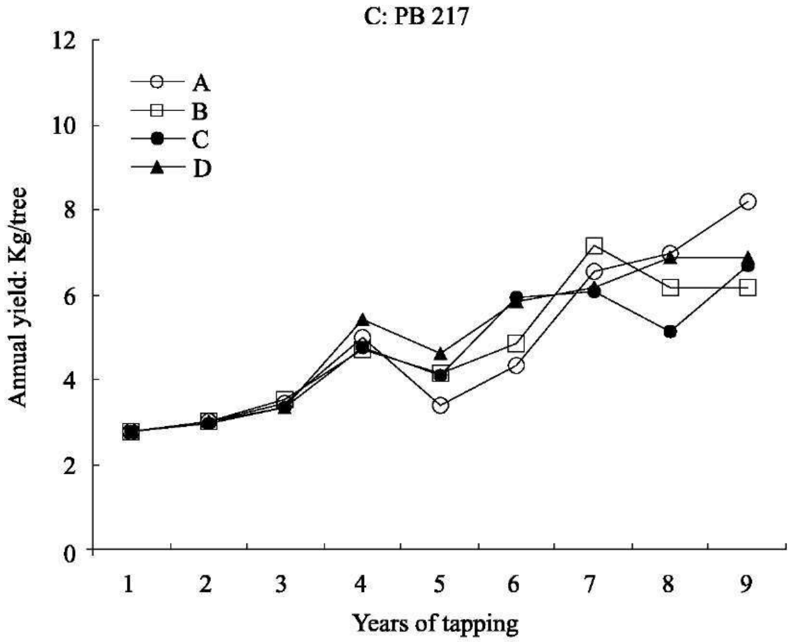


Figure 2. Annual yield (kg/tree) per treatment and per clone.
A: No panel change (1PC); B: Triennial panel change; C: Biennial panel change after three years on Panel BO-1*; D: Annual panel change after two years on* BO-1 *(control).*



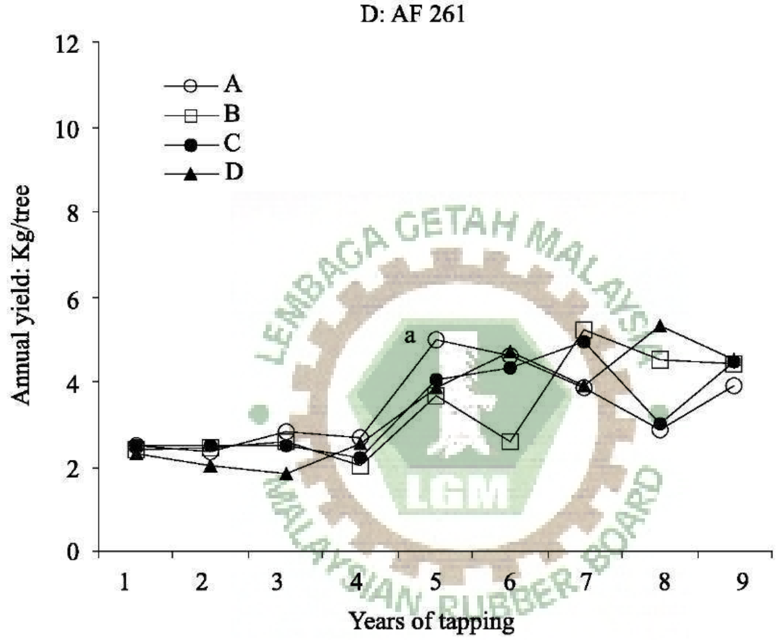


Figure 2 (Cont.). Annual yield (kg/tree) per treatment and per clone.
A: No panel change (1PC); B: Triennial panel change; C: Biennial panel change after three years on Panel BO-1*; D: Annual panel change after two years on* BO-1 *(control).*

