Development of Ready Reckoner to assess the impact of excessive bark consumption in S/2d2 and S/2d3 harvesting systems

T U K Silva*, P Seneviratne* and K A G B Amaratunga*

** Rubber Research Institute of Sri Lanka, Dartonfield, Agalawatta*

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Abstract

Recently, the poor bark management in different rubber plantations resulted in lower yield per tree in renewed barks leading to either maintaining at uneconomical levels or uprooting before full economic lifespan. Considering the long period, i.e. 24 years of harvesting latex from rubber plantation, monitoring bark consumption rates at very early stages are more effective and economical rather than implementing other special recommendations. However, the normal calculation to realize the excess rate of BC and the expected durations to be tapped according to the relevant ER is difficult to perform in the field. Therefore, attempts were made to prepare a Ready Reckoner to monitor the bark consumption of trees to identify the excess rate of the bark consumed for a certain period of tapping and the relevant durations to be finished for panel A, B, or C.

Key words: bark consumption, calculation, latex, panel, tapping

Introduction

As in the past, the rubber industry played a major role providing Rs.1133 million from export earnings to the Sri Lankan economy in year 2009 (Central Bank, 2009). Further, the industry provides employment for about 500,000 people (CARP Reports, 1992). Also, it is increasingly becoming a valuable source of timber and fuel and this eases the pressure on our fast depleting

natural forests (Jacob, 2000 and Silva 2009).

The economically important life span of the rubber plant is about 30 years (Samarappuli and Tillekeratne, 1999). The tree in general is tapped for latex once it has reached a certain growth stage, i.e. tappable girth (Nugawela, 2001). Depending on the clone and management practices, it takes ca. 5-6 years to bring the plants into the

tappable stage. Tapping is a specialized method by which, controlled wounding of the bark is done to open the latex vessels to harvest latex from the rubber trees (Silva, 1998). As described by Ridley 1891, the excision of bark is made without damaging the cambium. According to Nugawela, 2001, the shaving thickness of the bark at each tapping should be 0.125 cm (1/20"). Therefore, it should be carried out systematically in order to achieve the maximum yield throughout the production period of the tree.

In Sri Lanka, the production period of the tree can be divided into two phases based on the bark tapped, *i.e.* virgin bark and renewed bark. Nugawela, (2001) also pointed out that for the clones recommended for d2 frequency of tapping, a half spiral cut should be made at 120 cm (48") height to tap the first virgin panel for 06 years (Panel BO-1). Other half of virgin bark (opposite side) is tapped from 7th to 12th year (Panel BO-2). Further, the tapping of the renewed bark has to be commenced from the initial height of opening after 12 years of bark renewal. Accordingly, first half of the renewed bark (Panel BI-1) can be tapped from 13th to 18th year of the tapping cycle. Second half of the renewed bark (Panel BI-2) can be tapped from 19th to 24th year of the production period. Therefore, a rubber tree could be tapped for a minimum period of 24 years.

However, in S/2 d3 tapping, a half spiral cut is made at 120 cm (48") height to tap the first virgin panel for 08

years (Panel BO-1). Other half of virgin bark (opposite side) is tapped from 9th to 16th year (Panel BO-2) of the tapping cycle. Tapping of the renewed bark has to be commenced from the initial height of opening after 16 years of bark renewal. Accordingly, first half of the renewed bark (Panel BI-1) can be tapped from 17th to 24th year of the tapping cycle. Second half of the renewed bark (Panel BI-2) can be tapped from 25th to 32nd year of the production period. Therefore, a rubber tree could be tapped for a minimum period of 32 years. In order to save bark, the above mentioned low frequency tapping was recommended in Sri Lanka first in 1994 (Nugawela, 2001).

