R.R.I.M. Planters' Conference, July 1966 Preprint No. 15

Budgeting on the Merits of a Shorter Replanting Period

COLIN BARLOW AND NG CHOONG SOOI
Rubber Research Institute of Malaya

New replanting techniques, like the poly-bag and soil block methods, have helped to bring immature areas into tapping considerably earlier than hitherto possible. The purpose of this paper is to budget on the additional profit earned through shorter replanting periods.

METHOD AND ASSUMPTIONS

Additional profits are computed by comparing the 'present net profits' earned by replants of high-yielding budded rubber brought into tapping at different ages, assuming that yield and tapping life of the trees remain unaffected by this age. The present profits are calculated in the manner already described (BARLOW AND NG, 1966) and are, as explained, the only measures giving a valid comparison of profitability in cases where the budgeted alternatives involve investments being made and revenues being earned over differing periods of time.

Six alternative replanting periods are considered, ranging from 4½ to 7 years, and a 21-year period of exploitation is assumed in each case. Before present profits can be determined, however, estimates have to be made of replanting inputs and costs, rubber prices, yields and revenue, as well as mature area inputs and costs. These estimates are discussed first.

Replanting period costs

Estimated costs for the six alternative replanting periods, all starting in January 1966, are presented in *Table 1*.* Because of the lack of information it is not possible to estimate these costs on the basis of detailed material and labour requirements, as in the case of the mature area costs, and the costs taken have been determined after inspection of current replanting cost records available to the Institute.

Scrutiny of *Table 1* shows that replanting costs are detailed separately as 'direct' costs of labour and materials, as costs of unseen emoluments, and as costs of administration and supervision. The assumed grand total direct costs are the *same* for all replanting periods considered, since it is assumed that the saving in maintenance costs in the latter years where a period is shorter is offset by the extra cost of using new techniques over the first two years. The total cost of unseen emoluments is also the same for all periods, since this cost is estimated at one-third of direct costs; but total administration costs — estimated at $35 per acre per year — naturally increase as the period grows longer.

*See p. 9.

Since these costs are all calculated at present-day levels, allowance must be made in budgeting for future cost increases. It is assumed after considering the proportion of labour and material costs in replanting, and after study of past trends, that replanting costs are likely to increase at an overall rate of 2% compound for the next ten years. The way in which this increase is allowed for over a 5½-year replanting period is illustrated in *Table 2:*

TABLE 2. ESTIMATED COSTS OF REPLANTING ONE ACRE OVER A 5½-YEAR PERIOD

Years[a]	*Total present cost*	*Compound interest factor*[b]	*Compounded total cost*
	$		$
0 — 1	515	1.010 (½)	520
1 — 2	348	1.030 (1½)	358
2 — 3	168	1.051 (2½)	177
3 — 4	155	1.072 (3½)	166
4 — 5	142	1.093 (4½)	155
5 — 5½	65	1.109 (5¼)	72
Total	1,393		1,448

[a]From start of replanting.

[b]For a rate of cost increase of 2% compound. Figures in brackets are the periods of years for which interest is calculated.

In these computations it is assumed that each cost shown is incurred half-way through the appropriate year. The total present cost of $515 for the first year of replanting is thus considered to be incurred half a year after replanting commences, and an allowance for a 2% compound increase in this sum over half a year has therefore to be added. This is done through multiplication by the appropriate compound interest factor of 1·010 in *Table 2*, to obtain the compounded total first year cost of $520. The compounded total costs in subsequent years are determined in the same manner, and represent the negative cash flows *before* tax referred to by BARLOW AND NG (1966). Estimated compounded total costs for all periods are detailed in *Table 1*.

Prices, yields and revenue

The R.S.S. 1 f.o.b. prices assumed in this budget suppose a decline of 1 ct. per year from 66 cts. per lb in June 1966, to 61 cts. per lb in June 1971, and a decline of ½ ct. per year thereafter until a level of 50 cts. per lb is reached in June 1993. With respect to lower grade prices, an average price of 35·5 cts. per lb ex-estate is assumed for scrap sold in

TABLE 3. ESTIMATED R.S.S. 1 F.O.B. PRICES, DUTY AND CESS PAYABLE, AND AVERAGE LOWER GRADE PRICES OVER THE PERIOD 1966 — 1993

YEAR	JUNE			DECEMBER		
	R.S.S. 1	Duty[a] & res. cess[b]	Lower grade	R.S.S. 1	Duty[a] & res. cess[b]	Lower grade
	cts./lb	cts./lb	cts./lb	cts./lb	cts./lb	cts./lb
1966	66.00	4.375	35.50	65.50	4.250	35.27
1967	65.00	4.250	35.00	64.50	4.125	34.73
1968	64.00	4.000	34.46	63.50	3.875	34.19
1969	63.00	3.875	33.92	62.50	3.750	33.65
1970	62.00	3.625	33.38	61.50	3.500	33.12
1971	61.00	3.500	32.85	60.75	3.375	32.71
1972	60.50	3.375	32.58	60.25	3.375	32.44
1973	60.00	3.250	32.31	59.75	3.250	32.17
1974	59.50	3.250	32.04	59.25	3.250	31.90
1975	59.00	3.250	31.77	58.75	3.250	31.63
1976	58.50	3.250	31.50	58.25	3.250	31.37
1977	58.00	3.250	31.23	57.75	3.125	31.10
1978	57.50	3.125	30.96	57.25	3.125	30.83
1979	57.00	3.125	30.69	56.75	3.125	30.56
1980	56.50	3.125	30.42	56.25	3.125	30.29
1981	56.00	3.125	30.15	55.75	3.125	30.02
1982	55.50	3.125	29.88	55.25	3.125	29.75
1983	55.00	3.125	29.62	54.75	3.000	29.48
1984	54.50	3.000	29.35	54.25	3.000	29.21
1985	54.00	3.000	29.08	53.75	3.000	28.94
1986	53.50	3.000	28.81	53.25	3.000	28.67
1987	53.00	3.000	28.54	52.75	3.000	28.40
1988	52.50	3.000	28.27	52.25	3.000	28.13
1989	52.00	3.000	28.00	51.75	3.000	27.87
1990	51.50	2.875	27.73	51.25	2.875	27.60
1991	51.00	2.875	27.46	50.75	2.875	27.33
1992	50.50	2.875	27.19	50.25	2.875	27.06
1993	50.00	2.875	26.92	50.00	2.875	26.92

[a]Duty calculated according to the current formulae (June 1966).