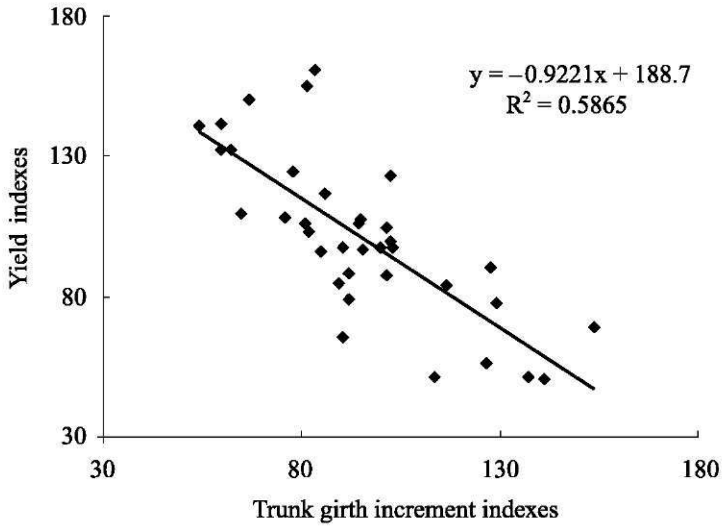


Figure 3. Relationship between yield and girth increment for the 3 periods of tapping for all clones ($df = 46$; $r = -0.77$). Index 100 is assigned to Treatment A.

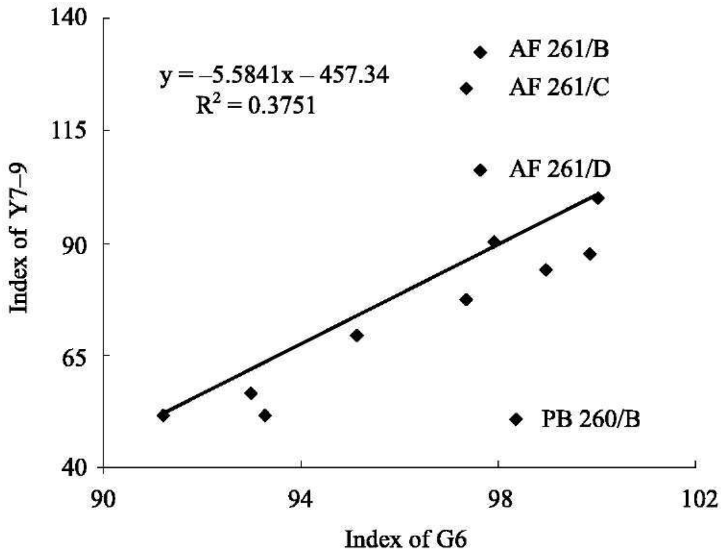
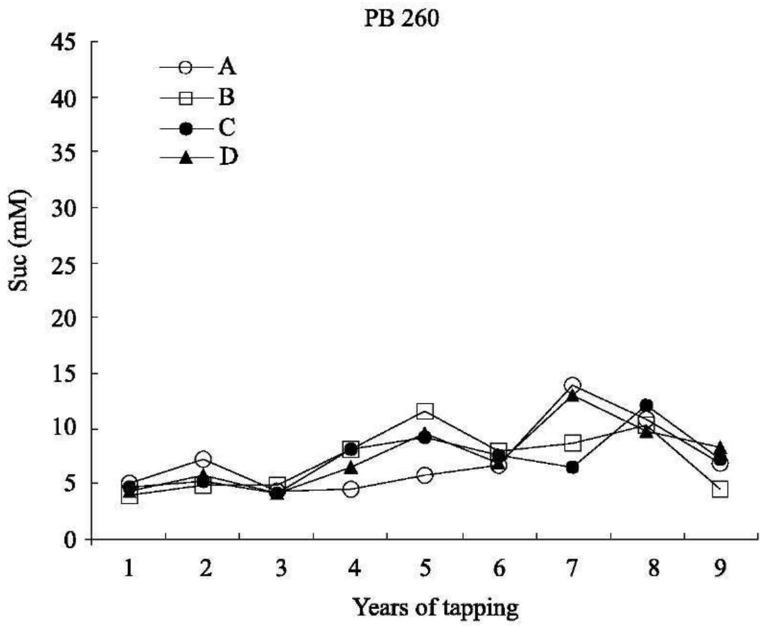


Figure 4. Relationship between the trunk girth increment indexes after 6 years of tapping (G6) and the cumulative yield indexes of the third tapping period (Y7-9) for the 4 treatments and the 4 clones ($df = 14$; $r = 0.61$). Index 100 is assigned to Treatment A.



