Q. Jl. Rubb. Res. Inst. Sri Lanka (Ceylon) (1973) 50, 40—54

ECONOMIC EVALUATION OF TAPPING SYSTEMS

By

S. D. Wimalaratne

INTRODUCTION

Tapping, the means of harvesting latex constitutes the biggest single item in the total cost of production of natural rubber. Therefore, tapping systems which give high returns without long term deleterious effects on the trees are of vital interest to the planting industry. A reduction in tapping cost could be achieved either by:

(*a*) Increase the production of rubber by increasing the output per acre

or

(*b*) Increase the intake of crop per tapper

Higher yields per harvestor constitutes a major element in cost reduction. Improved material of higher intrinsic yields raise the yield per acre as well as per harvestor.

During the period 1900 to 1920 there were no uniformity in tapping systems and various estates carried out their own modes of tapping, resulting in the tapping systems then administered being unbalanced and economically unsound (Dijkmann, 1951). Investigations into the aspect of drying up of trees were started in 1919 by Sharples & Lambourne (1924). They reduced, the spiral tapping systems which encircled the tree a number of times, to a one full spiral. In the early 1930's due to low rubber prices a number of estates in Sri Lanka carried out experiments with double cut tapping systems (Murray, 1933). Most of these involved the tapping of two half spiral cuts either every third day with a periodic rest known as the double three or Sunderland system or every fourth day without a rest period known as the double four or Mealey's system. In 1936, investigations into various aspects of tapping budded trees were carried out on a large scale in Sri Lanka by Mann (1936). De Silva (1945, 1947, 1959) compared various tapping systems including the double three or double four systems at the Rubber Research Institute of Sri Lanka. His work indicated that tapping intensities of over 100% were unsuited for long term exploitation of improved planting material. In recent years, due to declining trends in rubber prices and high costs of labour and materials many estates have shown a renewed interest in various tapping systems particularly, those that could give high yields per tapping. The results of some of the trials carried out in other rubber growing countries have also provided an additional impetus to further experimentation. The present paper discusses the early results of some of the tapping systems which have been of topical interest to the rubber planting industry in Sri Lanka.

MATERIALS AND METHOD

MATERIALS

The present discussion is confined mainly to some of the recent tapping experiments carried out at Dartonfield Estate from 1971. The clones involved were RRIC 52, RRIC 45, RRIC 7 and PB 86 planted in 1961 and 1955.

RRIC 52

The clone RRIC 52 is a moderate yielder during early tapping years and a vigorous grower. This clone reaches tappable girth one year earlier than most of the clones. It is shade tolerant and is resistant to both *Oidium* and *Phytophthora* diseases (De Silva, 1960).

RRIC 45

The clone RRIC 45 is a high yielder and is presently recommended for large scale planting in Sri Lanka (Chandrasekera, 1971).

RRIC 7

This is a high yielding clone with good secondary characters (De Silva & Satchuthananthavale, 1962). One disadvantage of this clone is that the latex is liable to undergo auto-oxidation probably due to the phenolic compounds. The latex of this clone also gives a black colouration. It is rather susceptible to *Oidium* leaf disease.

PB 86

This is a foreign clone planted in Sri Lanka on a large scale. In 1963 about 70% to 80% of small-holdings had been planted with this clone (De Silva, 1963).

METHOD

Experiment I

Large scale tapping experiment

In this trial, the clones RRIC 45, RRIC 52, RRIC 7 and PB 86 were tapped on the following tapping systems—

(1) S/2, d/2, 100% (control)
(2) S/2, d/1, 200%
(3) S/1, d/4, 100%
(4) S/1, d/3, 133%
(5) 2S/2, d/4, 100%
(6) 2S/2, d/3, 133%

Each treatment was applied to 5-tree plot replicated 8 times except in clone PB 86 which had only 6 replicates. All were planted in 1961 and were tapped on the half spiral alternate daily system for 3 years before the various treatments were applied in 1971.

