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Influence of Depth of Tapping on Growth and Yield of Hevea Brasiliensis

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Three years' additional records are provided, of experiments reported earlier (DE JONGE AND WARRIAR, 1965), *which demonstrate a pronounced effect on yield from depth of tapping. Deep tapping increases yield, reduces the rate of girthing and the d.r.c. of latex and prolongs the flow of rubber. The thickness of renewed bark, though initially thinner for deep tapping, shows no difference from shallow tapping after three years' renewal.*

A marked interaction between depth of tapping and response to yearly panel changes and full-spiral tapping is demonstrated.

Results of experiments concerning the depth of tapping were reported at the annual Planters' Conference in Kuala Lumpur recently (DE JONGE AND WARRIAR, 1965). The present paper provides three years' additional data of the two experiments carried out on clones GT 1 and PB 5/51.

OBJECTS OF THE EXPERIMENTS

The main object of the experiments was comparison between deep and shallow tapping regarding their effects on yield and growth of rubber trees. The two treatments are difficult to define precisely. Deep tapping may be considered as cutting the bark to within 1 mm from the cambium, and shallow tapping as cutting to within 1½–2 mm from the cambium.

The second object of the experiment was to determine the stage at which the full-spiral system of tapping could be most profitably introduced. To facilitate this, yearly panel changes were made, so that a S/1 cut could be introduced at several stages *(Figure 1)*. The first change to S/1 has been made after three years of tapping (III in *Figure 1)*. A second set of trees will be changed to S/1 tapping after five years of tapping when a S/1 cut will also be introduced on half the number of trees tapped on the S/2.d/2 system, which are then due for change to Panel B. The S/1 cut on these trees will be half in virgin and half in renewed bark.

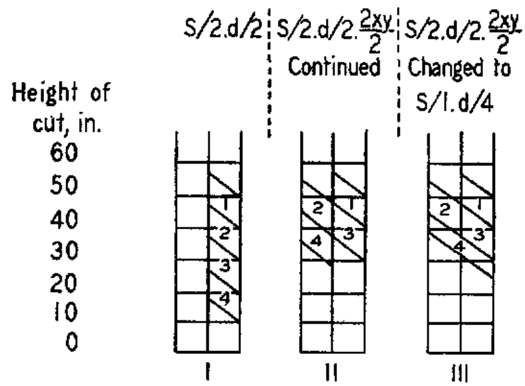

Figure 1. Yearly sequence of tapping panels.

History of Experimental Areas

The trees were planted in 1958, budded in 1959 and opened for tapping in May 1964 (S/2.d/2) at 50 inches above the union. The 'depth of tapping' treatments were introduced in August 1964. Panel changes for S/2.d/2.2xy/2 system took place in May 1965, May 1966 and August 1967.

Design of Experiments

The experiments have been laid out in a randomised tree-plot design with 40 replications

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TABLE 1. DEEP VERSUS SHALLOW TAPPING VERSUS PERIODIC PANEL CHANGE
[Yield in lb of dry rubber per acre. Dry trees as % of the total number of trees allotted to treatment (40 trees)]

Period	Shallow tapping				Deep tapping				Effect of *deep tapping*	
	GT 1		PB 5/51		GT 1		PB 5/51		GT 1	PB 5/51
1 (8/64 – 5/65)	Yield	d.r.c.	Yield	d.r.c.	Yield	d.r.c.	Yield	d.r.c.		
S/2d.d/2	462	33.8	576	35.5	707	29.5	693	32.1	+53	+20
S/2.d/2. 2xy/2	447	34.3	574	34.8	719	29.1	688	32.2	+61	+20
Effect of panel change, %	—		—		—		—			
2 (6/65 – 5/66) S/2.d/2	634	36.6	916	39.6	918	31.8	1009	37.7	+45	+10
S/2.d/2. 2xy/2	563	37.0	868	39.5	1111	29.7	1193	34.9	+97	+37
Effect of panel change, %	−11		−5		+21		+18			
3 (6/66 – 6/67) S/2.d/2	1134	33.9	1523	41.2	1257	31.9	1519	39.7	+11	−0.3
S/2.d/2. 2xy/2	1044	35.4	1482	4.04	1622	29.4	1661	35.4	+55	+12
Effect of panel change, %	−8		−3		+29		+9			
4 (9/67 – 6/68) S/2.d/2	822	35.6	1185	41.1	1026	31.7	1337	37.4	+25	+13
S/2.d/2. 2xy/2	757	36.2	1172	39.8	1150	27.9	1319	32.8	+52	+13
S/1d./4	667	37.4	920	41.9	1373	28.9	1151	35.1	+106	+25
Effect of panel change, %	− 8		− 1		+12		− 1			
Effect of S/1.d/4, %	−19		−22		+34		−14			
Incidence of dry trees as at September 1967, %	Total	Part	Total	Part	Total	Part	Total	Part		
S/2.d/2	nil	2.5	nil	nil	nil	2.5	nil	nil		
S/2.d/2. 2xy/2	nil	nil	nil	5.0	nil	2.5	nil	15.4		