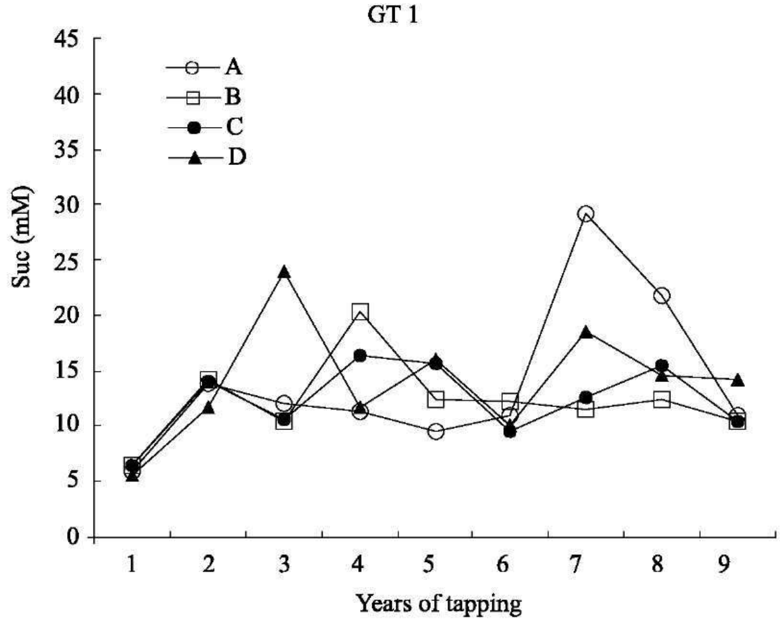
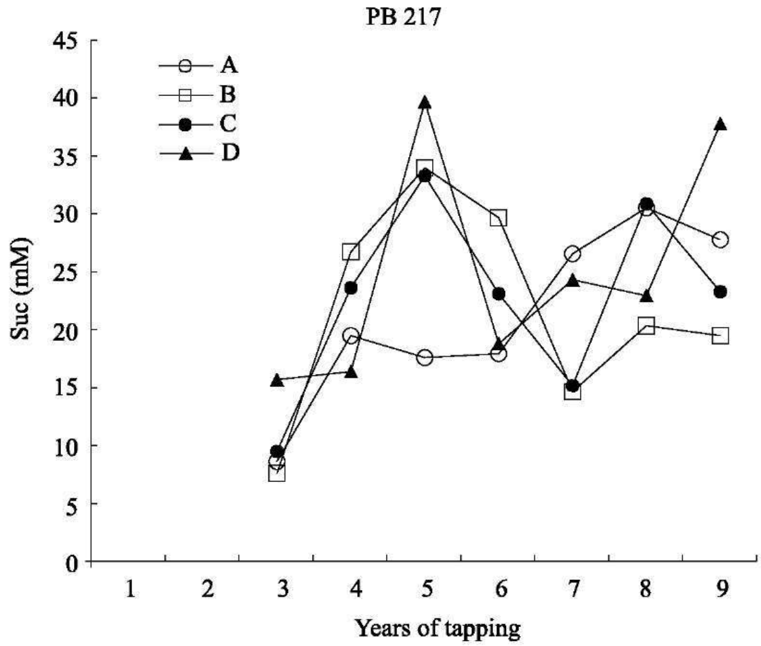


Figure 5. Annual sucrose content per treatment and per clone (mM per litre of latex).
A: No panel change (1PC); B: Triennial panel change; C: Biennial panel change after three years on Panel BO-1*; D: Annual panel change after two years on* BO-1 *(control).*