Pre-treatment yield records were taken in all the plots with S/2, d/2, 100% tapping intensity. Yield records were made for various tapping systems by bulking of latex collected for each tapping system and determining the dry rubber content from a 100 ml latex sample. The cup lump and panel scrap from every five tree plot was collected, rolled and dried at 85 °C and weighed. The average number of trees per tapper with each tapping system used in the calculation of experimental yields is as follows :

Tapping system	*No. of trees*
S/2, d/2, 100%	250
S/2, d/1, 200%	250
S/1, d/3, 133%	175
S/1, d/4, 100%	175
2S/2, d/3, 133%	175
2S/2, d/4, 100%	175

In order to ensure the correct tapping frequency, polythene skirt type rainguards were used in the first year of the experiment, in 1971, but were removed in 1972, due to non availability of the materials for fixing these rainguards and their general unsuitability. (*See Fig. 2—page 32*)

RESULTS AND DISCUSSION

Percentage yield in g/tree/tapping

The yield recorded in g/tree/tapping for the four clones, for the two years 1971 and 1972, as a percentage of the control which is the standard alternate daily half spiral tapping system, S/2, d/2, 100% is given in Table 1. It could be seen that when the yield recorded for the alternate daily half spiral tapping system is considered as 100%, the half spiral daily tapping system with 200% intensity showed generally a decrease in yield in all clones. This is interesting, as the daily tapping system is practised by smallholders because of weather patterns in Sri Lanka. All the other tapping systems showed increased yields in the first year but declined gradually during the 2nd year in all clones except those were introduced in the recent past in Sri Lanka on certain estates. It appears that clone PB 86 may stand up to all the tapping systems investigated but it is still premature to forecast the long term effects. The double four tapping system has shown satisfactory yields over the first two years of the experiment.

Yield trend (clone PB 86)

The yield trend for various tapping systems for clone PB 86 is shown in Fig. 1. Here the yield in g/tree/tapping is plotted against time. There was a drop in yield in both years during the month of February and this was probably due to wintering. The same tendency is seen in May, September/October probably due to the low dry rubber content caused by high rainfall. During 1972 October the rain being less intense, such a drop in yield was not marked.

(*See Fig. 1—page 43*)

Yield per ac. per yr

The total yield per acre year for the two years 1971 and 1972 or the four clones under different tapping systems is shown in Table 2. The daily tapping system (S/2, d/1, 200%) in all four clones gave the highest yield per ac. per yr due to the large number of tapping days. In 1971 there were 342 tapping days because of the rainguards compared 298 in 1972 during which year the rainguards were removed. In spite of the increased number of tapping days in 1971, the yields per ac. per yr were lower in 1971 than in 1972 probably due to the use of rainguards in 1971 which reduced the average dry rubber content in latex. This is probably an indication that a rest to the trees, due to rain interferences is beneficial.

