

Impact of different latex harvesting systems adopted by some growers on economic performance

T U K Silva*, **A M W K Senevirathna****, **P Seneviratne***, **W A J M De Costa*****
and **H Subasinghe***

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

** *Faculty of Export Agriculture, Uva Wellassa University, Badulla, Sri Lanka*

*** *Faculty of Agriculture, University of Peradeniya, Peradeniya, Sri Lanka*

Abstract

Due to higher thickness of bark shavings and excessive recovery tappings (RT), the crop losses and the percentage tapping panel dryness (TPD) of rubber plantations are very high. This has resulted in either uprooting of rubber trees before reaching the potential economic lifespan or maintaining them at uneconomical levels. Therefore, this study was carried out to determine the impact of different bark consumption (BC) rates associated with additional days of latex harvesting on yield and related parameters of rubber plantations in four estates (E1, E2, E3 and E4). An on-station experiment with five different harvesting systems, (i.e. T1 - S/2 d2 + rain guards (RG), T2 - S/2 d2 + 3 RT per month, T3 - S/2 d2 + 5 RT per month, T4 - S/2 d3 + 2.5% Ethephon + RG and T5 - S/2 d1, was also tested with four rubber clones according to a split plot design with 3 replicates in a 5.0 hectare field. Survey results revealed that the estates with management (E1 and E2) had a higher BC compared to well managed estates (E3 and E4). Intensive tapping systems and RT (T3 and T5) also led to significantly higher BC rates. It is estimated that high intensity (T3 and T5) tapping of the renewed panels will be consumed within 7-9 years, whilst those in normal tapping (T1 and T2) panels will be consumed normally within 10-12 years (potential lifespan). The higher number of RT and daily tappings would result in shortening of the economic lifespan of rubber trees with no significant increase in the yield per tree per tapping. More importantly, low frequency of harvesting (T4) will be extended the economic lifespan of both renewed panels more than 13 years with significantly higher yield per tree per tapping than the other harvesting systems.

Key words: bark consumption, harvesting systems, recovery tapping, rubber estates, yield

Introduction

Extending the economic lifespan through recommended latex harvesting systems

and high quality tapping leads to increases in growers income whilst contributing to enhance national gross

domestic production (Nugawela, 1995). Yield losses due to malpractices in harvesting could be minimized by utilizing the optimum harvesting period effectively which in turn will uplift the livelihood of latex harvesters and other sundry workers too (Silva *et al.*, 2012). Also, when the economic lifespan is extended, replanting could be delayed and hence causing minimum damage to the environment.

According to Nugawela (2001), the potential yield of each panel (from base/ground level to 120 cm height) should be exploited for at least 6 years under half spiral cut every other day, *i.e.*, S/2d2 tapping system. However, at present, in most commercial plantations, a panel is consumed within 3-4 years as a result of increasing tapping frequency with the objective of obtaining high yields (Silva *et al.*, 2012). In a situation like this, the estimated long term crop loss and the percentage of tapping panel dryness (TPD) are very high in rubber plantations (Nugawela, 1995; Senevirathna *et al.*, 2007). This has resulted in either uprooting of rubber trees before reaching the full economic lifespan or maintaining them at uneconomical levels (Silva *et al.*, 2012). Higher bark consumption rates also leads to harvesting of partially renewed bark. Under such situations, it is essential to study growth and yield related parameters in rubber trees. Being a commercial plantation crop, financial implications associated with different harvesting systems adopted by growers need to be assessed.

Therefore this study was aimed at determining the impact of different bark consumption rates associated with different latex harvesting systems on growth, yield and some yield determining parameters of rubber plantations.

Materials and Methods

This study was conducted as an on station field experiment and also as a survey in the field. A five hectare rubber field planted in 1999 at Rubber Research Institute of Sri Lanka (RRISL) sub-station, Kuruwita, in Ratnapura district was selected to conduct the on station experiment. This field consists of four rubber clones, *i.e.*, RRIC 100, RRIC 102, RRIC 121 and RRIC 133. Five different harvesting system, *i.e.* T1 -S/2 d2 + rain guards (RG), T2 - S/2 d2 +3 Recovery Tappings (RT) per month, T3 - S/2 d2 + 5 RT per month, T4 - S/2 d3 + 2.5% Ethephon + RG, T5 - S/2 d1, were tested in all four rubber clones using a split plot design with 3 replicates.