A survey carried out recently showed that each panel is generally exploited within 3-4 years and both virgin panels (A and B) are completely tapped in 6 to 8 years (Senevirathne, 2011). This situation leads to poor bark renewal and also improper ratio of immature/mature on estates. The above condition results in huge yield loss, poor g/t/t, poor intake/tapper and shorter production cycle. Finally, it affects the cost of production, income of the owners, income of the latex harvesters and the future investments.

The Rubber Research Institute of Sri Lanka has made some attempts to minimize the above hazards while improving quality of rubber clearings for sustainable high yields through training and monitoring. In this process, the correct identification of the bark

consumption rate is essential to decide an appropriate correction.

Materials and Methods

Preliminary field survey

Every rubber fields in four different estates in two Regional Plantation Companies were selected to conduct the preliminary survey to assess the situation of bark consumption rates with respect to the age and different panel positions. Each tapping block was observed and 10 percent of trees selected randomly were used to take bark measurements and other observations, i.e. depth of tapping, angle of tapping and tapping panel dryness. According to the bark consumption rates, the relevant excess rates and the periods to be tapped for panel A and B in different fields in each estate were calculated.

Calculations for excess rate (ER) of consumed bark

For the usual way to find out the excess rate of bark consumed in any tapping task (block), the average actual bark consumption (ABC) and the number of years in tapping (YT) should first be known. The average ABC can be calculated measuring at least 10% of trees in tapping (leaving brown bast and runts). In addition recommended BC (RBC) for the period concerned should also be known. Then ER can be calculated using Equation below.

$$ER = \frac{ABC - RBC}{YT}$$

eg for S/2 d2 system:

- (I) At the end of first year of tapping (12 months), if the actual BC is 8", and the recommended BC also 8" then the excess rate is 0 inches/year.

$$ER = \frac{8-8}{1} = 0$$

- (II) If the actual BC is 10", and the recommended BC is 8" then, the excess rate is 2 inches/year.

$$ER = \frac{10-8}{1} = 2$$

However, this requires measuring and calculating which demands a proper skill and so, it is difficult to perform in the field.

Use of Ready Reckoner to monitor the BC rates

Therefore, attempts were made to prepare a Ready Reckoner to monitor the bark consumption of trees to identify the excess rate of the bark consumed for a certain period of tapping and the relevant durations to be finished for panel A, B, or C. This will help to assess the situation and suggest remedial actions required. Microsoft Excel 2007 package was used to develop the linear relationship between the time and the BC. Above calculations were done in each quarter of each year (time) against BC (inches) and calculated values of different excess rates were prepared up to the panel C. These pre-calculated charts were used to

prepare a Ready Reckoner for panels A, B and C. To clarify its accuracy, it was checked in the fields at several times.

Results and Discussion

The survey conducted in this study clearly showed that most of the rubber fields in both plantation companies the rate of the utilization of rubber bark increase at an alarming rate. Actual panel duration for A and B panels in most of the rubber fields in estate A, B and C will be finished by 6-8, 5-8 and 6-8 years respectively (Fig. 1). However, in estate D where that durations is between 10-12 can be improved better than in the other estates (Fig. 2). Further, most of the fields in the four estates surveyed cannot be tapped on A and B panels for about 12 years as recommended by the RRISL. Therefore, the correct identification at the correct time can minimize the damage due to the higher rate of bark consumption in rubber plantations. Reckoner charts therefore can be used as indicated below.

Guidelines to use the Ready Reckoner

- Ready Reckoner for the bark consumption of tapping consists of six columns for each year.
- First two columns, *i.e.* PP and BC indicates the panel position and the bark consumption (in inches) respectively.
- To find out the excess bark consumed in any tapping task (block), the average BC and the

number of years in tapping should first be known.