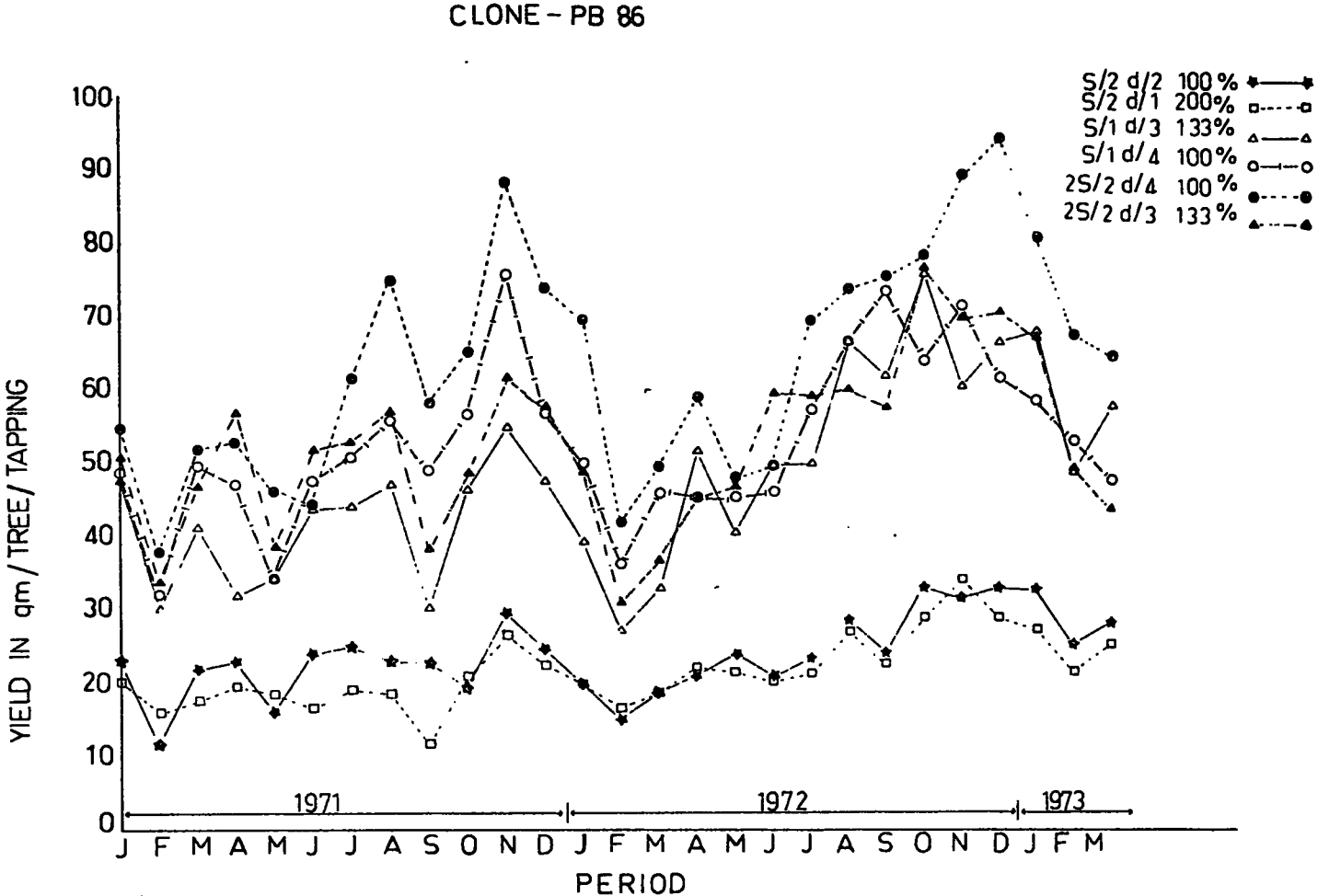
CLONE – PB 86
S/2 d/2 100 %
S/2 d/1 200%
S/1 d/3 133%
S/1 d/4 100%
2S/2 d/4 100%
2S/2 d/3 133%
YIELD IN gm/TREE/TAPPING
100
90
80
70
60
50
40
30
20
10
0
1971
1972
1973
J F M A M J J A S O N D J F M A M J J A S O N D J F M
PERIOD

Fig. 1

TABLE I

YIELD IN G/TREE/TAPPING AS A PERCENTAGE OF THE CONTROL

Tapping system	PB 86		RRIC 45		RRIC 7		RRIC 52	
	1971	1972	1971	1972	1971	1972	1971	1972
S/2, d/2, 100%	100	100	100	100	100	100	100	100
S/2, d/1, 200%	90.3	97.2	114.8	91.1	89.9	101.9	78.4	84.0
S/1, d/3, 100%	185.6	202.1	248.9	187.0	200.0	154.4	195.2	171.8
S/1, d/4, 133%	230.6	233.9	251.1	206.4	204.7	194.5	207.2	182.7
2S/2, d/3, 100%	219.0	223.2	223.0	202.0	225.7	165.1	191.0	195.7
2S/2, d/4, 133%	259.3	282.9	233.0	189.2	212.8	236.2	185.0	193.6

TABLE 2

YIELD PER AC. PER YEAR IN LB

Tapping System	PB 86		RRIC 45		RRIC 7		RRIC 52	
	1971	1972	1971	1972	1971	1972	1971	1972
S/2, d/2, 100%	1301.7	1222.8	819.6	1191.3	940.2	1075.8	1124.0	1259.5
S/2, d/1, 200%	2302.1	2372.1	1892.3	2162.3	1506.7	2183.2	1663.3	2099.2
S/1, d/4, 100%	1539.6	1418.8	973.6	1223.2	829.7	1035.2	940.7	1134.5
S/1, d/3, 133%	1667.3	1588.6	1329.8	1436.5	1233.4	1064.7	1361.9	1382.4
2S/2, d/4, 100%	1764.4	1716.1	928.6	1121.4	958.6	1257.1	853.8	1126.7
2S/2, d/3, 133%	1972.6	1754.2	1366.0	1557.4	1474.5	1139.0	1296.9	1575.0