[b]Research cess is estimated to remain at the current rate of 0.875 ct./lb over all future years.

June 1966. Since a study of the relative prices of R.S.S. 1 and scrap has revealed that their relationship has not varied significantly over the past 5 years, it is further assumed that the 66·0 : 35·5 price ratio between R.S.S. 1 and scrap taken for June 1966 remains the same even when the R.S.S. price declines. The estimated June and December prices of R.S.S. 1 and lower grades for the period 1966 — 1993 are given in *Table 3*.

The estimated yields of latex and lower grades over the 21-year period of exploitation are presented in *Table 4*,* and are based on field trials of high-yielding clones. Unfortunately, such trials have only been carried out for about ten years of the producing life of these clones, and it is therefore necessary to base later yields on hypothesis, in the light of practical and experimental results to-date. It is also supposed that the latex and lower grade yields given are equivalent respectively to the quantities of R.S.S. 1 and scrap sold.

Revenues calculated using the above yields and prices are also given in *Table 4*, which refers to production commencing 5½ years after replanting. In this calculation it is assumed that yields are secured *halfway* through the period to which they apply. Thus the yield of 527 lb. latex obtained in the first year of tapping, 5½ — 6½ years after replanting in January 1966, is supposed to be produced 6 years later — in December 1971. The appropriate price in December 1971 of 60·75 cts. per lb. *(Table 3)* is thus applied to this yield to secure an estimated revenue of $320.15 per acre.

Mature area inputs and costs

The estimated annual mature area inputs and costs for a 21-year period, commencing June 1971, are given in *Tables 4*, and *5*.** The calculation of tapping cost is presented in *Table 4*, where MPIEA rates are assumed and the formula described by WATSON (1965) is used. The management, field maintenance, manuring, weeding, and pest and disease control costs are presented in *Table 5*. The method of compounding the costs detailed in *Tables 4* and *5* is that illustrated in *Table 2* above.

The labour, material and other requirements shown in *Tables 4* and *5* are based on current production records of estates following R.R.I.M. recommendations, with allowance for changes thought likely in the future. One such adaptation is the change-over after five years of tapping from s/2 d/2 to s/1 d/4 *(Table 4)*, a practice likely to become necessary because of mounting labour costs.

Other costs and profit

The remaining costs — manufacturing, duty and cess, f.o.b. charges and transport — are presented in *Table 6*.*** The total annual revenue and the total annual costs for the items dealt with in *Tables 4* and *5* are

*See p. 10.
**See pp. 11 to 15.
***See p. 16.

also given, together with the estimated annual profits. With the exception of a small loss of $25.39 during the first year of tapping, these profits are the equivalent of the positive cash flows dealt with previously.

Computation of present net profit

This is illustrated in *Table 7*, again in reference to a replanting period of 5½ years followed by tapping for 21 years. In this table the figures detailed in each year as the 'actual value of cash flow before tax' are the same as the annual compounded total replanting costs and the annual profits already given in *Tables 1* and *6* respectively.

TABLE 7. CALCULATION OF PRESENT PROFIT AFTER TAX FROM ONE ACRE OVER A 26½-YEAR PERIOD (JANUARY 1966 – JUNE 1992)

Years[a]	Cash flow before tax		Years[a]	Cash flow before tax	
	Actual value	*Present value*[b]		*Actual value*	*Present value*[b]
	$	$		$	$
0 — 1	− 520.00	− 506.10	13½ — 14½	345.73	152.92
1 — 2	− 358.00	− 328.04	14½ — 15½	329.36	137.43
2 — 3	− 177.00	− 153.01	15½ — 16½	313.70	123.49
3 — 4	− 166.00	− 135.37	16½ — 17½	308.47	114.55
4 — 5	− 155.00	− 119.25	17½ — 18½	282.17	98.86
5 — 5½	− 72.00	− 53.20	18½ — 19½	312.00	103.12
5½ — 6½	− 25.39	− 17.90	19½ — 20½	294.74	91.90
6½ — 7½	114.05	+ 75.85	20½ — 21½	249.06	73.26
7½ — 8½	203.86	127.90	21½ — 22½	231.75	64.31
8½ — 9½	251.01	148.57	22½ — 23½	188.13	49.25
9½ — 10½	264.23	147.54	23½ — 24½	171.75	42.42
10½ — 11½	306.48	161.45	24½ — 25½	132.88	30.96
11½ — 12½	338.98	168.46	25½ — 26½	119.14	26.19
12½ — 13½	360.12	168.84	Total[c]	3,644.22	794.40

Present profit after 40% tax = ($794.40 x 0.60) = $476.64

[a]From start of replanting.

[b]Assuming 6% compound interest.

[c]Over 26½-year period.

The short cut method of calculating present profit (BARLOW AND NG, 1966) is also used in *Table 7* with an interest rate of 6%. As in the computations of revenue and compounded cost it is assumed that the

cash flows shown apply to a time half-way through the appropriate periods, and the determination of present value is carried out on this understanding. Thus the actual cash flow of $114.05 secured from $6\frac{1}{2} - 7\frac{1}{2}$ years after replanting is estimated as being obtained 7 years after replanting, giving a present value at 6% of $75.85.

Table 7 denotes that the total present value of the negative and positive cash flows is $794. After allowing for 40% company tax, this becomes $477.

RESULTS

Estimated net present profits after tax, computed for the six replanting periods ranging from $4\frac{1}{2}$ to 7 years and for the compound interest rates 4, 6 and 8%, are presented in *Table 8*. These profits are determined in the manner outlined above for 21 years of production following $5\frac{1}{2}$ years of replanting, the only distinction being that the compounded costs and the prices employed are those applying to different periods of time (all the data necessary for making these computations is contained in *Table 1* and *Tables 3* to *6*).