Initial field establishment including five treatments were laid as main plots (*ca.* 75 trees) whilst clones were taken as sub plots (*ca.* 15 trees) in October 2013. Before introducing the treatments, initial growth and bark thickness were measured. Pretreatment yield measurements were also obtained till end of March 2014 adopting conventional tapping system, *i.e.* S/2 d2 in the plots demarcated. Subsequently, tapping treatments were introduced and latex yields in terms of volume, dry rubber content (DRC) and yield per tree per tapping were taken. Tree girth, bark

thickness and the thickness of the shaved bark were also taken at six months intervals. Assessments on wounds, tapping panel dryness and bark deformation on tapping panels were also done. Data of each variable was analyzed using analysis of variance procedure.

Using four different estates, *i.e.* E1, E2, E3 and E4 selected from two Regional Plantation Companies a preliminary field survey was done to assess the situation of bark consumption rates and panel position with respect to the age in each rubber field selected. In a tapping block of a field 10 percent of trees selected randomly were used to take measurements on bark depth, consumption, depth of tapping, angle of tapping and incidences of tapping panel dryness. According to the bark consumption rates, the relevant excess rates and the period for panels A and B (actual panel lives) to be consumed in different fields in each estate were estimated.

Results and Discussion

The study reveals that in most of the rubber fields in both plantation companies selected, the bark had been consumed at a higher rate than recommended. Actual tapping period of A and B panels in most of the rubber fields in estates E1, E2 and E3 were 6-8, 5-8 and 6-8 years, respectively (Figs. 1 & 2). However, in estate E4 it is in between 10-12 years and is substantially better when compared to other estates. It is

apparent that, most of the fields in all four estates surveyed, A and B panels are consumed in less than the 12 years as recommended for d/2 frequency by the RRISL. The loss of tapping days due to the interference of rain results in huge monetary losses to the country (Nugawela and Tillekeratne, 2001). Widely adopted method of the planters to recover the crop loss is to tap the rubber trees continuously when weather conditions are favorable to do so. This tapping system leads to higher bark consumption rates, poor yield per tree per tapping and TPD levels high as 15-20% at 2-3 years after tapping (Senevirathna *et al.*, 2007). The reason for high TPD could be that the crop is harvested from a tree without giving sufficient time required to re-synthesize the latex prior to harvesting it again (Gomez, 1983; Priyadarshan, 2011). Also, undertaking of late tapping results in 25% loss of crop when compared to normal tapping (Silva *et al.*, 2001). The above approaches are not the appropriate remedies to maintain proper yield whilst sustaining the use of rubber bark during the economic lifespan of the plantation. In this situation, planters are compelled to maintain their fields uneconomically or otherwise uproot such fields before the completion of the recommended lifespan, *i.e.* 30 years. Main reason for low yield levels from C and D panels could be due to not giving sufficient time for bark to renewal and also due to high incidences of tapping panel dryness.