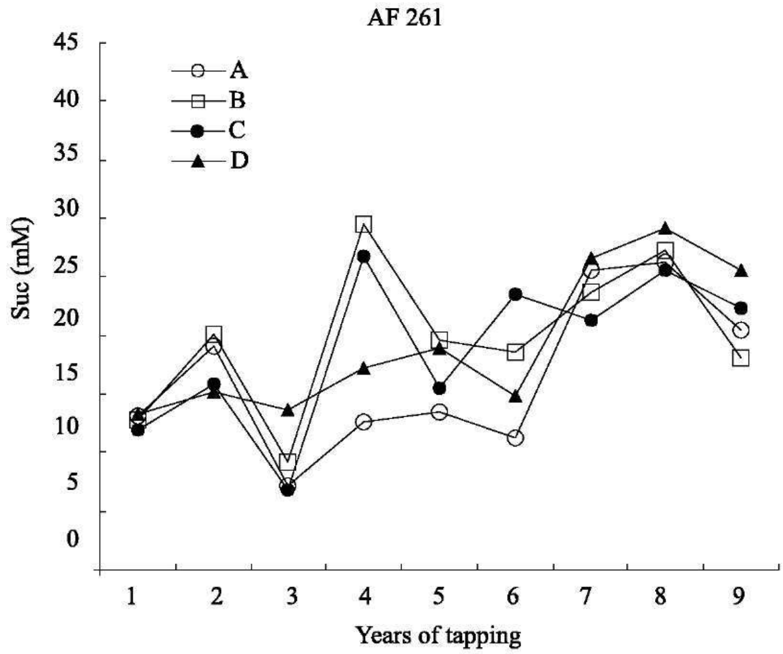


Figure 5 (Cont.). Annual sucrose content per treatment and per clone (mM per litre of latex). A: No panel change (1PC); B: Triennial panel change; C: Biennial panel change after three years on Panel BO-1*; D: Annual panel change after two years on* BO-1 *(control).*

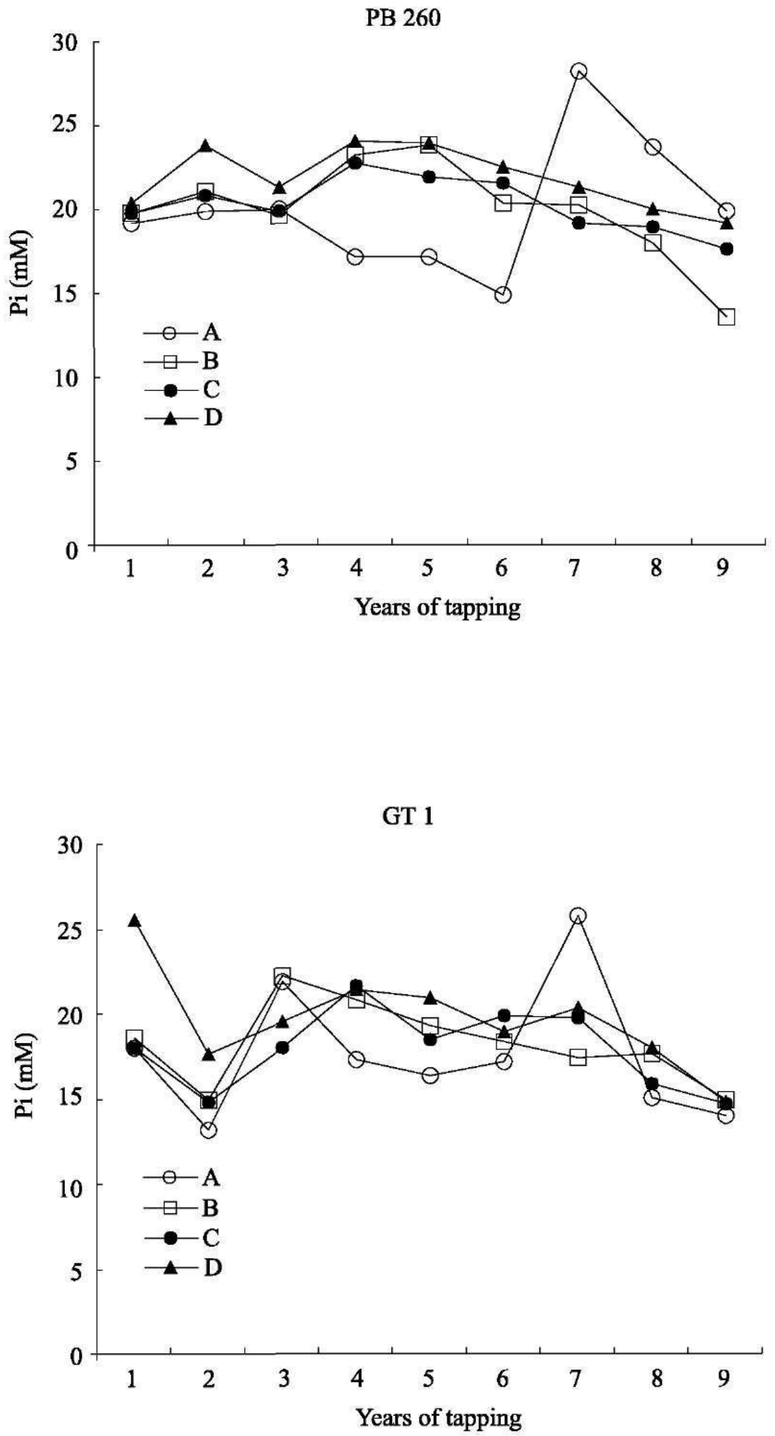
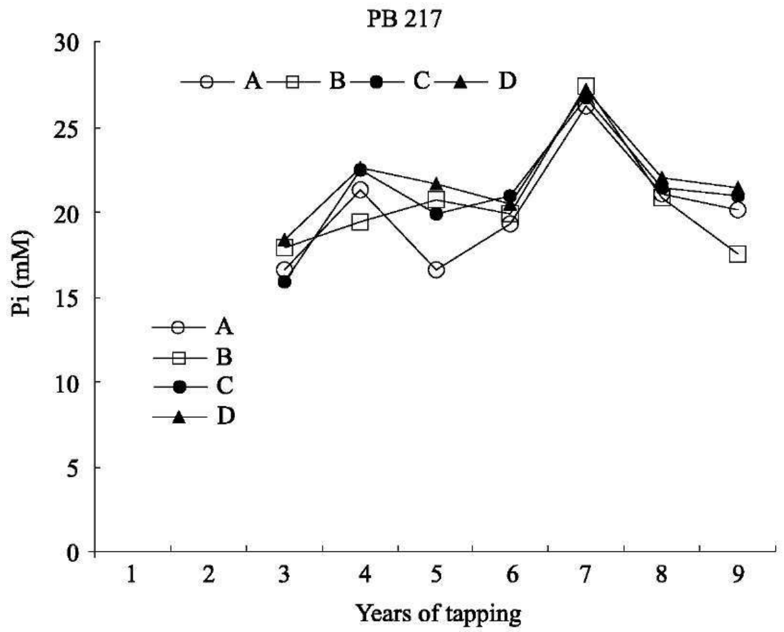