TABLE 3

YIELD PER TAPPER PER TAPPING AND TAPPING COST PER LB

Tapping system	PB 86		RRIC 45		RRIC 7		RRIC 52	
	Total rubber in lb	Tapping cost/lb in cts.	Total rubber in lb	Tapping cost/lb in cts.	Total rubber in lb	Tapping cost/lb in cts.	Total rubber in lb	Tapping cost/lb in cts.
S/2, d/2, 100%	12.3	32	12.0	31	10.9	36	12.7	31
S/2, d/1, 200%	11.9	33	10.9	37	11.0	36	10.6	38
S/1, d/4, 100%	20.7	24	17.8	25	15.1	27	16.5	26
S/1, d/3, 133%	17.9	25	16.2	26	12.0	33	15.5	27
2S/2, d/4, 100%	25.0	21	16.3	26	18.3	25	17.5	25
S/2, d/3, 133%	19.7	25	17.4	25	12.8	32	17.7	25

The average yield per ac. per yr for the four clones, for the year 1972 is shown in Fig. 2. A significant increase in their overall yield was only observed with the half spiral daily tapping system (S/2, d/1, 200%). In other tapping systems, the yield per ac. per yr was almost the same as the yield obtained from the standard half spiral alternate daily tapping system (S/2, d/2, 100%).

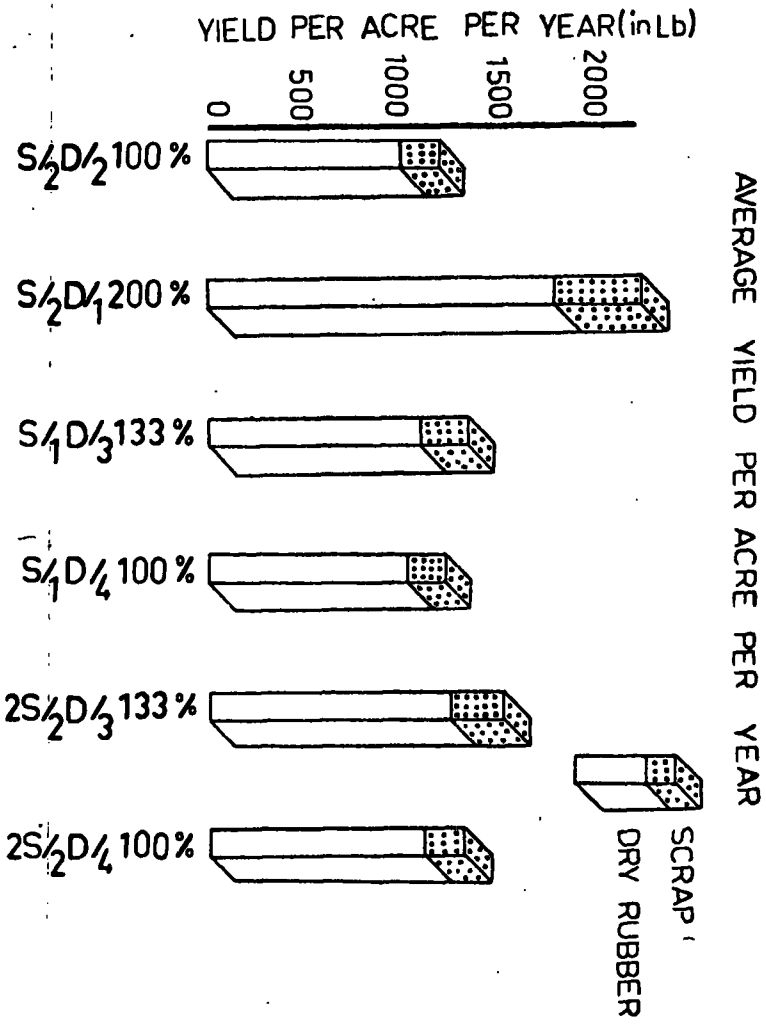

Fig. 2

Yield/tapper/tapping

The yield per tapper per tapping and the tapping cost per lb are shown in Table 3. For the computation of the tapping cost the premium paid for the extra poundage and scrap as well as the E.P.F. was considered. The clone PB 86 showed a significantly higher yield per tapper per tapping, with the double four system than the half spiral alternate daily system mainly due to the large number of half spiral cuts tapped. The calculations of yield per tapper per tapping are based on the average task sizes allocated in commercial estates. For double cuts systems we considered 175 trees per task which is equivalent to 350 half spiral cuts. For half spiral tapping systems the taks size was 240 trees.