The three interest rates taken are those thought to cover the likely range of alternative returns on investment *after* the 40% tax has been taken into account. They represent gross interest rates of 6·7, 10·0 and 13·3% before tax respectively.

Study of *Table 8* shows that the present net profit declines both with lengthening period of replanting and increasing interest rate. For a 7-year replanting period and at an interest rate of 8%, present net profit is only $18. This indicates that if the interest rate from alternative investments much exceeded 8%, and if the replanting period could not be reduced below 7 years, the present net profit would be negative, and it would be more profitable to invest money in the alternatives.

TABLE. 8. ESTIMATED PRESENT NET PROFIT PER ACRE WITH DIFFERENT REPLANTING PERIODS AND DIFFERENT INTEREST RATES

Replanting period, years	*Interest rates*		
	4%	*6%*	*8%*
	$	$	$
$4\frac{1}{2}$	1,049	645	355
5	953	560	280
$5\frac{1}{2}$	858	477	208
6	765	397	140
$6\frac{1}{2}$	674	320	76
7	587	248	18

The decline in present profit with lengthening period of replanting is of course the major topic of interest in this paper. *Table 9* denotes the *gains* in present profit per acre secured by bringing areas into tapping earlier. These gains decline with lengthening replanting period and increasing interest rate.

TABLE 9. GAINS IN ESTIMATED PRESENT NET PROFIT PER ACRE WITH DIFFERENT REPLANTING PERIODS AND DIFFERENT INTEREST RATES

Replanting period, years	*Interest rates*		
	4%	*6%*	*8%*
	$	$	$
4½ rather than 5	96	85	75
5 rather than 5½	95	83	72
5½ rather than 6	93	80	68
6 rather than 6½	91	77	64
6½ rather than 7	87	72	58
Total savings	462	397	337

Assuming that returns from alternative investment are likely to bring in 6% after tax, *Table 9* indicates that there is a considerable financial advantage in bringing areas into tapping earlier. A replanting period of 5 rather than 5½ years, for example, will increase the present net profit by $83 per acre per year. A period of 5 rather than 6 years will raise the profit by $163. These gains can also be looked at as *additional expenditures*, over and above those already incorporated in *Table 1*, which are justified when it is desired to get an area into tapping earlier but not suffer any reduction in overall lifetime profit as compared with the longer conventional replanting period.

A final qualification that would be made is that the figures in *Table 9* are based on the assumptions discussed earlier in the paper. Assuming higher future yields or prices will lead to larger estimated gains in present profit from earlier replanting, but the reverse will be true of higher future costs. Thus although this worked example should provide a guide to those who wish to budget on the gain from earlier replanting, care should be taken to relate all assumptions made to the individual situation being planned for.

ACKNOWLEDGEMENTS

The authors wish to thank many colleagues, both within the Institute and in the Industry at large, who have advised on the estimates made in budgeting. Their special thanks are due to Mr. Chong Kow Ming, who was responsible for collecting much of the basic information and for the computations involved.

REFERENCES

BARLOW, C. AND NG, C.S. (1966). Some principles of estate budgeting, *Rubb. Res. Inst. Malaya Pltrs' Conf. 1966.* Preprint No. 14.

WATSON, I. (1965). The economic evaluation of tapping systems. *Pltrs' Bull. Rubb. Res. Inst. Malaya No.80.* 236.

TABLE 1. ESTIMATED COSTS OF REPLANTING ONE ACRE OF HIGH-YIELDING RUBBER OVER PERIODS RANGING FROM 4½ TO 7 YEARS (STARTING JANUARY 1966)

Years[a]	Direct Costs[b]	Unseen Emoluments[c]	Administration/ Supervision	Total Present Cost	Compounded Total Cost[d]
4½	$	$	$	$	$
0—1	400	133	35	568	574
1—2	270	90	35	395	407
2—3	100	33	35	168	177
3—4	90	30	35	155	166
4—4½	40	14	18	72	78
Total	900	300	158	1,358	1,402
5					
0—1	380	127	35	542	547
1—2	250	83	35	368	379
2—3	100	33	35	168	177
3—4	90	30	35	155	166
4—5	80	27	35	142	155
Total	900	300	175	1,375	1,424
5½					
0—1	360	120	35	515	520
1—2	235	78	35	348	358
2—3	100	33	35	168	177
3—4	90	30	35	155	166
4—5	80	27	35	142	155
5—5½	35	12	18	65	72
Total	900	300	193	1,393	1,448
6	$	$	$	$	$
0—1	340	113	35	488	493
1—2	220	74	35	329	339
2—3	100	33	35	168	177
3—4	90	30	35	155	166
4—5	80	27	35	142	155
5—6	70	23	35	128	143
Total	900	300	210	1,410	1,473
6½					
0—1	315	105	35	455	460
1—2	215	72	35	322	332
2—3	100	33	35	168	177
3—4	90	30	35	155	166
4—5	80	27	35	142	155
5—6	70	23	35	128	143
6—6½	30	10	18	58	66
Total	900	300	228	1,428	1,499
7					
0—1	300	100	35	435	439
1—2	200	67	35	302	311
2—3	100	33	35	168	177
3—4	90	30	35	155	166
4—5	80	27	35	142	155
5—6	70	23	35	128	143
6—7	60	20	35	115	131
Total	900	300	245	1,445	1,522

[a] ~~Form~~ from start of replanting.

[b] All labour and materials for replanting.

[c] Estimated at one third of direct costs.

[d] Assuming an overall compound rate of cost increase over the whole period of 2% per year. Costs are estimated as being incurred half-way through each year or part of a year. Thus compounded total cost of $574 for the first year of the 4½ year period, for instance, is $568 compounded at 2% for half year.