Figure 6. Annual inorganic phosphorus content per treatment and per clone (mM per litre of latex. A: No panel change (1PC); B: Triennial panel change; C: Biennial panel change after three years on Panel BO-1; *D: Annual panel change after two years on* BO-1 *(control).*



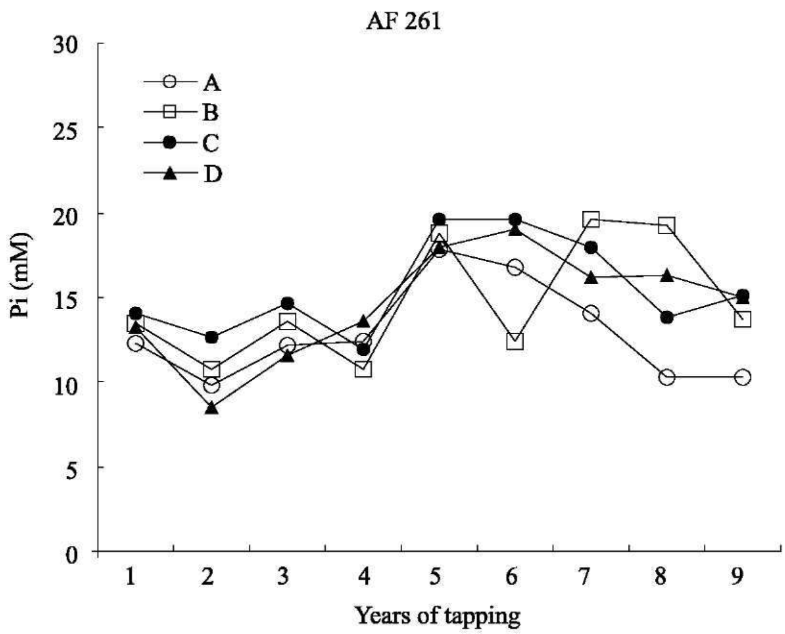
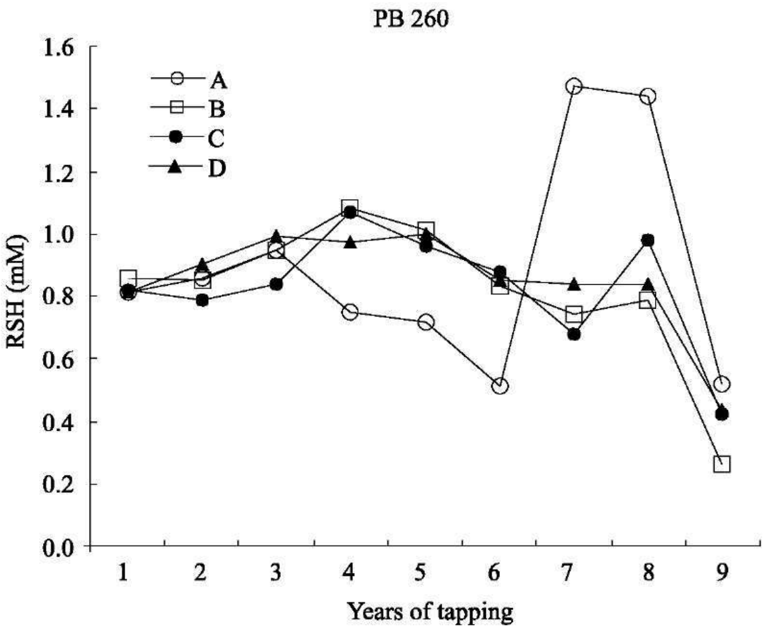