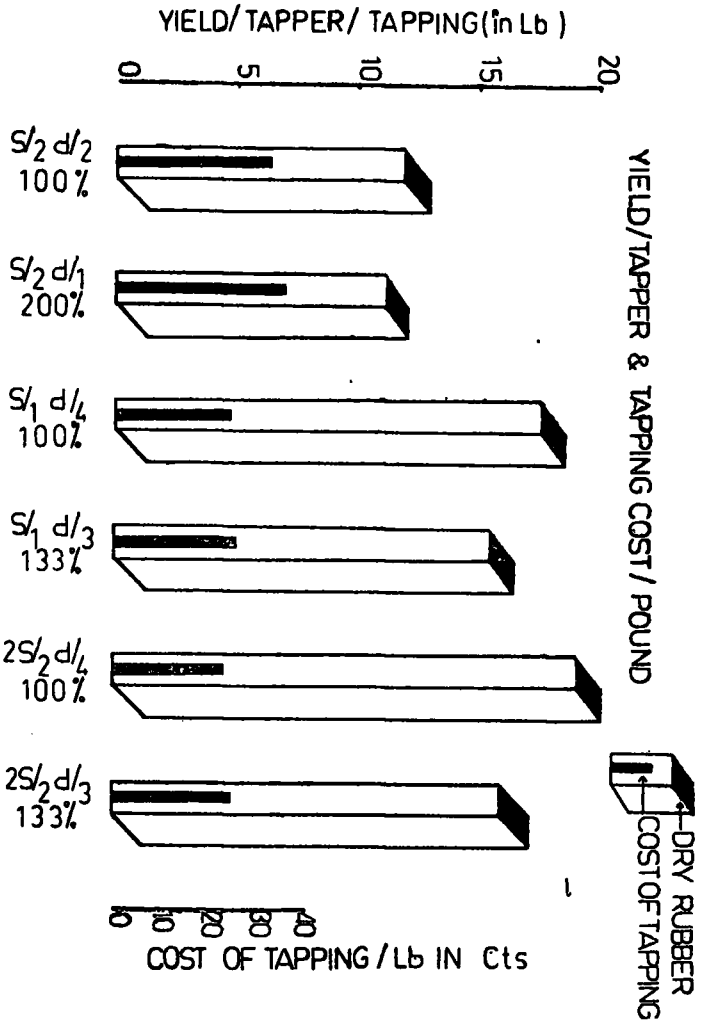

Fig. 3

The average yield per tapper per tapping for the four clones for the year 1972 and the tapping cost shown in Fig. 3. In general it can be seen that the half spiral daily tapping system which is represented in the 2nd line gave the lowest yield per tapper per tapping with the highest tapping cost per lb. In 1972 the average yield per tapper per tapping was about 16 lb for full spiral tapping systems and 18 lb for the double cut tapping systems whereas in the alternate daily half spiral tapping system the average was 12 lb. This means that the percentage increase in yield per tapper per tapping over the S/2, d/2, 100% system is 33% for full spiral systems and 50% for the double cut tapping systems. Here the increased yields recorded for the full spiral and double cut systems are mainly due to the influence of task size as compared with the alternate daily half spiral tapping system. This effect is also reflected in the relative tapping costs.

The tapping costs per lb of dry rubber harvested was 26 cts. for full spiral system and 25 cts. for double cut systems while for the S/2, d/2, 100% system the cost is 32 cts.