TABLE 4. ESTIMATED YIELDS, REVENUE AND TAPPING COSTS ON ONE ACRE OF HIGH-YIELDING RUBBER FOR A 21-YEAR PERIOD OF TAPPING (JUNE 1971 — JUNE 1992), STARTING AFTER A 5½-YEAR REPLANTING PERIOD (JANUARY 1966 — JUNE 1971)

Tapping system and years[a]	*YIELD*			*REVENUE*[c]			*TAPPING AND COLLECTION ITEMS*								
	Latex	*Lower grades*	*Total*	*R.S.S.*	*Lower grades*	*Total*	*Trees tapped/ acre D*	*No. of tappings/ yr r*	*No. of trees/ task t*	*W*[d]	$\frac{D.r}{t}.W$	*Latex incentive*[e] B_{fi}	*L/G incentive*[f] B_{ci}	*Total tapp. & coll. cost*[g] *Present level*	*Total tapp. & coll. cost*[g] *Future level*[h]
	lb	*lb %*	*lb*	$	$	$	*trees*	*tappings*	*trees*	*cts*	$	$	$	$	$
s/2 d/2 2 x $\frac{ly^b}{2}$															
5½ — 6½	527	93 (15)	620	320.15	30.42	350.57	100	155	500	155	48.05	98.89	6.51	153.45	176.77
6½ — 7½	858	152 (15)	1,010	516.95	49.31	566.26	130	155	500	298	109.07	72.07	10.64	191.78	225.87
7½ — 8½	1,071	189 (15)	1,260	639.92	60.80	700.72	125	155	529	298	109.07	89.96	13.23	212.26	255.08
8½ — 9½	1,207	213 (15)	1,420	715.15	67.95	783.10	120	155	508	298	109.07	101.39	14.91	225.37	276.23
9½ — 10½	1,275	225 (15)	1,500	749.06	71.17	820.23	119	155	504	298	109.07	107.10	15.75	231.92	289.61
s/1 d/4															
10½ — 11½	1,280	320 (20)	1,600	745.60	100.38	845.98	117	77.5	350	298	77.18	107.52	22.40	207.10	262.06
11½ — 12½	1,360	340 (20)	1,700	785.40	105.74	891.14	115	77.5	344	298	77.18	114.24	23.80	215.22	276.68
12½ — 13½	1,440	360 (20)	1,800	824.40	110.99	935.39	114	77.5	341	298	77.18	120.96	25.20	223.34	291.91
13½ — 14½	1,440	360 (20)	1,800	817.20	110.02	927.22	112	77.5	335	298	77.18	120.96	25.20	223.34	295.63
14½ — 15½	1,440	360 (20)	1,800	810.00	109.04	919.04	111	77.5	332	298	77.18	120.96	25.20	223.34	300.42
15½ — 16½	1,440	360 (20)	1,800	802.80	108.07	910.87	110	77.5	329	298	77.18	120.96	25.20	223.34	305.57
2s/2 d/4															
16½ — 17½	1,440	360 (20)	1,800	795.60	107.10	902.70	109	77.5	326	298	77.18	120.96	25.20	223.34	308.93
2s/2 d/4 6/12 s/1 d/4 + 1 st./yr 6/12															
17½ — 18½	1,440	360 (20)	1,800	788.40	106.13	894.53	108	77.5	323	298	77.18	120.96	25.20	223.34	313.72
s/1 d/4 + 2 st./yr															
18½ — 19½	1,500	500 (25)	2,000	813.75	146.05	959.80	107	77.5	340	298	72.71	126.00	35.00	233.71	333.70
19½ — 20½	1,500	500 (25)	2,000	806.25	144.70	950.95	105	77.5	334	298	72.71	126.00	35.00	233.71	338.91
20½ — 21½	1,425	475 (25)	1,900	758.81	136.18	894.99	104	77.5	330	298	72.71	119.70	33.25	225.66	332.50
21½ — 22½	1,425	475 (25)	1,900	751.69	134.90	886.59	103	77.5	327	298	72.71	119.70	33.25	225.66	336.59
22½ — 23½	1,350	450 (25)	1,800	705.38	126.59	831.97	102	77.5	324	298	72.71	113.40	31.50	217.61	329.44
23½ — 24½	1,350	450 (25)	1,800	698.63	125.42	824.05	100	77.5	318	298	72.71	113.40	31.50	217.61	334.50
24½ — 25½	1,275	425 (25)	1,700	653.44	117.30	770.74	99	77.5	314	298	72.71	107.10	29.75	209.56	326.82
25½ — 26½	1,275	425 (25)	1,700	647.06	116.15	763.21	98	77.5	311	298	72.71	107.10	29.75	209.56	331.93
Total	27,318	7,392 (21)	34,710	15,145.64	2,184.41	17,330.05								4,550.22	6,242.87

[a]From start of replanting.

[b]Half spiral alternate daily system on alternate panels in alternate years.

[c]Estimated R.S.S. f.o.b. prices and average ex-estate lower grade prices are as shown in *Table 2.*

[d]Basic coverage cost of 143 cts. per tapping plus labour benefits estimated at 155 cts. per man-day. In the *first year of tapping,* basic coverage cost is not incurred because payment follows the unclassified category. The figure of 155 cts in this year represents labour benefits only.

[e]Payment of latex incentive (B) in the *1st year* of tapping follows the MPIEA 'unclassified category' at an assumed rate of $3.40/day (including lower grades incentive). From the *second year* onwards payment follows the current MPIEA 'category A' rate of 8 cts./lb + 0.4 ct./lb for E.P.F. = 8.4 cts./lb.

[f]payment of lower grades incentive (B_{ci}) follows the current MPIEA rate of 6.7 cts./lb dry (4 cts./lb wet) + 0.3 ct./lb for E.P.F. = 7.0 cts./lb.

[g]Calculated as $(B_{fi} + B_{ci} + \frac{D.r}{t}.W)$. For further details see WATSON, 1965.

[h]The compound rate of labour cost increase is estimated to be 2½% from the 1st to the 5th year, 2% from the 6th to the 10th, and 1½% for subsequent years.