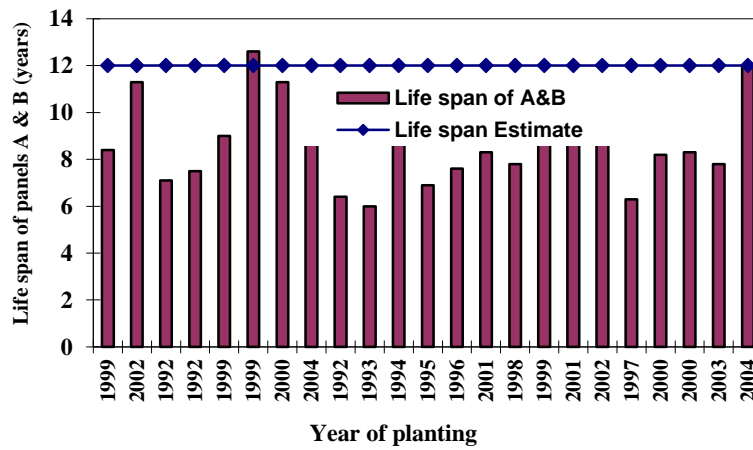
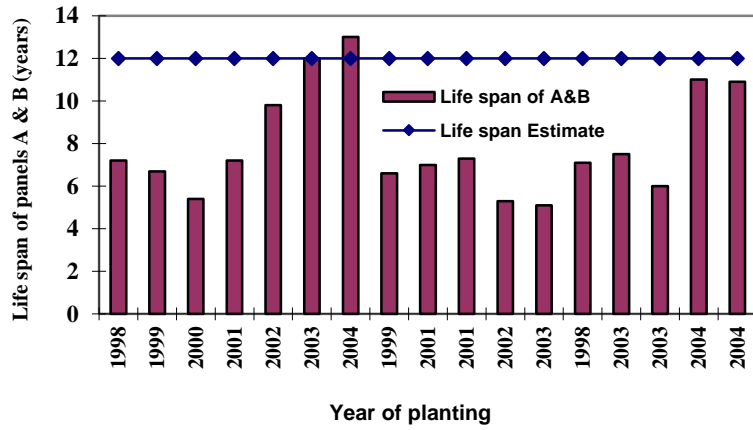


Fig. 1. Actual and recommended lifespans for panels A & B in different rubber fields indicated by year of planting in Estates E1 (above) and E2 (below). Horizontal line indicates the recommended lifespan to consume above panels

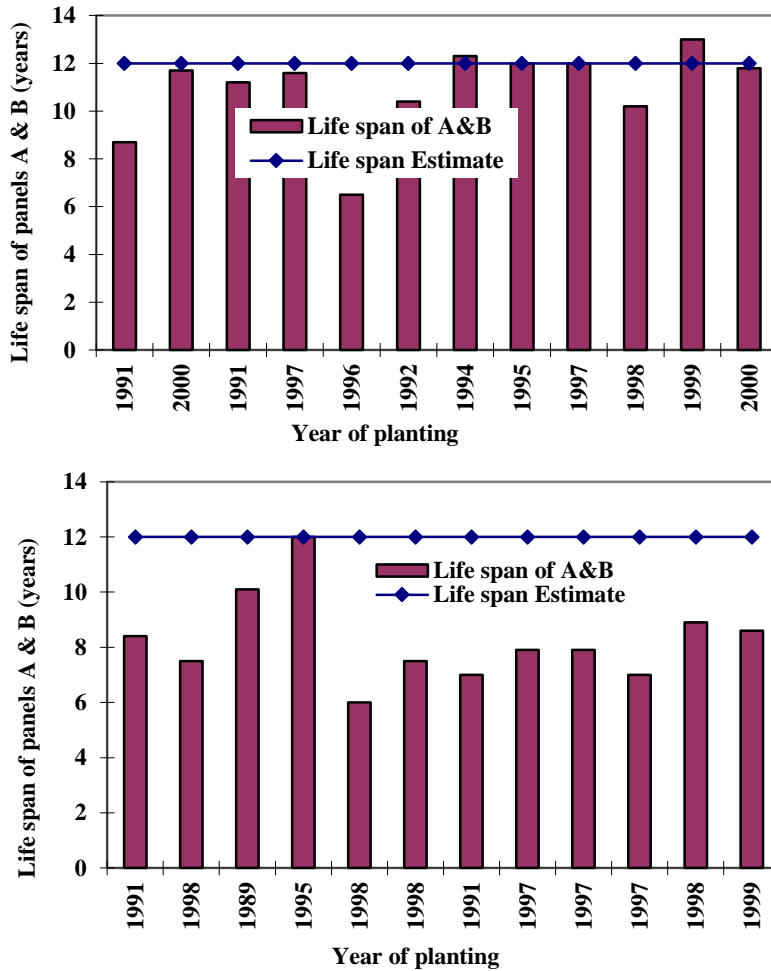


Fig. 2. Actual and recommended lifespans for panels A & B in different rubber fields indicated by year of planting in Estates E3 (above) and E4 (below). Horizontal line indicates the recommended lifespan to consume above panels