per tapping treatment. Recording of yield of each tapping was made throughout the duration of the experiment. Girth and bark renewal measurements were taken at approximately yearly intervals. Recording of dryness was a monthly routine in which length of tapping cut and of dry patches were measured.

The experiments have progressed smoothly to-date, with no major disturbances. The only abnormality has been a very low yielding post-wintering period in 1965 for clone PB 5/51. Commercial observations since made suggest that such is a clonal characteristic.

No serious leaf disease problems have been experienced in either experiment.

RESULTS

Data on yield, d.r.c. and dry trees are summarised in *Table 1*. The following observations are made:

TABLE 2. LATE DRIPPING AS % OF TOTAL CROP (FIRST THREE YEARS OF TAPPING)

Tapping system	GT 1 %	Mean d.r.c.	PB 5/51 %	Mean d.r.c.
S/2.d/2 shallow	9.7	34.8	13.1	38.8
S/2.d/2. 2xy/2 shallow	12.3	35.6	13.6	38.2
S/2.d/2 deep	16.3	30.9	14.6	36.5
S/2.d/2. 2xy/2 deep	21.9	29.4	16.2	34.2

1. Deep tapping results in increased yield. Clone GT 1 responds more favourably than clone PB 5/51. Part of the increased yield is obtained in the form of late drippings as shown in *Table 2.* The d.r.c. is reduced by deep tapping, especially for the better responding clone.

2. Yearly panel changes result in a reduced yield if shallow tapping is done. When tapping is deep, a highly increased yield is observed from yearly changes of tapping panels.

This yield-increasing effect from panel changes decreases in time and no effect is observed after the third panel change in the case of clone PB 5/51.

3. When a full-spiral cut was introduced, clonal responses observed in the R.R.I.M. tapping trials (NG *et al.*, 1965; RUBBER RESEARCH INSTITUTE OF MALAYA, 1968) were confirmed: clone GT 1 responds favourably to S/1 tapping but clone PB 5/51 responds unfavourably.

However, it is noted that if shallow tapping is done, both clones respond unfavourably to a full-spiral cut.

This provides therefore yet another illustration of a pronounced interaction between tapping system and depth of tapping.

4. The incidence of dryness has remained low. In neither experiment has a single dry tree been recorded yet, notwithstanding the high yield and low d.r.c. observed in some treatments. Deep tapping with yearly panel change resulted in six trees, of a total of thirty-nine with clone PB 5/51, partially drying out.

Data on effect of shallow and deep tapping on growth are summarised in *Tables 3* and *4.* Deep tapping, especially when combined with yearly panel changes, results in a retarding effect on girth rate, but the actual differences are small — less than one inch in three years between the best and the poorest girthing treatment. With these two wind-fast clones, this is a small price to pay for the additional yield per acre obtained: 1224 lb/acre/3 years for GT 1 and 540 lb/acre/3 years for PB 5/51.

The bark renewal data demonstrate that the fear of unsatisfactory renewal on deep tapping is unfounded. It cannot, of course, be denied that deep tapping lends to occasional wounding

TABLE 3. EFFECT OF TREATMENTS ON GIRTH INCREMENT

Tapping system	Girth increment (cm)								Yield (lb/acre)	
	6/64 – 6/65		6/65 – 5/66		5/66 – 9/67		6/64 – 9/67		8/64 – 7/67	
	GT 1	PB 5/51	GT 1	PB 5/51	GT 1	PB 5/51	GT 1	PB 5/51	GT 1	PB 5/51
S/2.d/2 shallow	6.60	6.62	3.58	4.32	3.73	3.35	13.91	14.29	2232	3024
S/2.d/2. 2xy/2 shallow	6.46	6.48	3.30	4.38	3.69	3.44	13.45	14.30	2052	2916
S/2.d/2 deep	5.68	5.80	3.46	4.21	3.91	3.25	13.05	13.26	2880	3204
S/2.d/2. 2xy/2 deep	5.64	5.68	2.77	3.80	3.32	3.22	11.73	12.70	3456	3564

TABLE 4. EFFECTS OF TREATMENTS ON BARK RENEWAL

Tapping system	Bark renewal (mm)					
	12 months		24 months		36 months	
	GT 1	PB 5/51	GT 1	PB 5/51	GT 1	PB 5/51
S/2.d/2 shallow	4.09	4.14	4.63	4.73	5.13	5.29
S/2.d/2. 2xy/2 shallow	4.23	4.24	4.99	4.67	5.26	5.38
S/2.d/2 deep	3.44	3.70	4.13	4.65	4.98	5.41
S/2.d/2. 2xy/2 deep	4.15	3.73	4.61	4.73	5.48	5.42

but such wounds do not form serious handicaps for tapping the renewed bark, some twelve years after the wound has been made.