TABLE 5. ESTIMATED COSTS OF MANAGEMENT, FIELD MAINTENANCE, WEEDING, MANURING, MISCELLANEOUS ITEMS, PEST AND DISEASE CONTROL AND LATEX STIMULATION ON ONE ACRE OF HIGH-YIELDING RUBBER FOR A 21-YEAR PERIOD OF TAPPING (JUNE 1971 — JUNE 1992), STARTING AFTER A 5½-YEAR REPLANTING PERIOD (JANUARY 1966 — JUNE 1971)

Years[a]	*Estimated costs of items at present cost levels*[b]			*Compounded costs*[b]
5½ — 6½	*Management*	$ per acre		$ per acre
	1 manager : $21,840/yr (including 15% Provident Fund and 3 months' bonus) for 2,000 acres	10.9		
	1 clerk : $ 6,320/yr (including 15% Provident Fund and 2 months' bonus) for 2,000 acres	3.2		
	2 conductors : $11,060/yr (including 15% Provident Fund and 2 months' bonus) for 2,000 acres	5.5		
	8 kanganis : $16,920/yr (including 5% Provident Fund and 1½ months' bonus) for 2,000 acres	8.5		
	Office expenses: $ 3,600/yr for 2,000 acres	1.8		
	Secretarial & visiting agent: $4 per acre	4.0		
	Building depreciation: $3,600 (5% of $72,000) for 2,000 acres	1.8		
	Repairs to buildings[b]: $2,160 (3% of $72,000) for 2,000 acres	1.1	36.8	41.2
	Field Maintenance			
	Roads and bridges	2.5		
	Fire patrol	0.5		
	Irrigation/drainage/terracing	2.2		
	Pruning/thinning/clearing	2.0		
		7.2		
	Panel opening	10.5	17.7	19.6
	Panel opening costs are estimated as follows for a 5 acre task:	$		
	Panel opening labour, including putting on spouts, springs, hangers and cups $4.7×2½ m-d =	11.8		
	500 spouts, springs & hangers and cups at 0.15 cts., 4 ct. & 4 ct respectively	40.8		
	Tasking done by kanganis	—		
	∴ cost on 1 acre= $\frac{52.6}{5}$ = $10.5	52.6		
	Weeding			
	Chemical cost for 2 sprayings of 6' rows	3.6		
	Two sprayings by contract labour at $1.5 per spray $1.5×2 =	3.0		
	One interrow hand slashing at 2 m-d/acre $4.7×2 =	9.4	16.0	17.9
	Manuring			
	One application at 2½ lb/tree for a stand of 140 trees 9.75 cts.×(1×2½×140)=	34.1		
	Manuring labour at 0.33 m-d/acre $4.7×0.33 =	1.5	35.6	44.8
	Miscellaneous			
	Bank charges	0.2		
	Land taxes	5.0		
	Insurance	2.0		
	Survey	—		
	Store & sundry buildings	0.3		
	Tools	0.4		
	Tapping equipment	0.6		
	Electricity	2.5		
	Water	2.5		
	Security	2.0	15.5	16.5
	Total carried forward		121.6	140.0

[a]From start of replanting.

[b]For further details see general notes at the end of this table.

(overleaf)

TABLE 5. ESTIMATED COSTS FOR A 21-YEAR PERIOD OF TAPPING—(CONTD.)

Years[a]	*Estimated costs of items at present cost levels*[b]				*Compounded costs*[b]
			$ per acre	$ per acre	$ per acre
5½ — 6½	*Total brought forward*			121.6	140.0
	Tapping equipment costs are estimated as follows for 1 tapper on *10 acres:*		$ per ~~acre~~ year		
	1×12-gallon churn at $10/- (3 years' life)		3.3		
	2× 3-gallon buckets at $2/- (2 years' life)		2.0		
	2 gunny sacks for scrap collection at 20 cts. each		0.4		
	Tapping knives (3 knives/yr) sharpening stones (4 pieces/yr) and kanda stick provided by tapper		—		
	∴ cost on 1 acre = $\frac{5.7}{10}$ = $0.6		5.7		
	Pest & Disease Control: 1.9 m-d/acre	$4.7×1.9=		8.9	10.3
	Total Cost			130.5	150.3
6½ — 7½	*Management* (same as 5½ — 6½)			36.8	41.8
	Field Maintenance				
	Same as 5½ — 6½ (except panel opening)		7.2		
	Plus panel opening cost on 2nd virgin bark		1.7		
	and extra cups etc. for 30 trees opened		2.5	11.4	13.2
	Panel opening costs are estimated as follows for a *3.8 acre* task:		$		
	Panel opening labour at $4.7×1.4 m-d		6.5		
	Retasking done by kanganis		—		
	∴ cost on 1 acre = $\frac{6.5}{3.8}$ = $1.7		6.5		
	Extra 30 spouts, springs & hangers and cups at 0.15 cts., and 4 cts. and 4 cts. respectively		2.5		
	Weeding (same as 5½ — 6½)			16.0	18.2
	Manuring (same as 5½ — 6½)			35.6	46.7
	Miscellaneous				
	Same as 5½ — 6½		15.5		
	plus spouts, springs & hangers and cups replacement		0.5	16.0	17.2
	Spouts, springs & hangers and cups rpleacement on a *3.8 acre* task are estimated as follows:		$		
	Spouts, springs & hangers		0.4		
	12 cups at 4 cts. each		0.5		
	Churn and bucket repairs		1.0		
	∴ cost on 1 acre = $\frac{1.9}{3.8}$ = $0.5		1.9		
	Pest & Disease Control: 1.6 m-d/acre	$4.7×1.6=		7.5	8.8
	Total Cost			123.3	145.9
7½ — 8½	*Management, Field Maintenance, Weeding and Manuring* (same as 5½ — 6½) *and Miscellaneous* (same as 6½ — 7½)			111.6	135.4
	Pest & Disease Control: 1.3 m-d/acre	$4.7×1.3=		6.1	7.3
	Total Cost			117.7	142.7

(overleaf)

TABLE 5. ESTIMATED COSTS FOR A 21-YEAR PERIOD OF TAPPING—(CONTD.)