Findings of the on station experiment showed that the, tree girth, thickness of shaved bark and length of the tapping cut are not significantly different among the treatments indicating the distribution of trees among the treatments was comparable (Table 1). Further, the

shaved thickness was also comparable since a single tapper was used to tap the trees in each and every sub plots. However, girth, thickness of the untapped bark and length of the tapping cut were significantly different ($p < 0.05$) among the clones tested due to their

inherent characteristics. The differences in the incidence of tapping panel dryness were significant ($p < 0.05$) among the treatments (Table 2). Two treatments with recovery tappings, *i.e.* T2 and T3 recorded significantly higher TPD whilst T1 and T4 recorded lowest TPD. Treatment with daily tapping without rainguards, *i.e.* T5 recorded moderately high TPD level and it could be due to tapping rest in the wet days (Fig. 3). Hence, more number of recovery tappings might have resulted in high TPD incidence (Senevirathna *et al.*, 2007 and Silva *et al.*, 2001) in T2 and T3 as compared to T1 (conventional S/2 d2) and T4 (low frequency tapping). This study clearly showed that the rate of bark consumption was higher in T3 and T5 due to the excessive recovery tapping and daily tapping respectively (Fig. 4). Therefore, the estimated lifespan of panels A and B also would have been shorter significantly in such treatments (Fig. 5). Further, the excessive recovery tappings (T3) and daily tapping (T5) significantly reduced the economic lifespan of rubber trees whilst low frequency tapping (T4) significantly extended the economic lifespan of the rubber trees. On the other hand, low frequency harvesting system, *i.e.* S/2 d3 can increase the intake per tapper and

increase the yield per unit of bark consumed (Nugawela, 2000 and Nugawela *et al.*, 2000). It will reduce the cost of tapping further by enhancing the economic lifespan of the rubber tree. Also, low frequency harvesting is beneficial for the health of the high yielding rubber clones. However, the adoption of low frequency harvesting should be implemented based on socio-economic dimensions of larger and smaller rubber holdings (Chandy *et al.*, 2013). It is evident that, excessive RT and daily tapping will result in shortening of the economic lifespan of the rubber plantations (Silva *et al.*, 2001), without increasing crop harvested. As a result majority of rubber fields have become uneconomical units (Nugawela, 1995) especially with ad-hoc tapping of the bark using different cuts which are not of the same age, less drainage area and insufficient bark renewal (Silva *et al.*, 2012). To avoid adverse impact of high tapping frequencies, double cut alternative (DCA) tapping system has been introduced in other countries (Rukkun *et al.*, 2012). However, long term investigation is required as some studies recorded comparatively higher TPD levels in DCA with stimulation than conventional low frequency harvesting.

Impact of different latex harvesting systems

Table 1. Results of the different parameters studied under five treatments tested. Treatment means with the different superscripts in same row are statistically significant ($p < 0.05$)

Parameter	Treatments tested					CV	P
	T1	T2	T3	T4	T5		
Mean girth (cm) at 150 cm	67.14 ^a	70.33 ^a	69.96 ^a	68.51 ^a	66.68 ^a	6.59	0.2134
Bark thickness (mm) at 150 cm	7.11 ^b	7.69 ^a	7.44 ^{ab}	7.17 ^b	7.24 ^b	5.46	0.3172
Thickness of the shaved bark (mm)	1.397 ^a	1.393 ^a	1.443 ^a	1.438 ^a	1.430 ^a	8.13	0.7957
Length of the tapping cut (cm)	45.18 ^a	48.39 ^a	45.77 ^a	45.84 ^a	45.07 ^a	9.28	0.4737

Table 2. Results of some yield determining variables under five treatments tested. Treatment means with the different superscripts in same row are statistically significant ($p < 0.05$).