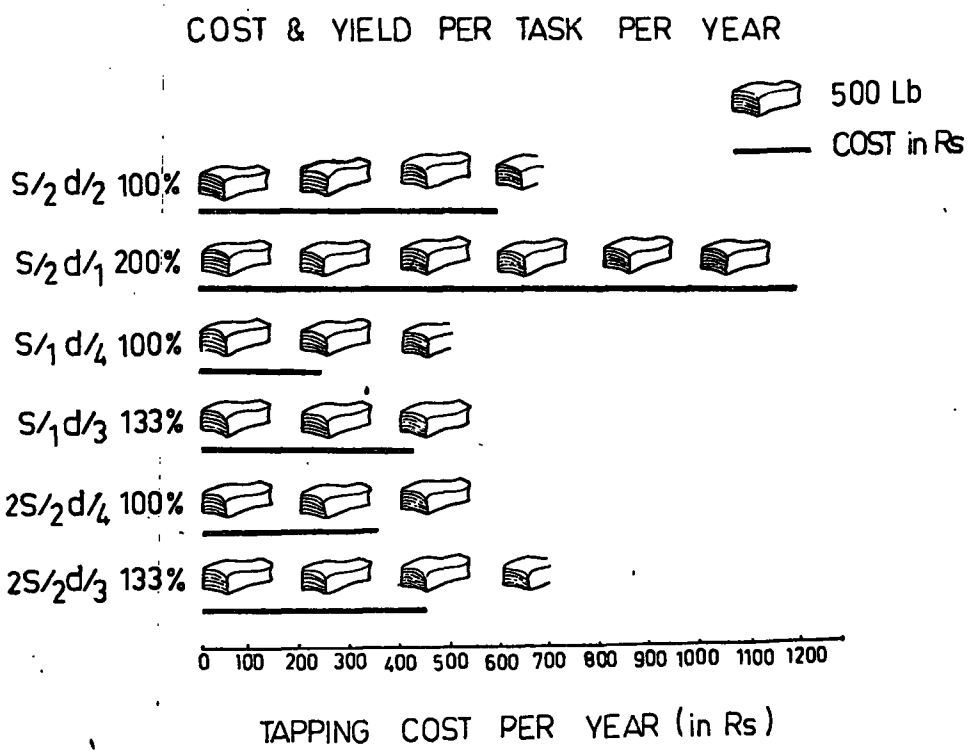

Fig. 4

Yield/task/year

The yield a tapper could harvest per task per year is shown in Fig. 4. It shows the average amount of dry rubber a tapper would harvest from a task with different tapping systems throughout the year and the tapping cost per year. The line beneath the yield shows the total tapping cost per task per year. The tapping cost pet year was the highest for the half spiral daily tapping system (S/2, d/1, 200%) and also the highest yield recorded. The tasks with fourth daily tapping systems had the lowest cost of of tapping per year, and also the lowest per task per year. The standard tapping system, half spiral alternate daily gave a better yield to the estate per task per year as compared with full spiral and double cut systems although the tapping costs per year were slightly higher than with the fourth daily system.

Dry rubber content (d.r.c.)

The average percentage d.r.c. for the four clones for various tapping systems, during the two years 1971 and 1972 is shown in Table 4. It can be seen that the precentage d.r.c. varies with tapping systems. In general the half spiral alternate daily tapping system had the highest d.r.c. while the half spiral daily tapping system had the lowest. It is also seen that during the year 1971 the d.r.c. percentages were generally lower than in 1972 probably due to the continued tapping without interference in 1971 as the tapping panels were protected by polythene rainguards.

TABLE 4

PERCENTAGE D. R. C.

(AVERAGES FOR 4 CLONES)

Tapping system	1971	1972
S/2, d/2, 100%	31.7	35.1
S/2, d/1, 200%	27.4	30.4
S/1, d/4, 100%	30.6	32.1
S/1, d/3, 133%	28.5	31.0
2S/2, d/4, 100%	32.2	34.0
2S/2, d/3, 133%	29.6	31.6
Mean	30.0	32.4

TABLE 5

PERCENTAGE SCRAP FOR 1972

Tapping system	PB 86	RRIC 45	RRIC 7	RRIC 52	Average
S/2, d/2, 100%	14.2	15.4	20.5	17.5	16.9
S/2, d/1, 200%	16.8	20.9	23.6	25.0	21.57
S/1, d/4, 100%	14.3	20.2	20.6	20.5	18.9
S/1, d/3, 133%	11.9	17.9	20.4	17.2	16.9
2S/2, d/4, 100%	13.1	17.4	20.2	19.1	17.5
2S/2, d/3, 133%	9.4	19.5	17.2	18.7	16.2

TABLE 6

INCIDENCE OF BROWN BAST

Tapping system	PB 86	RRIC 45	RRIC 52	RRIC 7
S/2, d/2, 100%	3.3	2.5	—	2.5
S/2, d/1, 200%	9.9	20.0	5.0	12.5
S/1, d/4, 100%	6.6	7.5	—	10.0
S/1, d/3, 133%	9.9	7.5	2.5	17.5
2S/2, d/4, 100%	3.3	2.5	2.5	2.5
2S/2, d/3, 133%	6.6	5.0	2.5	10.0