Years[a]	*Estimated costs of items at present cost levels*[b]				*Compounded costs*[b]
			$ per acre		$ per acre
8½ — 9½	*Management, Field Maintenance, and Weeding* (same as 5½ — 6½) and *Miscellaneous* (same as 6½ — 7½)			76.0	88.3
	Manuring				
	One application at 2½ lb/tree for a stand of 135 trees	9.75 cts.×(1×2½×135)=	33.0		
	Manuring labour (same as 5½ — 6½)		1.5	34.5	48.8
	Pest & Disease Control: 1.02 m-d/acre	$4.7×1.02=		4.8	5.9
	Total Cost			115.3	143.0
9½ — 10½	*Management, Field Maintenance, Weeding, Manuring and Miscellaneous* (same as 8½ — 9½)			110.5	140.4
	Pest & Disease Control: 0.94 m-d/acre	$4.7×0.94=		4.4	5.5
	Total Cost			114.9	145.9
10½ — 11½	*Management*				
	Same as 5½ — 6½		36.8		
	Minus one kangani due to fourth daily tapping		−1.1	35.7	43.1
	Field Maintenance				
	Same as 5½ — 6½		7.2		
	Plus extra springs and hangers and cups for full spiral tapping		9.4	16.6	19.6
	Extra cost of full spiral tapping is estimated as follows for a stand of *117 trees* per acre:		$		
	117 springs & hangers and cups at 4 cts. respectively		9.4		
	Tasking done by kanganis		—		
			9.4		
	Weeding (Same as 5½ — 6½) and *Miscellaneous* (Same as 6½ — 7½)			32.0	37.2
	Manuring				
	One application at 2½ lb/tree for a stand of 130 trees	9.75 cts.×(1×2½×130)=	31.7		
	Manuring labour (same as 5½ — 6½)		1.5	33.2	50.7
	Pest & Disease control: 0.77 m-d/acre	$4.7×0.77=		3.6	4.6
	Total Cost			121.1	155.2
11½ — 12½	*Management and Manuring* (same as 10½ — 11½), *Field Maintenance and Weeding.* (same as 5½ — 6½) and *Miscellaneous* (same as 6½ — 7½)			108.1	143.2
	Pest & Disease Control: 0.68 m-d/acre	$4.7×0.68=		3.2	4.1
	Total Cost			111.3	147.3
12½ — 13½	*Management* (same as 10½ — 11½), *Field Maintenance and Weeding* (same as 5½ — 6½) and *Miscellaneous* (same as 6½ — 7½)			74.9	91.6
	Manuring				
	One application at 2½ lb/tree for a stand of 120 trees	9.75 cts.×(1×2½×120)=	29.3		
	Manuring labour (same as 5½ — 6½)		1.5	30.8	50.8
	Pest & Disease Control: 0.62 m-d/acre	$4.7×0.62=		2.9	3.8
	Total Cost			108.6	146.2
13½ — 14½	*Management, Field Maintenance, Weeding, Manuring and Miscellaneous* (same as 12½ — 13½)			105.7	145.3
	Pest & Disease Control: 0.55 m-d/acre	$4.7×0.55=		2.6	3.4
	Total Cost			108.3	148.7

(overleaf)

TABLE 5. ESTIMATED COSTS FOR A 21-YEAR PERIOD OF TAPPING—(CONTD.)

Years[a]	*Estimated costs of items at present cost levels*[b]		$ per acre	$ per acre	*Compounded costs*[b] $ per acre
14½ — 15½	*Management, Field Maintenance, Weeding, Manuring and Miscellaneous* (same as 12½ — 13½)			105.7	148.7
	Pest & Disease Control: 0.53 m-d/acre	$4.7×0.53=		2.5	3.4
	Total Cost			108.2	152.1
15½ — 16½	*Management, Field Maintenance, Weeding, Manuring and Miscellaneous* (same as 12½ — 13½)			105.7	151.9
	Pest & Disease Control: $0.8 per acre			0.8	1.1
	Total Cost			106.5	153.0
16½ — 17½	*Management, Weeding, Miscellaneous and Pest & Disease Control* (same as 15½ — 16½)			68.5	87.3
	Field Maintenance				
	Same as 5½ — 6½		7.2		
	Plus opening panel C, 109 trees at 2½ cts. per tree		2.7	9.9	13.7
	Manuring				
	One application at 2 lb/tree for a stand of 115 trees	9.75 cts.×(1×2×115)=	22.4		
	Labour (same as 5½ — 6½)		1.5	23.9	45.7
	Total Cost			102.3	146.7
17½ — 18½	*Management, Weeding, Manuring, Miscellaneous and Pest & Disease Control* (same as 16½ — 17½)			92.4	135.7
	Field Maintenance				
	Same as 5½ — 6½		7.2		
	Plus opening panel D, 108 trees at 2½ cts. per tree		2.7	9.9	13.9
	Latex stimulation				
	One application of stimulant on full spiral cut at 3" belt — 3.2 pints	62½ cts.×3.2=	2.0		
	Scraping & painting labour at $6 per application	$6×1=	6.0	8.0	10.8
	Total Cost			110.3	160.4
18½ — 19½	*Management, Weeding, Manuring, Miscellaneous and Pest & Disease Control* (same as 16½ — 17½)			92.4	138.6
	Field Maintenance				
	Same as 5½ — 6½		7.2		
	Minus terrace repairs		−0.5	6.7	9.6
	Latex stimulation				
	Two applications of stimulant on full spiral cut at 3" belt-6.4 pints	62½ cts.×6.4=	4.0		
	Scraping & painting labour at $6 per application	$6×2=	12.0	16.0	21.9
	Total Cost			115.1	170.1
19½ — 20½	*Management, Field Maintenance, Weeding, Miscellaneous, Pest & Disease Control and Latex Stimulation* (same as 18½ — 19½)			91.2	122.5
	Manuring				
	One application at 2 lb/tree for a stand of 110 trees	9.75 cts.×(1×2×110)=	21.5		
	Manuring Labour (same as 5½ — 6½)		1.5	23.0	49.3
	Total Cost			114.2	171.8
20½ — 21½	*Management, Field Maintenance, Weeding, Manuring, Miscellaneous, Pest & Disease Control and Latex Stimulation* (same as 19½ — 20½)			114.2	175.2

(overleaf)

TABLE 5. ESTIMATED COSTS FOR A 21-YEAR PERIOD OF TAPPING—(CONTD.)

