Yield Variation among *Hevea brasiliensis* Trees of Different Ages in Clone RRIC 121

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ABSTRACT

Commercially cultivated rubber plantations show less productivity than the potential. One reason is yield variation found among the plants of a clone planted. This study was carried out using clone RRIC121 to identify reasons for such yield variation and to develop strategies to optimize land productivity and profitability. One tapping task each from two separate fields tapped on panels BO-1 and BO-2 were selected for the study. For collection of data 20% of trees were selected randomly from each tapping block. Girth, bark depth, position of tapping cut, latex yield, scrap yield and dripping time were studied in the selected trees. Grams/tree/tapping was significantly correlated with girth of the tree in both the panels. Nevertheless the bark depth was significantly correlated to yield only in trees tapped on panel BO-1. The other parameters studied though showed a positive relationship with yield were not significant. The potential yield loss due to low girth category trees is high as 744 kg/ha/year. The scrap percentage of individual trees varied from 1.1 to 31.2% and from 1.6 to 45.8% in panels BO-1 and BO-2 respectively. The high percentage of scrap could be attributed to poor hygienic conditions in latex collecting cups. Achieving optimum and uniform growth during immature period will minimize lower gtt trees whilst improving land productivity and profitability.

KEYWORDS: Bark depth, Dripping time, Girth, Scrap, Yield

INTRODUCTION

Hevea brasiliensis is cultivated for the natural rubber found in its latex. For this purpose the rubber tree is exploited by periodic excision of a thing shaving of the bark along a sloping groove placed spirally on the bark of the tree trunk. Tapping is a process of systematic wounding of the bark of the rubber tree to extract latex. An ideal tapping system is one which gives the highest latex yield at lowest tapping cost and bark consumption with satisfactory tree growth, bark renewal and lowest incidence of Tapping Panel Dryness (TPD). Presently the continuous excision method of tapping developed by Ridley is used to exploit rubber trees for its latex (Thilakarathna and Nugawela, 2001).

Commercial plantations are established using budded plants of high yielding clones. Nevertheless, the productivity, i.e. yield per hectare of such plantations is much less than the potential of the planted clones (Nugawela, 1998). One reason is the tree to tree variation in yield even within a clone. The reasons for such variations need to be identified for further yield improvements.

Length of the tapping cut is one of the factors affecting the yield and it is determined by the girth of the tree for a given system of tapping. Girth increment after commencement of tapping, is essential to obtain continuous high yields during the entire tapping cycle of the tree.

Normally yield per tapping of a budded rubber tree decreases with increase in the tapping height (Mann, 1934). This may be due to the relatively low maturity and hence the low depth of bark with the increasing height of the tapping cut.

The rubber content of latex, each time the tree is tapped is determined basically by the period which elapsed after the previous tapping as well as the inheritant rubber regenerating capacity of the laticiferous cells. Rubber content tends to be low in the clones with low plugging index as more latex is lost each time the tree is tapped. Though the rubber content is a factor determining yield, the differences en-counted in rubber content is much smaller than the differences in the volume of latex obtained on tapping. So the direct effect of rubber content on yield can be masked by the large difference in the volume of latex obtained.

Plugging index also affects the dripping time. A high plugging index indicates that plugging occurs relatively fast resulting in a lesser dripping time (Sethuraj and Mathew, 1992).

The objective of the study was to identify factors governing the tree to tree variation in yield within the rubber clone RRIC 121, i.e. a widely grown clone in the country.

MATERIALS AND METHODS

This study was conducted at the Muwankanda estate, Mawathagama, Kurunagala, from January to March 2013.

Two mature rubber fields of clone RRIC 121 tapped on panels BO-1 and BO-2 were chosen for the study. From each field a single tapping block was selected and from it 60 trees, i.e. 20% of the total trees, were selected randomly to collect relevant data.

The data collected from the trees selected were:

1. Girth of tree.
2. Depth of bark.
3. Position of the tapping cut.
4. Latex dripping time.
5. Dry Rubber Content (DRC) of latex.
6. Latex yield / tree / tapping (gtt)
7. Scrap yield / tree / tapping.

Girth of Tree

The girth of a tree was determined at a height of 150 cm from the bud union using a measuring tape.

Depth of Bark

Bark depth was measured using a bark gauge at a height of 150 cm from the bud union.

Position of the Tapping Cut

The position of the tapping cut was determined by measuring the distance to it from a height of 150 cm from the bud union.

