Different Latex Harvesting Systems and Their Impact on Bark Consumption and Economic Lifespan of Rubber Plantations in Sri Lanka

TUK Silva[1*], AMWK Senevirathna[1], P Seneviratne[1] and WAJM De Costa[2]
[1]Department of Plant Science, Rubber Research Institute of Sri Lanka, Dartonfield, Agalawatta, Sri Lanka,
[2]Faculty of Agriculture, University of Peradeniya, Peradeniya, Sri Lanka

Abstract
Due to higher bark shavings and excessive recovery tappings (RT), the crop losses and the percentage tapping panel dryness (TPD) of rubber plantations are very high resulting in either uprooting before full economic lifespan or maintaining 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 plantation including a preliminary survey in four estates (A, B, C and D). Also, 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% Ethephone +RG) T5 (S/2 d1), were tested with four rubber clones using split plot design in 3 replicates in 5.0 hectare field. Results showed that the estates A and B were managed poorly and their BC was at an alarming rate compared with C and D. In the on station experiment, the BC rate was significantly higher in T3 and T5 whilst significantly lowest in T4. Based on the prediction of tapping on two renewed panels, T3and T5will be finished within 7-9 years whilst T1 and T2 will be finished satisfactorily within 10-12 years. Both renewed panels of T4 will be utilized for more than 13 years due to low frequency of harvesting and significantly extended the economic lifespan of rubber. Finally, the higher rates of RT and daily tapping shorten the economic lifespan of the rubber plantations whilst not increasing significant yield per tree per tapping.

Keywords: Bark, Latex, Rubber Plantation, Yield
****Corresponding author:*** tuksilva@yahoo.com

Introduction

Rubber is one of the major plantation crops in Sri Lanka. Economic lifespan of rubber could be utilized effectively for the sustainable yield and can be extended over the present level by providing comprehensive protocol in latex harvesting. Therefore, economic return will be increased by increasing the yield and minimizing the yield loss arising from malpractices in harvesting. Utilization of the optimum harvesting period effectively will uplift the livelihood of latex harvesters and other sundry workers too. Also, when the economic lifespan is extended, replanting will be delayed causing minimum damage to the environment.

In order to obtain the potential yield each panel (120cm of height) should be exploited for at least 6 years *i.e.* under half spiral cut every other day generally termed as S/2d2 tapping (Nugawela, 2001). But at present, a panel is consumed within 3-4 years for high yields in commercial scale. In a situation like this, the crop loss in long term is heavy and also the percentage tapping panel dryness (TPD) is very high in rubber plantations. This situation leads to poor bark management in rubber plantations resulting either uprooting before full economic lifespan or maintaining at uneconomical levels (Silva *et al.*, 2012). The higher rates of bark consumption resulted in shifting to other panels early and therefore harvesting being continued on comparatively smaller trees and on partially renewed bark. Hence, the growth and yield related parameters should be studied. Being rubber as a commercial plantation crop, financial implications associated with different harvesting systems also needed to be assessed. Hence an in-depth economic analysis considering social and environmental impacts should be done finally.

Therefore this study is planned to determine the impact of different bark consumption rates associated with different latex harvesting systems on growth, yield and some yield determining parameters of rubber plantation.

Materials and Methods

This study was conducted mainly with on station formal experiment and a preliminary field survey. A five hectare rubber field which was planted in year 1999 at RRISL sub-station, Kuruwita in Ratnapura District was selected to conduct the on station experiment. This field consists of four major rubber clones, *i.e.*, RRIC 100, RRIC 102, RRIC 121 and RRIC 133.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% Ethephone +RG) T5 (S/2 d1), were tested with four major rubber clones using split plot design with 3 replicates.

Five treatments were laid as main plots (ca.75 trees) whilst clones were taken as sub plots (ca. 15 trees) in October 2013. Before, implementing the treatments initial growth and bark measurements were taken. Yield measurements were also monitored continuing conventional tapping system, i.e. S/2 d2 till end of March 2014. Daily latex yields in terms of latex volume, dry rubber content (DRC) and hence 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 and bark deformation on tapping panels were also done. Data of each experiment were analyzed using Analysis of variance procedure under the supervision of Biometrician of RRISL.

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.

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 is high 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. However, in estate D duration is in between 10-12 and was better than other estates. 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. The loss of tapping days due to the interference of rain resulted in huge monitory loss to the country. Widely adopted method of the planters is to tap the rubber trees continuously when weather conditions are favorable. This method leads to increase the rate of bark consumption, poor yield per tree per tapping and TPD levels high as 15-20%. The fact is that the crop is harvested from a tree a certain period of time required to re-synthesize the latex prior to harvesting it again. Also, undertaking late tapping results in 25% loss of crop when compared to normal tapping (Silva *et al.*, 2001). The above approaches are not complete remedies for issue. In this situation planters have to maintain their fields uneconomically or otherwise uproot such fields before the recommended lifespan, i.e. 30 years. Main reason identified is the low yields from C and D panels due to insufficient bark renewal and high incidences of tapping panel dryness.

Based on the findings of the on station experiment, tree girth, thickness of shaved bark and length of the tapping cuts were not significant among the treatments indicating the distribution of trees among the treatments was comparable (Table 1). Further, the shaved thickness also comparable due to the single tapper was used to tap trees in entire replicate. However, girth, thickness of the untapped bark and length of the tapping cut were significant ($p < 0.05$) among the clones tested due to their inherent characteristics. According to the above assessments excessive recovery tapping (T3) and daily tapping (T5) significantly reduced the economic lifespan of rubber whilst low frequency tapping (T4) significantly extended

Table 1: Results of the different variables under four treatments tested

Variable	Treatments tested					CV	P
	T1	T2	T3	T4	T5		
Mean Girth (cm) at 150 cm	67.14	70.33^{a}	69.96	68.51	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	1.393^{a}	1.443	1.438^{a}	1.430^{a}	8.13	0.7957
Length of the tapping cut (cm)	45.18	48.39^{a}	45.77^{a}	45.84^{a}	45.07	9.28	0.4737
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
Estimated duration to be finished C & D panels in years (y) and months (m)	10y 7m	9y 0m	8y 3m	13y 5m	9y 0m		

Treatment means with the different superscripts in same row are statistically significant ($p < 0.05$)

the economic lifespan of rubber. On the other hand, low frequency harvesting systems, i.e. S/2 d3 can increase the intake per tapper and increase the yield per unit of bark consumed. It will reduce the cost of tapping further by enhancing the economic lifespan of the rubber tree. Also, low frequency harvesting considers the health of the high yielding rubber clones. Finally, the higher rates of RT and daily tapping shorten the economic lifespan of the rubber plantations whilst not increasing significant yield per tree per tapping. Therefore, the correct identification at the correct time and introduction of remedies can minimize the damage due to the higher rate of bark consumption in rubber plantations.

Acknowledgement
Authors Acknowledge the NSF grant RG/2012/AG/06 for the financial support.

References

Nugawela A 2001. Exploitation for economic yields, chapter 16. In: LMK Tillekeratne and A Nugawela (eds). Handbook of Rubber Agronomy, Rubber Research Institute of Sri Lanka, Agalawatta, Sri Lanka. 1:pp176-190.

Silva TUK, Nugawela A, Rodrigo VHL 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 TUK, Senevirathne P and Bandara KAGB 2012. Development of Ready Reckoner to assess the impact of excessive bark consumption in S/2 d2 and S/2 d3 harvesting systems.Jl. Rubb. Res. Inst. Sri Lanka. 92: 22-31.