Years[a]	Estimated costs of items at present cost levels[b]			Compounded costs[b]
			$ per acre	$ per acre
21½ — 22½	*Management, Field Maintenance, Weeding, Manuring, Miscellaneous, Pest & Disease Control and Latex Stimulation* (same as 19½ — 20½)		114.2	178.6
22½ — 23½	*Management, Field Maintenance, Weeding, Manuring, Miscellaneous, Pest & Disease Control and Latex Stimulation* (same as 19½ — 20½)		114.2	182.1
23½ — 24½	*Management, Field Maintenance, Weeding, Manuring, Miscellaneous, Pest & Disease Control and Latex Stimulation* (same as 19½ — 20½)		114.2	185.5
24½ — 25½	*Management, Weeding, Manuring, Miscellaneous, Pest & Disease Control and Latex Stimulation* (same as 19½ — 20½)		107.5	178.6
	Field Maintenance			
	Same as 18½ — 19½	6.7		
	Minus irrigation and drainage	−1.7	5.0	7.8
	Total Cost		112.5	186.4
25½ — 26½	*Management, Field Maintenance, Weeding, Miscellaneous, Pest & Disease Control and Latex Stimulation* (same as 24½ — 25½)		89.5	128.3
	Manuring			
	One application at 2 lb/tree for a stand of 105 trees 9.75 cts.×(1×2×105)=	20.5		
	Labour (same as 5½ — 6½)	1.5	22.0	59.2
	Total Cost		111.5	187.5

GENERAL NOTES ON TABLE 5

Management : The estimated compound rates of salary increase are 2½% from the 1st to the 5th year, 2% from the 6th to the 10th year, and 1½% in subsequent years, starting from the 1st year of replanting. This decline in rate of cost increase is estimated to occur partly because of increased efficiency leading to management being spread over a larger acreage.

Office expenses are compounded at a constant rate of 1% per year.

Secretarial and visiting agent fees are assumed to be constant at $4 per acre per year.

Depreciation of buildings is estimated to be 5% per year for the whole period on the following items:—

Manager's bungalow	(brick)	$32,000
Office building	(brick)	$10,000
Clerk's quarters	(brick/plank)	$10,000
Conductors' quarters	(brick/plank)	$20,000
		$72,000

Repairs to buildings per year are estimated to be 3% of the total building cost for the whole period.

Labour Costs : The estimated compound rates of increase taken for all labour costs are 2½% from the 1st to the 5th year, 2% from the 6th to the 10 year, and 1½% for the rest of the period, starting from the 1st year of replanting. As with management costs, the decline in rate of labour cost increase is assumed to occur partly because of more effective deployment of workers.

Field Maintenance : These costs mainly consist of labour, and are obtained from records available to the Institute. They are compounded at the rates given for labour above.

Miscellaneous : These costs are obtained from records available to the Institute. They are compounded at the constant rate of 1%.

Manuring : Present fertiliser cost is estimated at $215 per metric ton or 9.75 cts. per lb, and is compounded at a constant rate of 4%. Present manuring labour cost is estimated at $4.70 per man-day ($3.20 wages + $1.50 unseen emoluments).

Weeding : Chemical cost assumes the use of 4 lb per spray of sodium arsenite at 45 cts. per lb. No increases in cost are estimated because it is expected that sodium arsenite will be replaced by other chemicals whose costs will be kept down in a competitive market.

Estimated present contract labour cost, at $1.50 per spray, is also based on sodium arsenite spraying.

The present cost of interrow hand slashing labour is estimated at $4.70 per man-day ($3.20 wages + $1.50 unseen emoluments).

Pest & Diesease Control : The present cost of this item, which mainly consists of labour, is estimated at $4.70 per man-day ($3.20 wages and chemical + $1.50 unseen emoluments).

Latex Stimulation : The present cost of stimulant is estimated at $5 per gallon or 62½ cts. per pint, compounded at a constant rate of 1%.

Labour cost on this work is estimated at $6 per acre on contract.

TABLE 6. ESTIMATED REVENUE, EXPENDITURE AND PROFIT ON ONE
(JUNE 1971 — JUNE 1992), STARTING AFTER A 5½-YEA

Years[a]	*Total revenue*	*E X*					
		Tapping & collection[b]	*Management*[c]	*Field maintenance*[c]	*Weeding*[c]	*Manuring*[c]	*Miscellaneous*[c]
	$	$	$	$	$	$	$
5½ — 6½	350.57	176.77	41.20	19.60	17.90	44.80	16.50
6½ — 7½	566.26	225.87	41.80	13.20	18.20	46.70	17.20
7½ — 8½	700.72	255.08	42.50	8.60	18.50	48.50	17.30
8½ — 9½	783.10	276.23	43.20	8.80	18.80	48.80	17.50
9½ — 10½	820.23	289.61	43.90	9.00	19.10	50.70	17.70
10½ — 11½	845.98	262.06	43.10	19.60	19.30	50.70	17.90
11½ — 12½	891.14	276.68	43.70	9.30	19.50	52.70	18.00
12½ — 13½	935.39	291.91	44.20	9.40	19.80	50.80	18.20
13½ — 14½	927.22	295.63	44.70	9.50	20.00	52.70	18.40
14½ — 15½	919.04	300.42	45.30	9.70	20.30	54.80	18.60
15½ — 16½	910.87	305.57	45.90	9.80	20.50	56.90	18.80
16½ — 17½	902.70	308.93	46.50	13.70	20.80	45.70	18.90
17½ — 18½	894.53	313.72	47.00	13.90	21.00	47.50	19.10
18½ — 19½	959.80	333.70	47.60	9.60	21.30	49.30	19.30
19½ — 20½	950.95	338.91	48.20	9.70	21.60	49.30	19.50
20½ — 21½	894.99	332.50	48.80	9.90	21.80	51.20	19.70
21½ — 22½	886.59	336.59	49.30	10.00	22.10	53.20	19.90
22½ — 23½	831.97	329.44	49.70	10.20	22.40	55.30	20.10
23½ — 24½	824.05	334.50	50.00	10.30	22.70	57.40	20.30
24½ — 25½	770.74	326.82	50.50	7.80	23.00	59.60	20.50
25½ — 26½	763.21	331.93	51.00	7.90	23.20	59.20	20.70
Total	17,330.05	6,242.87	968.10	229.50	431.80	1,085.80	394.10

[a]From start of replanting.