- The average BC can be calculated measuring at least 10% of trees in tapping (leaving BB and runs).
- Last four columns indicate the excess rates (inches/ year) in each quarter of the year.
- The value in the place where both lines meet, *i.e.* the BC value in inches (horizontally) and the years in tapping (vertically), is the excess rate (inches/year).

eg for S/2 d2 system:

- (I) At the end of first year of tapping (12 months), if the BC is 8", then the excess rate is 0 inches/year (Table 1).
 - (II) If the BC is 10", then, the excess rate is 2 inches/year (Table 1).
- Accordingly, the possible life span of panels A, A+B or A+B+C can be read from the Table 3.

eg:

- (I) Excess rate 0 means the panel A could be tapped for 6 years (Table 3).
- (II) Excess rate 2 means the panel A could be tapped only for 04 years and 10 months (Table 3).

eg: for S/2 d3 system:

- (I) At the end of first year of tapping (12 months), if the BC is 6", then the excess rate is 0 inches/year (Table 2).
- (II) If the BC is 8", then, the excess rate is 2 inches/year (Table 2).

Fig. 1. Actual and estimated life spans for panel A & B in different rubber fields of estate **a.** and **b.**

Fig. 2. Actual and estimated life spans for panel A & B in different rubber fields of estate **c** and **d**

Development of ready reckoner to assess the bark consumption

Table 1. Bark consumption & excess rates for 1st year of tapping in S/2 d2 harvesting system

PP	BC	Excess rate (inches/year)			
B 1	56	216.0	104.0	66.7	48.0
	55	212.0	102.0	65.3	47.0
	54	208.0	100.0	64.0	46.0
	53	204.0	98.0	62.7	45.0
	52	200.0	96.0	61.3	44.0
	51	196.0	94.0	60.0	43.0
	50	192.0	92.0	58.7	42.0
	49	188.0	90.0	57.3	41.0
A 6	48	184.0	88.0	56.0	40.0
	47	180.0	86.0	54.7	39.0
	46	176.0	84.0	53.3	38.0
	45	172.0	82.0	52.0	37.0
	44	168.0	80.0	50.7	36.0
	43	164.0	78.0	49.3	35.0
	42	160.0	76.0	48.0	34.0
	41	156.0	74.0	46.7	33.0
A 5	40	152.0	72.0	45.3	32.0
	39	148.0	70.0	44.0	31.0
	38	144.0	68.0	42.7	30.0
	37	140.0	66.0	41.3	29.0
	36	136.0	64.0	40.0	28.0
	35	132.0	62.0	38.7	27.0
	34	128.0	60.0	37.3	26.0
	33	124.0	58.0	36.0	25.0
A 4	32	120.0	56.0	34.7	24.0
	31	116.0	54.0	33.3	23.0
	30	112.0	52.0	32.0	22.0
	29	108.0	50.0	30.7	21.0
	28	104.0	48.0	29.3	20.0
	27	100.0	46.0	28.0	19.0
	26	96.0	44.0	26.7	18.0
	25	92.0	42.0	25.3	17.0
A 3	24	88.0	40.0	24.0	16.0
	23	84.0	38.0	22.7	15.0
	22	80.0	36.0	21.3	14.0
	21	76.0	34.0	20.0	13.0
	20	72.0	32.0	18.7	12.0
	19	68.0	30.0	17.3	11.0
	18	64.0	28.0	16.0	10.0
	17	60.0	26.0	14.7	9.0
A 2	16	56.0	24.0	13.3	8.0
	15	52.0	22.0	12.0	7.0
	14	48.0	20.0	10.7	6.0
	13	44.0	18.0	9.3	5.0
	12	40.0	16.0	8.0	4.0
	11	36.0	14.0	6.7	3.0
Eg: ii →	10	32.0	12.0	5.3	2.0
	9	28.0	10.0	4.0	1.0
Eg: i →	8	24.0	8.0	2.7	0.0
A 1	7	20.0	6.0	1.3	-1.0
	6	16.0	4.0	0.0	-2.0
	5	12.0	2.0	-1.3	-3.0
	4	8.0	0.0	-2.7	-4.0
	3	4.0	-2.0	-4.0	-5.0
	2	0.0	-4.0	-5.3	-6.0
	1	-4.0	-6.0	-6.7	-7.0
	Quarter	1 st	2 nd	3 rd	4 th
1 st year					