TABLE 7

TAPPING AT HIGH PANELS

Tapping system	Yield in g/tree/tapping (average)
Ladder tapping	28.5
Two quarter spiral tapping	31.9
'V' cut tapping	36.0

Percentage scrap

The percentage of scrap for the various clones is shown in Table 5. The percentage scrap in relation to total yield remained fairly constant for most of the tapping systems. The half spiral daily tapping system with 200% intensity gave an increase in percentage of scrap due to the late drip of latex. This late drip is caused by the delay in plugging of the latex vessels which may be due to the low d.r.c, caused by daily tapping. The half spiral alternate daily tapping systems had a low percentage of scrap compared to fourth daily tapping systems.

Brown Bast

The earliest visible symptoms of excessive exploitation of *Hevea* is the drying up of the tapping panels, which condition is called Brown Bast. Table 6 shows the percentage Brown Bast recorded, against each tapping system for the four clones. It could be seen that the largest number of Brown Bast cases was recorded for the half spiral daily tapping system with 200% intensity, which is beyond the permissible limits in commercial practice. Therefore such a tapping system is not generally advocated. The full spiral tapping systems, either third daily or fourth daily and the double three systems showed a fairly high incidence of Brown Bast in all clones except RRIC 52. RRIC 52 appears to be able to withstand high tapping intensities without much adverse effects at least during the first two years of tapping. This gives an indication of the high degree of adaptability of clone RRIC 52 to different tapping systems. It is significant that the lowest incidence of Brown Bast was shown by the half spiral alternate daily tapping system, which is the most popular system of tapping in Sri Lanka.

High Panel Tapping Experiment

Besides the earlier mentioned tapping systems on low panels an experiment on high panel tapping was carried out. Table 7 shows some of the early results of the high panel tapping commenced in early 1972 on the clone RRIC 52 planted in 1955. Ladder tapping downwards at a height of 100" above the graft union alternate daily had the lowest yield of 28.5 g/tree/tapping. 'V' cut upwards, alternate daily tapping had the highest yield of 36.0 g/tree/tapping; while two quarter spiral tapped upwards alternate daily had about 31.9 g/tree/tapping.

CONCLUSIONS

These tapping experiments were carried out only for two years. It is therefore premature to arrive at any definite conclusions on the influence of tapping systems on young budded rubber trees. However, the data of these two years indicate that the standard half spiral alternate daily tapping system at 100% intensity gives yields that compare favourably in terms of yield per tree per tapping, yield per acre per year, and yield per task per year with the other tapping systems. Also this system gave the highest d·r.c. a low percentage of scrap and the lowest incidence of Brown Bast. Therefore it appears that the half spiral alternate daily tapping system, is the most suited tapping system taking all circumstances into consideration. It also appears to be the most suitable system of tapping for a majority of local clones planted commercially. This is not surprising as these clones are bred and selected for this system of tapping.

High panel tapping experiments have shown 'V' cuts tapped upwards to have given a better yield than two quarter spiral cuts tapped upwards or ladder tapping downwards of a half spiral cut. The 'V' cut tapped upwards therefore appears to be better suited for exploitation of high panels.

All factors considered the data gathered so far from these multiple experiments conducted on the various tapping systems and intensities with and without rainguards show that the standard half spiral alternate daily tapping system in common practice in Sri Lanka is still the best system of tapping, for young budded trees.

ACKNOWLEDGEMENTS

I am very much indebted to Dr. O. S. Peries, Director, and Mr. L. B. Chandrasekera, Head of Botany Department, Rubber Research Institute of Sri Lanka, for creating this invaluable opportunity and facilities provided to pursue this research work at the Botanical Laboratories and for their guidance and interest in my work.

I am thankful to the Biometrician, Mr. V. Abeywardene, of the Coconut Research Institute of Sri Lanka and the Assistant Statistician, Mr. G. A. J. P. R. Gunasekera of the RRISL who helped me to lay out the experiment and for the statistical analysis of the results.

It is appropriate here to express my thanks to Messrs. W. G. V. Fernando, L. S. S. Pathiratna, S. Kodikara and S. Wijesinghe who helped me throughout the course of the work.

I am also thankful to Mr. S. de S. Daluwatte, Estate Superintendent, for his help to carry out the experiment.

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