Latex Dripping Time

The above was determined by the time difference between the time of tapping and the time of collecting latex using a stop watch.

Dry Rubber Content (DRC) of Latex

The DRC of latex collected from the entire tapping block was determined by using a Metrolac.

Latex Yield / Tree / Tapping (gtt)

After tapping, once latex flow has completely ceased the volume of latex collected to the cup was determined using a measuring cylinder. gtt was calculated using latex volume and the DRC of the tapping block.

Scrap

The scrap was collected separately in each tree prior to the next tapping, and the weight was determined using a top loading balance.

Data on items 4, 5, 6 and 7 above were collected two times from trees selected for the study, and the mean of each parameter was calculated.

A multiple linear regression was conducted to analyze the data.

RESULTS AND DISCUSSION

In both panels tested there was a significant variation in yield among the trees of the clone RRIC121. It varied from 24.0 to 210.5 g per tree per tapping (gtt) in trees tapped on BO-1 panel (Table 1). In trees tapped on panel BO-2 it varied from 15.1 to 127.8 g (Table 2).

Table 1. Yield variation among rubber trees of different ages in clone RRIC 121, BO – 1 panel

	Latex Yield / Tree / Tapping			
	20-70	71 - 120	121 - 150	151-220
% of trees	38.3	38.3	11.7	11.7

Table 2. Yield variation among rubber trees of different ages in clone RRIC 121, BO – 2 panel

	Latex Yield / Tree / Tapping			
	15-44	45-74	75-104	104-134
% of trees	20	30	20	30

In panel BO – 1 for each 1 mm increase in bark depth the gtt increased by 89.4 g whilst it increased only by 18.4 g in panel BO -2 (Table 4). Further, the correlation between gtt and bark depth was significant only in panel BO – 1 (Table 3 and Figure 1).

Table 3. The p values of multiple linear regression for girth (G), bark depth (BD), dripping time (DR) and tapping position (TP)

	G	BD	DT	TP
BO-1	0.000	0.031	0.050	0.231
BO-2	0.000	0.565	0.244	0.617

BO -1 R-Sq(adj) 60.5% BO -2 R-Sq(adj) 47.4%

Table 4. The regression values of multiple linear regression for girth (G), bark depth (BD), dripping time (DR) and tapping position (TP)

	G	BD	DT	TP
BO-1	+1.7	+89.4	+0.21	+0.422
BO-2	+2.0	+18.4	+0.57	+0.233

The latex vessels are found in the bark of rubber tree and the number of latex vessel rings increases with the increasing depth of the bark. Therefore a positive correlation between yield and bark depth can be expected. The relationship between gtt and bark depth in panel BO – 2 may not have been significant due to the harvester not utilizing the entire depth of bark during harvesting.

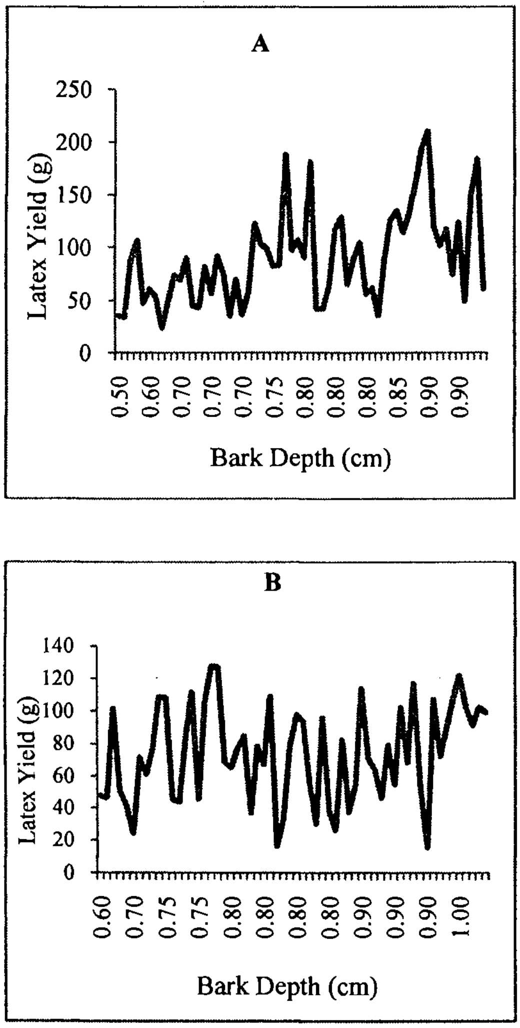


Figure 1. The effect of depth of bark on latex yield among rubber trees of different ages in clone RRIC 121; A- BO- 1; B- BO- 2

Though not significant, the distance to the tapping cut from 150 cm above the bud union showed a positive relationship with yield (Table 3 and Figure 2). This could be expected since the maturity of the bark increases with the increasing distance to the tapping cut from 150 cm above the bud union. The increase in yield was 0.422 and 0.223 g per cm in BO - 1 and BO - 2 panels respectively (Table 4).