Variable	Treatments tested					CV	P
	T1	T2	T3	T4	T5		
Bark consumption rate (cm/year)	22.64 ^c	26.82 ^b	29.16 ^a	17.88 ^d	27.14 ^b	5.86	<0.0001
Yield per tree per tapping (g)	23.29 ^b	22.77 ^b	19.55 ^b	28.62 ^a	22.15 ^b	13.26	0.0256
% TPD	22.02 ^{cb}	33.24 ^a	35.75 ^a	17.87 ^c	29.40 ^{b,a}	43.44	0.0205
Estimated tapping duration of C & D panels in years (y) & months (m)	10y 7m	9y 0m	8y 3m	13y 5m	9y 0m		

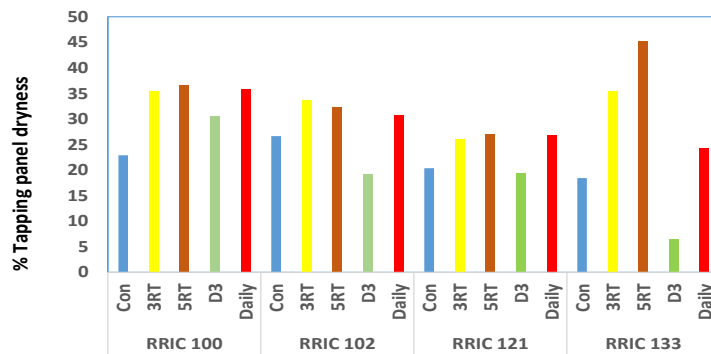


Fig. 3. Incidence of tapping panel dryness of different harvesting systems of different clones after three years

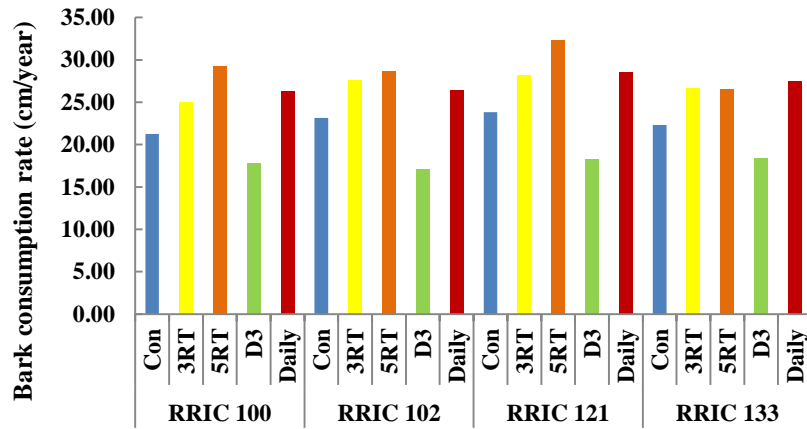


Fig. 4. Rate of the bark consumption of different harvesting systems of different clones

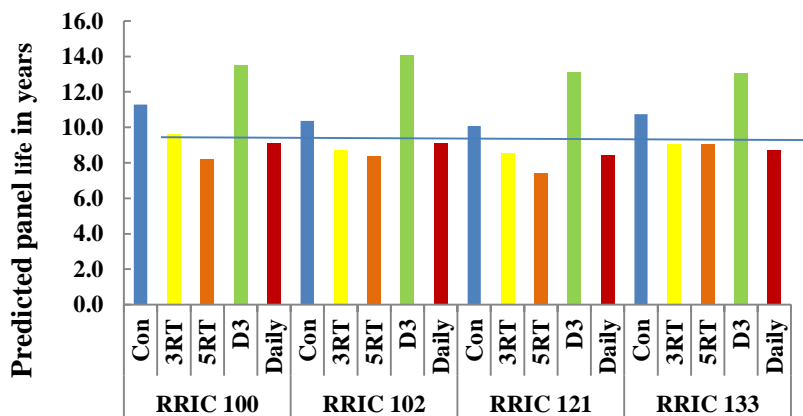


Fig. 5. Estimated panel lifespan according to the bark consumption rates of different treatments and clones

Conclusions

The results of the present study confirmed that over exploitation with excessive recovery tapping and daily tapping adversely influence on economic lifespan of rubber plantations without providing significantly high yields. This study also revealed that the incidence of TPD to be higher with over exploitation leading to a reduction of healthy trees in the plantation.