Table 2. Bark consumption & excess rates for 1st year of tapping in S/2 d3 harvesting system

PP	BC	Excess rate (inches/ year)			
A4	24	90	42	26.00	18.00
	23.5	88	41	25.33	17.50
	23	86	40	24.67	17.00
	22.5	84	39	24.00	16.50
	22	82	38	23.33	16.00
	21.5	80	37	22.67	15.50
	21	78	36	22.00	15.00
	20.5	76	35	21.33	14.50
	20	74	34	20.67	14.00
	19.5	72	33	20.00	13.50
	19	70	32	19.33	13.00
	18.5	68	31	18.67	12.50
A3	18	66	30	18.00	12.00
	17.5	64	29	17.33	11.50
	17	62	28	16.67	11.00
	16.5	60	27	16.00	10.50
	16	58	26	15.33	10.00
	15.5	56	25	14.67	9.50
	15	54	24	14.00	9.00
	14.5	52	23	13.33	8.50
	14	50	22	12.67	8.00
	13.5	48	21	12.00	7.50
	13	46	20	11.33	7.00
	12.5	44	19	10.67	6.50
A2	12	42	18	10.00	6.00
	11.5	40	17	9.33	5.50
	11	38	16	8.67	5.00
	10.5	36	15	8.00	4.50
	10	34	14	7.33	4.00
	9.5	32	13	6.67	3.50
	9	30	12	6.00	3.00
	8.5	28	11	5.33	2.50
Eg ii	8	26	10	4.67	2.00
A1	7.5	24	9	4.00	1.50
	7	22	8	3.33	1.00
	6.5	20	7	2.67	0.50
	6	18	6	2.00	0.00
	5.5	16	5	1.33	-0.50
	5	14	4	0.67	-1.00
	4.5	12	3	0.00	-1.50
	4	10	2	-0.67	-2.00
	3.5	8	1	-1.33	-2.50
	3	6	0	-2.00	-3.00
	2.5	4	-1	-2.67	-3.50
	2	2	-2	-3.33	-4.00
	1.5	0	-3	-4.00	-4.50
	1	-2	-4	-4.7	-5.00
Quarter		1 st	2 nd	3 rd	4 th
1 st year					

Table 4. Expected durations of harvesting
in S/2 d2 system

Excess rate (inches/ year)	Years to be tapped on					
	Panel A		Panel A+B		Panel A+B+C	
	YY	MM	YY	MM	YY	MM
0 ↔ 0.5	6	0	12	0	18	0
0.6 ↔ 1.0	5	4	10	8	16	0
1.1 ↔ 1.5	5	1	10	2	15	3
1.6 ↔ 2.0	4	10	9	7	14	5
2.1 ↔ 2.5	4	7	9	4	13	9
2.6 ↔ 3.0	4	4	8	9	13	1
3.1 ↔ 3.5	4	2	8	4	12	6
3.6 ↔ 4.0	4	0	8	0	12	0
4.1 ↔ 4.5	3	10	7	8	11	6
4.6 ↔ 5.0	3	8	7	5	11	1
5.1 ↔ 5.5	3	6	7	1	10	7
5.6 ↔ 6.0	3	5	6	10	10	3
6.1 ↔ 6.5	3	3	6	7	9	10
6.6 ↔ 7.0	3	2	6	5	9	7
7.1 ↔ 7.5	3	1	6	2	9	3
7.6 ↔ 8.0	3	0	6	0	9	0
8.1 ↔ 8.5	2	11	5	10	8	9
8.6 ↔ 9.0	2	10	5	8	8	6
9.1 ↔ 9.5	2	9	5	6	8	3
9.6 ↔ 10.0	2	8	5	4	8	0
10.1 ↔ 11.0	2	6	5	1	7	7
11.1 ↔ 12.0	2	5	4	10	7	2
12.1 ↔ 13.0	2	3	4	7	6	10
13.1 ↔ 14.0	2	2	4	4	6	7
14.1 ↔ 15.0	2	1	4	2	6	3
15.1 ↔ 16.0	2	0	4	0	6	0
16.1 ↔ 17.0	1	11	3	10	5	9
17.1 ↔ 18.0	1	10	3	8	5	6
18.1 ↔ 19.0	1	9	3	7	5	4
19.1 ↔ 20.0	1	8	3	5	5	2