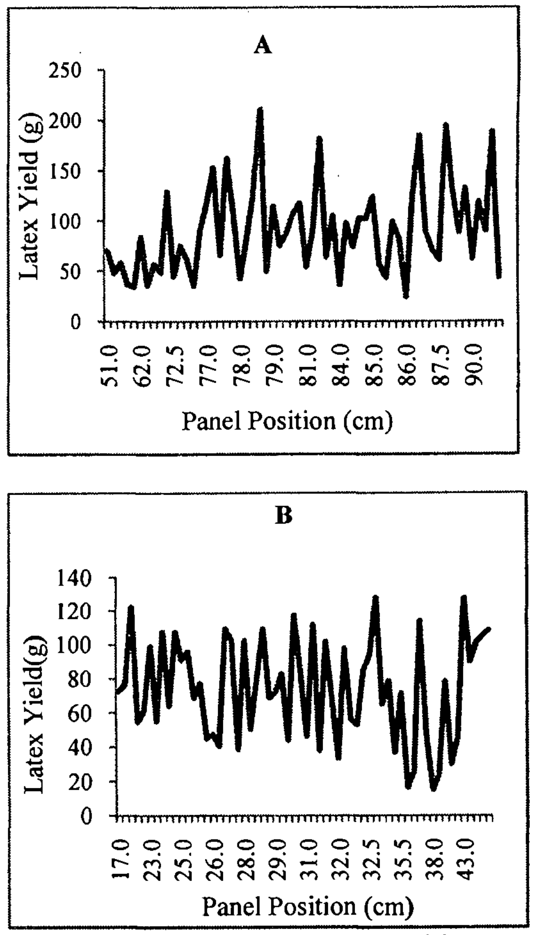
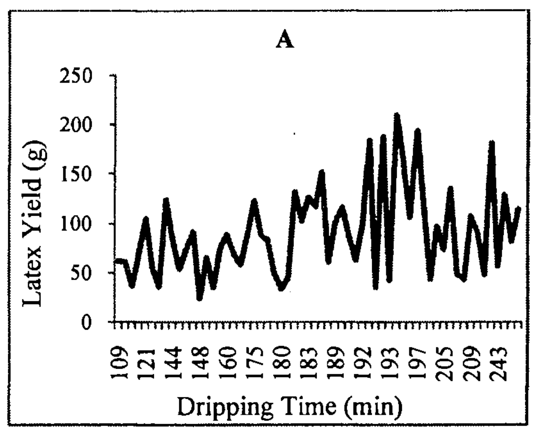


Figure 2. The effect of panel position on latex yield among rubber trees of different ages in clone RRIC 121; A- BO- 1; B- BO- 2

The time given for latex flow, i.e. dripping time, showed a positive and a significant relationship with yield in panel BO -1. However this relationship was not significant in panel BO – 2 (Table 3 and Figure 3). If latex is collected after the complete cessation of latex flow a correlation between gtt and dripping time may not be expected.



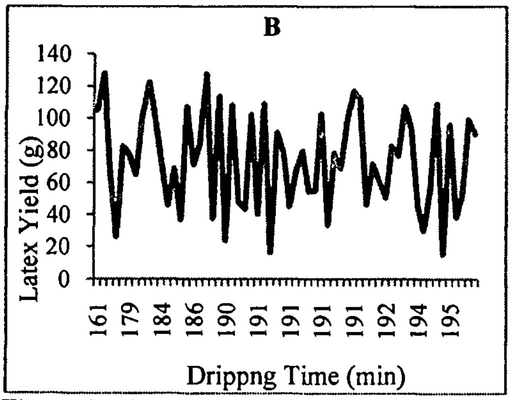


Figure 3. The effect of latex dripping time on yield among rubber trees of different ages in clone RRIC 121; A- BO- 1; B- BO- 2

Yield increased significantly with the increase of girth in both BO – 1 and BO – 2 panels (Table 3 and Figure 4). The yield increased by 1.7 and 2.0 g for each centimeter increase in girth in BO – 1 and BO – 2 panels respectively (Table 4). The relationship that is apparent between yield and girth clearly shows that with increasing girth the economic yield of rubber tree also increases. The length of tapping cut of a rubber tree is positively correlated to tree girth. Thus, with increasing girth more number of latex vessels will be cut during tapping resulting in a higher economic yield.