Figure 6 (Cont.). Annual inorganic phosphorus content per treatment and per clone (mM per litre of latex. A: No panel change (1PC); B: Triennial panel change; C: Biennial panel change after three years on Panel BO-1*; D: Annual panel change after two years on* BO-1 *(control).*



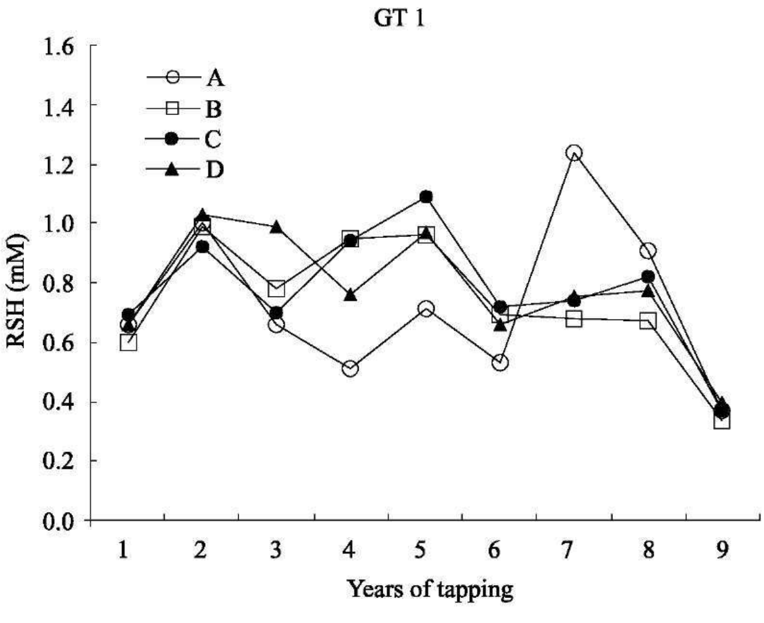
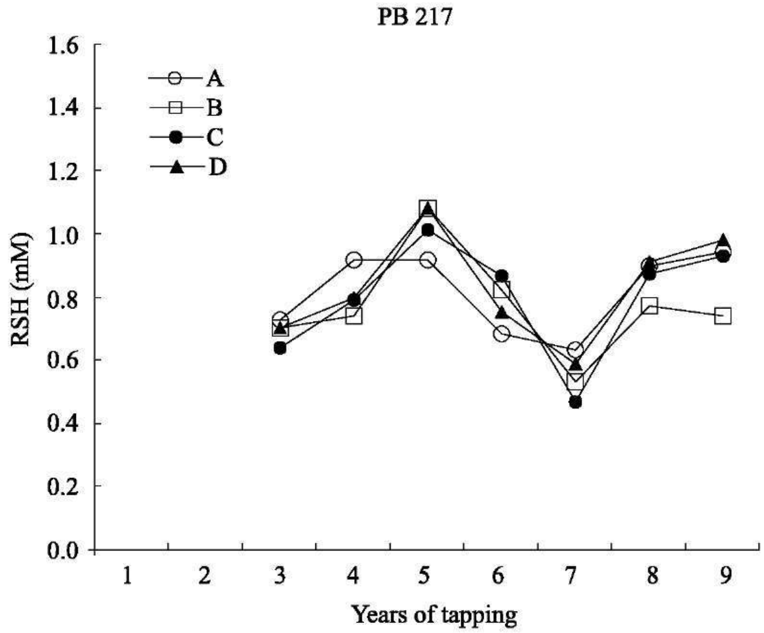