[b]See *Table 4.*

[c]See *Table 5.*

[d]Manufacturing cost is on R.S.S. only. It consists of labour (2.1 cts./lb), material (0.9 ct./lb) and repairs (0.4 ct./lb). For these items a compound rate of increase of 2% is taken from the 1st to the 5th year, 1½% from the 6th to the 10th year, and 1% for subsequent years. Depreciation is estimated to be constant at 0.6 ct./lb.

ACRE OF HIGH-YIELDING RUBBER FOR A 21-YEAR PERIOD OF TAPPING
R REPLANTING PERIOD (JANUARY 1966 — JUNE 1971)

EXPENDITURE							Profit[h]
Pest & disease[c]	*Stimulation*[c]	*Manufacturing*[d]	*Duty & res. cess*[e]	*F.o.b. charges*[f]	*Transport*[g]	*Total*	
$	$	$	$	$	$	$	$
10.30		23.19	17.79	5.27	2.64	375.96	–25.39
8.80		38.61	28.96	8.58	4.29	452.21	114.05
7.30		48.20	34.81	10.71	5.36	496.86	203.86
5.90		55.52	39.23	12.07	6.04	532.09	251.01
5.50		58.65	41.44	12.75	7.65	556.00	264.23
4.60		60.16	41.60	12.80	7.68	539.50	306.48
4.10		63.92	42.50	13.60	8.16	552.16	338.98
3.80		69.12	45.00	14.40	8.64	575.27	360.12
3.40		69.12	45.00	14.40	8.64	581.49	345.73
3.40		69.12	45.00	14.40	8.64	589.68	329.36
1.10		70.56	45.00	14.40	8.64	597.17	313.70
1.10		70.56	45.00	14.40	8.64	594.23	308.47
1.10	10.80	72.00	43.20	14.40	8.64	612.36	282.17
1.10	21.90	75.00	45.00	15.00	9.00	647.80	312.00
1.20	22.30	76.50	45.00	15.00	9.00	656.21	294.74
1.20	22.60	72.68	42.75	14.25	8.55	645.93	249.06
1.20	22.90	74.10	42.75	14.25	8.55	654.84	231.75
1.20	23.20	70.20	40.50	13.50	8.10	643.84	188.13
1.20	23.60	70.20	40.50	13.50	8.10	652.30	171.75
1.20	23.80	67.58	36.66	12.75	7.65	637.86	132.88
1.30	24.20	67.58	36.66	12.75	7.65	644.07	119.14
70.00	195.30	1,342.57	844.35	273.18	160.26	12,237.83	5,092.22

[e]See *Table 3*.

[f]F.o.b. charges estimated to remain constant at 1 ct./lb for rubber sold ex-estate, due both to increased competition between dealers and to the forecast decline in price.

[g]Transport cost is estimated at 0.5 ct./lb. A compound rate of increase of 1% is taken for all future years.

[h]Total revenue *less* total expenditure.

AGRICULTURAL SERIES.

DEPARTMENT OF AGRICULTURE, S.S. & F.M.S.

Agricultural Leaflet No. 16.

(Second and Revised Edition)

BUDGRAFTING FRUIT TREES

Published by the Department of Agriculture, Straits Settlements and Federated Malay States, Kuala Lumpur, F.M.S., and Printed by Kyle, Palmer & Co., Ltd., Kuala Lumpur.
November, 1939.

FIG. 1.

FIG. 2.

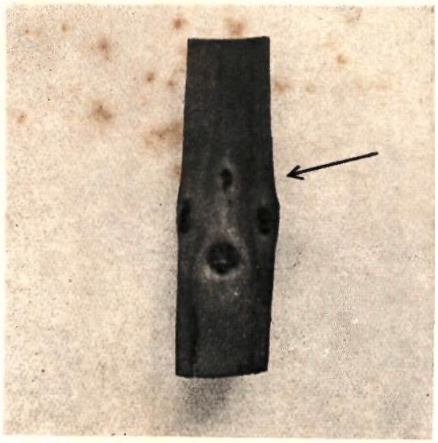

FIG. 3.

FIG. 4.

FIG. 5.

FIG. 6.

FIG. 7.

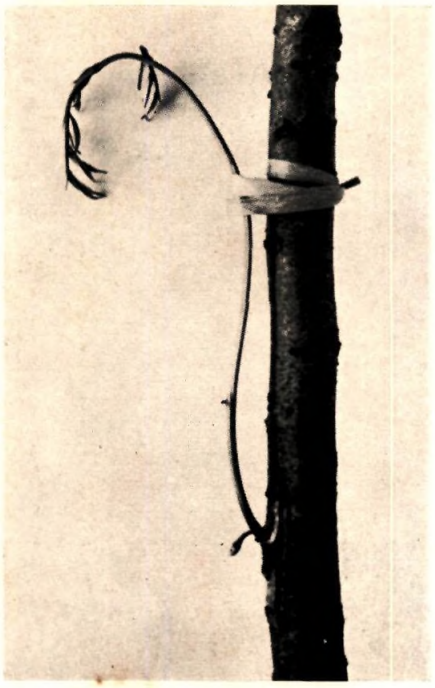

FIG. 8.

FIG. 9.