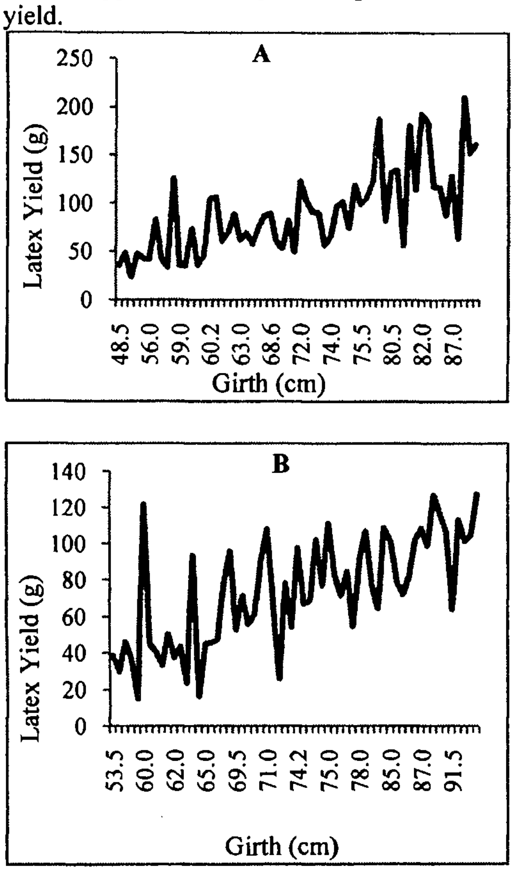


Figure 4. The effect of girth of tree on yield among rubber trees of different ages in clone RRIC 121; A- BO- 1; B- BO- 2

Among the trees sampled in panel BO – 1 the lowest 25% of the trees when ranked according to the girth had an average gtt of 50.4. The average gtt for the rest of the trees were 104.5. Hence the yield loss due to below average girth category is 54.1 gtt. Assuming 500 trees per hectare, and 110 tappings per year, the total loss of yield due to below average girth is more than 744 kg per hectare per year. At a selling price of Rs. 400 per kg of rubber the loss of revenue due to poor girthing is around Rs. 297,000 yr/ha. Similar calculation shows that the loss of income for panel BO – 2 is around Rs. 213,000 yr/ha. Therefore in order to increase the performance of the rubber plantations the poor girth category of trees should be eliminated.

In rubber plantations the replanting cycle is around 30 years. Therefore high quality plants with promising vegetative characters must be selected for field establishment. Further all plants must be provided with optimum conditions for growth. In rubber plantations it is generally observed that trees located in areas convenient for supervising are generally healthy. Similarly, in mature fields the quality of tapping is also high in such areas. Therefore it is apparent that if good management practices are adopted equally in all areas of the plantations the number of lower performing trees could be reduced. With this approach both land productivity and profitability can be enhanced in rubber cultivations.

Scrap is a low grade rubber, which gives a relatively low income to the grower. Therefore the management should take steps not to produce scrap rubber at the expense of latex. This study reveals that the scrap percentage varies from 1.1 to 31.2% in the trees tapped on BO – 1 panel. Further in trees tapped on BO – 2 panel, it varied from 1.6 to 45.8%. Field observations showed that high percentage of scrap is generally associated with poor hygienic conditions of the collecting cups. The study also revealed that the scrap percentage was not significantly correlated to dripping time ruling out early collection of latex. Therefore in order to reduce the scrap percentage, the management should take necessary steps to maintain plastic latex collecting cups clean and in good hygienic conditions.

CONCLUSIONS

Growth of the tree as measured by girth, bark depth was found to be significantly and positively correlated to yield. Therefore, management practices in the plantations need to be focused to achieve high and uniform growth.

Improving hygienic conditions of latex collecting cups will also improve the financial performance in rubber plantations.

ACKNOWLEDGEMENTS

The authors wish to express their sincere gratitude to Mr. I. Senanayake (Senior Group Manager, Pitiyakanda Group), Mr. Mahesh Kurukulasooriya (Manager, Muwankanda Estate) and the field staff in Muwankanda Estate for their valuable assistance, throughout the study.

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