Figure 7. Annual thiols content per treatment and per clone (mM per litre of latex).
A: No panel change (1PC); B: Triennial panel change; C: Biennial panel change after three years on Panel BO-1*; D: Annual panel change after two years on* BO-1 *(control).*



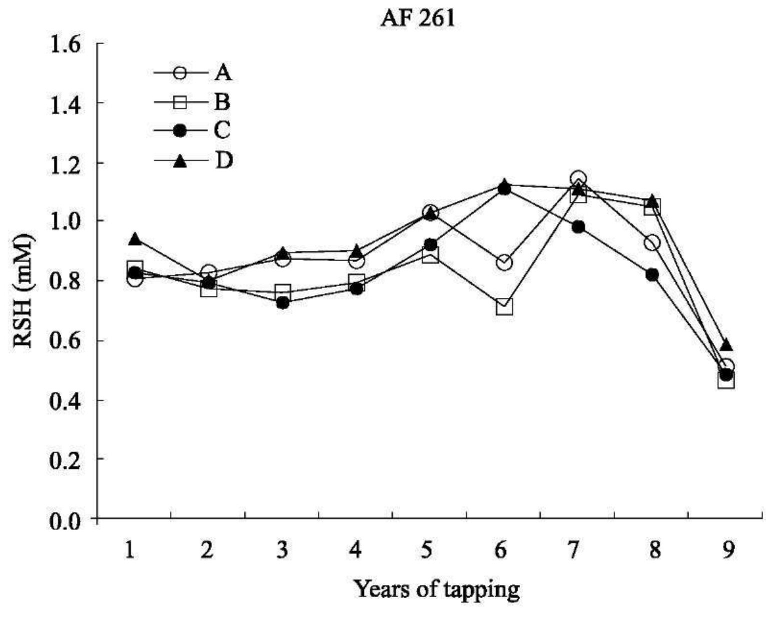


Figure 7 (Cont.). Annual thiols content per treatment and per clone (mM per litre of latex). A: No panel change (1PC); B: Triennial panel change; C: Biennial panel change after three years on Panel BO-1*; D: Annual panel change after two years on* BO-1 *(control).*

from the 7th to 9th year was higher and slightly greater respectively for clones PB 260 and PB 217. Conversely, for clone AF 261, the Pi content was much lower on *Panel BO-2* than on *Panel BO-1*.

Thiols contents from *Treatment A* were much lower in the first 6 years on *Panel BO-1*, and higher in years 7 and 8 on the new *Panel BO-2* for clones PB 260 and GT 1 (*Figure 7*). The other panel managements showed similar thiols contents, decreasing from the 4th and 5th tapping year. The thiols content was good for clones PB 217 and AF 261. Slight variations were seen between the different types of panel management. For the clone AF 261, there was a slight increase until 8th year then a decrease in the 9th year. For the thiols content of clone PB 217, there was an increase during the 4th to 9th year. *Treatment B* showed the lowest thiols content: the last two years, 8 and 9, on *Panel BO-1* for clone PB 217.

DISCUSSION

Yield and Panel Management Strategy

A general trend emerges for clones PB 260, GT 1, and PB 217. The behaviour of clone AF 261 was opposite to that of the three other clones. For clones PB 260, GT 1, and PB 217, the cumulative yield after six years was higher for *Treatment D* than for *Treatment A*. At that period, *Treatment D* had involved 4 panel changes, whereas *Treatment A* had none. The gain was 8 kg per tree for clone PB 260, and more than 5 kg per tree for GT 1. The performance of clone PB 217 was different, since, irrespective of the type of panel management used, yield continued to rise over time. The cumulative yield gain of clone PB 217 reached only 2.8 kg per tree over the first six years of tapping. After nine years, the difference between *Treatments A* and *D* was reduced to nil for clones PB 217 and PB 260, or even inverted in the case of GT 1. That inversion can be explained by the high yield obtained by *Treatment A* during the last tapping period (year seven to nine) on the newly opened *Panel BO-2*. For AF 261, the yield for the first six years of tapping was higher with *Treatment A* than with the other treatments, but this difference was reduced to nil after nine years.

Cumulative yield after 9 years for *Treatment B* (3 years on *Panel BO-1*, 3 years on *Panel BO-2*, then 3 years on *Panel BO-1*) was lower than that of *Treatments A* and *D* for PB 260 and PB 217. This was not the case for GT 1. Conversely, for AF 261, *Treatment B* appeared particularly favourable to yield in the third tapping period. For most good yielding clones, tapping the base of *Panel BO-1* in the last three years of the 9-year period is probably the worst solution. In all cases, according to our results, *Treatment B* would have to be avoided.