DISCUSSION

The experiments have demonstrated that large early yield increases can be obtained by deep tapping, without serious ill effects, at least over the first four years of tapping.

A large additional early yield increase is obtained from yearly panel changes, but response between the two clones differed (with GT 1 showing continued favourable response, but PB 5/51 not responding further after the third panel change). This suggests that clones known to respond favourably to S/1 tapping may also respond favourably to the yearly panel change. It was therefore unfortunate that the S/1.d/4 system was not included as a treatment from the start of the experiments, as we are not in a position now to know if the S/2.d/2.2xy/2 system has any advantage over the S/1.d/4 system.

The main disadvantage of the S/1.d/4 system is its depressing effect on the rate of girthing. It was therefore recommended by the RUBBER RESEARCH INSTITUTE OF MALAYA (1941) to introduce S/1 tapping on young trees only after the trees had reached 24-inch girth and the yearly panel change in the experiments under review is an effort to bring the trees quickly to 24-inch girth by S/2.d/2 tapping and to avoid the need of tapping bark of different ages on later full-spiral tapping. The girth depressing effect of panel changes was not foreseen.

The interest in full-spiral tapping is caused by the known favourable response of several clones to either S/1.d/4 or even S/1.d/6 tapping.

The following clones are reported to show a favourable early response to S/1 tapping: GT 1, PR 107, RRIM 600, 607, 612 and, to a lesser extent, RRIM 605, 623 and PB 86 (NG *et al.*, 1965). In several experiments, effect of S/1.d/4 tapping appears to decrease relative to S/2.d/2 (RUBBER RESEARCH INSTITUTE OF MALAYA, 1968). All experiments were, however, opened at approximately 20-inch girth. The two experiments reported in this paper should provide information on yield trend when starting full-spiral tapping at later age. Unfortunately, one of the clones (PB 5/51) is now known to respond unfavourably to a full-spiral cut, which factor is already confirmed in this experiment.

The most interesting finding in these experiments is the very pronounced effect of depth of tapping on response to S/1.d/4 tapping in case of GT 1 and also on response to yearly panel changes for both clones.

The effect of depth of tapping to response to tapping systems has already been discussed in an earlier paper (DE JONGE AND WARRIAR, 1965) and the current observations underline the statement: '*It is apparent that the relative performance of tapping systems can be very much influenced by depth of tapping – an effect which will have to be considered during the conduct of tapping experiments.*'

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DISCUSSION

Chairman: Mr. S. E. Chua

Mr. de Jonge, in reply to Mr. C.K. Lee, declined to predict future trends in yield with deep tapping, because the results to-date were not entirely in agreement with expectation. Dr. J-P. Poliniere asked if the same rate of vertical bark consumption could be maintained with deep or shallow tapping and whether there was any interaction with frequency of tapping and length of cut. Mr. de Jonge believed the rate of bark consumption was independent of the depth of tapping; but, in addition to the well-known effect of frequency on bark consumption, length of cut also had an obscure effect, associated perhaps with the amount of care given by the tapper to the longer and more difficult cuts. Mr. J. Frantzen asked how much wounding should be tolerated. This Mr. de Jonge found difficult to define, although occasional wounds were evidence that the tapping was deep.

Mr. de Jonge informed Mr. S.W. Pakianathan that the incidence of dryness was very low in these experiments and was nil in GT 1. Dr. E.K. Ng reported an experiment on deep tapping of PB 5/51 on the S/2.d/4 system, in which responses of 20 to 30% were obtained during the first six months, but hardly any during the second. Mr. de Jonge agreed that his trial on PB 5/51 tapped S/2.d/2 had shown a decline with time, even if not abruptly, but he considered the data inadequate to postulate any interaction with frequency of tapping. Dr. B.L. Archer asked if there was any correlation between response to deep tapping and the plugging index for example, which might be used to predict responses. Mr. de Jonge thought anatomical features were more promising in this respect, such as the density of functional latex vessels near the cambium.