Table 4. Expected durations of harvesting
in S/2 d3 system

Excess rate (inches/ year)	Years to be tapped on					
	Panel A		Panel A+B		Panel A+B+C	
	YY	MM	YY	MM	YY	MM
0 ↔ 0.5	8	0	16	0	24	0
0.6 ↔ 1.0	6	10	13	9	20	7
1.1 ↔ 1.5	6	5	12	10	19	3
1.6 ↔ 2.0	6	0	12	0	18	0
2.1 ↔ 2.5	5	8	11	4	17	0
2.6 ↔ 3.0	5	4	10	8	16	0
3.1 ↔ 3.5	5	1	10	2	15	3
3.6 ↔ 4.0	4	10	9	7	14	5
4.1 ↔ 4.5	4	7	9	2	13	9
4.6 ↔ 5.0	4	4	8	9	13	1
5.1 ↔ 5.5	4	2	8	4	12	6
5.6 ↔ 6.0	4	0	8	0	12	0
6.1 ↔ 6.5	3	10	7	8	11	6
6.6 ↔ 7.0	3	8	7	5	11	0
7.1 ↔ 7.5	3	6	7	0	10	6
7.6 ↔ 8.0	3	5	6	10	10	3
8.1 ↔ 8.5	3	3	6	6	9	9
8.6 ↔ 9.0	3	2	6	5	9	7
9.1 ↔ 9.5	3	1	6	2	9	3
9.6 ↔ 10.0	3	0	6	0	9	0
10.1 ↔ 11.0	2	10	5	8	8	6
11.1 ↔ 12.0	2	8	5	4	8	0
12.1 ↔ 13.0	2	6	5	1	7	7
13.1 ↔ 14.0	2	5	4	10	7	2
14.1 ↔ 15.0	2	3	4	7	6	10
15.1 ↔ 16.0	2	2	4	4	6	7
16.1 ↔ 17.0	2	1	4	2	6	3
17.1 ↔ 18.0	2	0	4	0	6	0
18.1 ↔ 19.0	1	11	3	10	5	9
19.1 ↔ 20.0	1	10	3	8	5	6

- Accordingly, the possible life span of panels A, A+B or A+B+C can be read from the Table 4.

eg:

- (I) Excess rate 0 means the panel A could be tapped for 8 years (Table 4).
- (II) Excess rate 2 means the panel A could be tapped only for 04 years and 10 months (Table 4).

(The BC rates and the panel positions given in the ready reckoner are based on the S/2 d2 and S/2 d3 tapping systems separately and at an opening height of 48”).

Benefits of monitoring BC rates

- To identify BC rates either tapping block or field wise.
- Monitoring process can be started at very beginning and save money, time and the property.
- Early actions can be taken to correct the situation through improving skill of tapper or to control unnecessary double tapplings.
- Correcting measures through low frequency tapping (S/2 d3) or controlled upward tapping (CUT) can be introduced based on the situation.
- It facilitates 24 years tapping cycle and maximum yield throughout.
- It can be used to find out the actual situation of tapping fields and re-arrange the bark consumption pattern with respect to the yield per tree per tapping and the years to be tapped.

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Address for correspondence: T U K Silva, Research Officer, Plant Science Dept., Rubber Research Institute of Sri Lanka, Dartonfield, Agalawatta, Sri Lanka.
e-mail: tuksilva@yahoo.com