Acknowledgments

Authors acknowledge the National Science Foundation (Grant RG/2012/AG/06) for the financial support. Miss S G I Madhubashini is thanked for her technical assistance during the study. Dr (Mrs) W Wijesuriya, Biometrician of RRI is also thanked for assisting in data analysis.

References

- Chandy, B, Thomas, K U, Veeraputhran, S and Siju, T (2013). Socio-economic dimensions of participatory trials on low frequency tapping (LFT) in Kerala. *Rubber Science* **26(1)**, 55-59.
- Chantuma, P, Gohert, E and Lacote, R (2015). Effect of DCA (double cut alternative tapping system) on renew bark and TPD (tapped panel dryness) symptom with RRIC 600 clone. *Proceedings of the International Rubber Conference 2015*, 2-3 November 2015, Ho Chi- Minh City, Vietnam, 365-375.
- Gomez, J B (1983). *Physiology of Latex (Rubber) Production*. Malaysian Rubber Research and Development Board, Malaysia, pp.2-33.
- Nugawela, A (1995). Towards an economically viable plantation. *Bulletin of the Rubber Research Institute of Sri Lanka* **32(1)**, 14-21.
- Nugawela, A (2000). Tapper shortage in Sri Lanka-reasons, repercussions and recommendations to minimize it. *Bulletin of the Rubber Research Institute of Sri Lanka* **41**, 39-40.
- Nugawela, A, Peries, M R C, Wijesekara, S and Samarasekara, R K (2000). Evaluation of d/3 tapping with stimulation to alleviate problems related to d/2 tapping of *Hevea*. *Journal of the Rubber Research Institute of Sri Lanka* **83**, 49-61.
- Nugawela, A (2001). Exploitation for economic yields, chapter 16. In: *Handbook of Rubber Vol. 1. Agronomy* pp176-190. (Eds. L.M.K. Tillekeratne and A. Nugawela), Rubber Research Institute of Sri Lanka, Agalawatta, Sri Lanka,
- Nugawela, A and Tillekeratne, L M K (2001). Minimizing of crop losses due to interference of rain on tapping. In: *Handbook of Rubber Vol. 1. Agronomy*, pp.198-206 (Eds. L.M.K. Tillekeratne and A. Nugawela) Rubber Research Institute of Sri Lanka, Agalawatta, Sri Lanka.
- Priyadarshan, P M (2011). Latex production, diagnose and harvest. In: *Biology of Hevea Rubber*. Chapter 4. Pp.71-73. Rubber Research Institute of India, India.
- Rukkun, J, Sdoodee, S, Rongsawat, S and Leconte, A (2012). Test of double cut alternative DCA tapping system under on-farm trials in southern Thailand. *Journal of Agricultural Technology* **8(5)**, 1811-1820. <http://www.ijat-aatsea.com>.
- Senevirathne, A M W K, Wilbert, S, Perera, S A P S and Wijesinghe, A K H S (2007). Can tapping panel dryness of rubber be minimized at field level with better management? *Journal of the Rubber Research Institute of Sri Lanka* **88**, 77-87.
- Silva, T U K, Nugawela, A, Rodrigo, V H L and Serasinghe, P (2001). Effect of recovery tapping on yield potential of rubber (*Hevea brasiliensis*) trees. *Journal of the Rubber Research Institute of Sri Lanka* **84**, 25-38.
- Silva, T U K, Senevirathne, P and Amaratunga, K A G B (2012). Development of Ready Reckoner to assess the impact of excessive bark consumption in S/2 d2 and S/2 d3 harvesting systems *Journal of the Rubber Research Institute of Sri Lanka* **92**, 22-31.
- Sivakumaran, S, Hashim, I and Abraham, P D (1985). The effect of direction of tapping and position of cut on yield responses to stimulation. *Journal of the Rubber Research Institute of Malaysia* **33(2)**, 83-104.

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