Treatment C (three panel changes applied after year 3, 5, and 7) appeared rather similar to *Treatment D* (seven panel changes). Whatever the clone and the period, the cumulative yield of *Treatment C* was the best. This treatment seemed to be less dependent on the metabolic type of the clone, and thus was rather well adapted to different types of clones.

Yield and Growth

The yield and growth results of this study confirm the well known negative relationship between yield and girth increment of the trunk during the same period[15,16]. The girth increment is largely dependent on the yield induced by the tapping system. The intensity of this relationship varies according to the clone: the impact of rubber production on the trunk growth is high for GT 1 but low for PB 217, which confirms results already published[15,16].

The main difference observed between PB 260 and GT 1 is the lower girth increment of GT 1 for *Treatments C* and *D* during the second tapping period (year 4–6) followed by a lower yield in the third period (year 7–9) for these treatments. In the case of GT 1, the impact of the yield on the trunk girth increment in a period might influence the yield of the following period in the form of a feed-back.

Latex Diagnosis

During the first 6 tapping years, in *Treatment A* and for clones PB 260, GT 1, and PB 217, the low content of sucrose, inorganic phosphorus, and thiols indicates a physiological fatigue[6,7,11,17]. Yield was limited because of sucrose consumption[9], the absence of carbohydrate reserve for fueling the laticifers metabolism[11], and the low metabolic activity probably due to physiological stress[6,7]. Conversely, for AF 261, the metabolic activity, as indicated by Pi associated with a lower sucrose level, was high. These findings account for the relatively low yield of *Treatment A* for PB 260, GT 1, and PB 217, and the relatively high yield of *Treatment A* for AF 261.

During the last tapping period (year 7, 8, and 9), a higher sucrose content was found in the newly opened *Panel BO-2* for *Treatment A*. When associated with high metabolic activity[9] (indicated by Pi), this higher sucrose level explains the higher yields of PB 260, GT 1, and PB 217. The laticifer metabolism of PB 260 can be activated quickly on a new panel by tapping. GT 1 has the added advantage of a higher trunk girth at the beginning of the last tapping period. Findings were similar for PB 217 but to a lesser extent because the metabolic activation of this clone on a new panel is not so fast[6,10,11]. Conversely, for AF 261, the reduction in metabolic activity is probably limiting for yield because the metabolic activation of this clone is very slow[6,10].

For *Treatment B*, the last tapping period (year 7 to 9) was done on the base of *Panel BO-1* where only a limited amount of sucrose reserves are available. The low reserves explain the low yield of PB 260 which, moreover, can be affected by physiological stress in this tapping area.

CONCLUSION

The four panel management strategies differed in the number of panel changes over a nine-year period of half-spiral downward tapping: 0, 1, 2, or 4 panel changes over the first 6 years, and 1, 2, 3, or 7 panel changes over 9 years. These treatments were applied to (four) clones: PB 260; GT 1; PB 217; and AF 261 that differed in their average yield, laticifer physiology, and the response of their trunk growth to latex production.

For PB 260, GT 1, and PB 217, the treatment with a maximum number of panel changes achieved a higher cumulative latex yield after six years than the treatment with a minimum number of panel changes. That advantage was reduced to nil after nine years or even inverted in the case of GT 1. For that clone, the drawback was balanced by a 17% increase in the nine-year yield, which could be explained by the high sensitivity of trunk growth of GT 1 to tapping and latex production. AF 261 behaved in an opposite manner because of the laticiferous metabolic characteristics of this clone which produced low yield levels.

Minimising the frequency of panel change by tapping *Panel BO-1* during the six successive years and then tapping *Panel BO-2* for three years, would not decrease cumulative latex yield over 9 years. No panel changing would be more simple and cost-effective. It could be monitored with latex diagnosis to detect any physiological stress that would indicate the need for an earlier panel change.

The treatment in the last three tapping years at the base of *Panel BO-1* decreased the cumulative yield, except in the case of AF 261. By contrast, the treatment with a biennial panel change (three panel changes over nine years) appeared to be equivalent to the best level of cumulative yield for any period; this treatment might be considered as a good trade-off between the two extreme tapping strategies studied here.

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