



A NEW BUCKING APPROACH TO IMPROVE TEAK (*Tectona grandis*) GRADING: A CASE STUDY IN KURUNEGALA DISTRICT

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INTRODUCTION

Teak (*Tectona grandis*) is one of the world's premier hardwood timber, which belongs to *Lamiaceae* family. Sri Lankan teak is a popular super luxury timber for indoor furniture manufacturing, constructions, parquet and other interior applications, due to unique colour and grain pattern (Weerasinghe and Amarasekara, 2010).

Bucking is the process of cutting the fallen trees into several logs. The length of the log mainly depends on the market demand and the grading method. The timber grading is done through quality classification by inspection and assessment of log shape, wood defects and other deteriorations (Jayawardhane *et al.*, 2016). Customers assess their quality by visual observation of defects; natural defects, artificial defects, defects caused by wood destroying agents, felling defects and manufacturing defects.

The economically important teak log grades are prime grade log (PR) and saw grade logs (S). Prime grade logs are excellent teak logs with well matured stem, while saw grade logs are not PR even though close to PR, which can be sold on free sale (Ruwanpathirana, 2013). PR grade logs can be produced using proper bucking techniques; however, poor operations are resulting in S grade and more lower grades than PR grade logs. The conversion of S grade logs into PR grade by removing defects, leads to loss of some amount of timber yield and it might be a case for an economical loss. On the other hand, conversion of S grade logs into PR grade logs cause a price increment.

The goal of this study was to develop a bucking technique to increase PR grade log for teak timber for profit maximization. Specific objectives of this study are to (a) make recommendations for logs with bucking defects, (b) determine the statistical significance of prices when converting S grade logs to PR grade logs, and (c) determine the difference between market and actual log dimensions.

METHODOLOGY

Data Collection and Sample Preparation

The logging sites of State Timber Corporation (STC) located at Wiharakanda and Athugalpura plantations in Kurunegala district in the Low Country Intermediate Zone (*IL_{1a}* and *IL₃*) were selected for this study. The market survey was carried out using a questionnaire aimed at timber vendors in Moratuwa and Kurunegala areas.

Three hundred and thirty teak logs (330 logs) were randomly selected. The lengths of the log and mid circumference were measured by using a distance tape (SLS, 1992). Their log dimensions were assessed along with log quality. Logs were categorized as S grade, based on their lengths and mid girth. Afterwards, new length and mid circumference were measured by assuming the defects are removed from S grade logs. Recorded visual defects were buttresses, knots, hollows, bends and splits. Teak logs were arranged into 23 different girth classes based on their mid circumference. 265 selected saw grade logs, which can be converted into PR grade after removing defects, were used for further analysis.

A questionnaire about the uses of teak and their sizes, purchasing methods, log dimensions, market dimensions of the logs and timber cutting dimensions, was distributed



among randomly selected thirty teak purchasing shops. The data collection was carried out from July to October in the year 2020.

Log Volume Calculation

The log volume was calculated followed by equation 1 on Huber’s formula (SLS, 1992). Where; $4\pi = 88/7$ and the volume in m^3 was converted into dm^3 . The log volume was calculated by using the equation 1.

$$V (dm^3) = (G^2 \times L \times 7000) / 88 \dots\dots\dots (1)$$

Where V is volume of the log (dm^3), G is mid circumference of the log (m) and L is length (m).

Log Selling Price Calculation

The three types of prices were calculated, namely normal selling price (A), sales price within the production region (P1) and selling price outside the production region (P2) (Table 1). Those prices were calculated per unit volume for both S logs and converted PR logs.

Table 1. Log selling price calculation

Length (m)	S Log				PR log	
	(P1)		(P2)		(P1)	(P2)
	≥ 0.94	≤ 0.93	≥ 0.94	≤ 0.93		
<5.4	A × 1.45	A × 1.30	A × 1.55	A × 1.40	A × 1.75	A × 1.85
≥ 5.4	A × 1.55	A × 1.40	A × 1.65	A × 1.50	A × 1.85	A × 1.95

A- Normal selling price ($A = pV$), p; price of $1dm^3$ volume of the log according to the girth range, V; volume of the log (dm^3), 0.94 and 0.93 are the mid circumference (m)

Statistical Analysis

Statistical comparison of mean values was performed by paired t-test using the Minitab (Version 18.0) statistical software.

RESULTS AND DISCUSSION

The most frequent girth class of teak in Wiharakanda plantation was 0.94-0.98 m, which was classified as class 11. Meanwhile, the frequent girth class in Athugalpura plantations was 0.76-0.80 m, which was classified as class 8. Thulasidas and Bhat (2009) have reported that farm practices might contribute to faster growth rate in Teak, resulting higher log volume, while other silvicultural practices might have effects on the log quality. The most often noticeable deformities are piths (Irimadaya), hollows, knots and buttresses. Jayawardhane *et al.*, (2012); Thulasidas and Bhat (2009) have also reported similar findings and described that harvesting damages and heart rot were generally less continuous. The most frequently observed defect in the field was buttresses. However, adaptation of standard silvicultural practices followed by pruning and thinning would give better log form and a lower number of knots (Bouaphavong *et al.*, 2016).

Market Survey

According to the 30 teak vendors 43% of log vendors prefer teak for furniture manufacturing purposes, while 18% and 16% prefer Mahogany and Jack, respectively. This trend agrees with the findings of Ariyadasa (2002). As indicated in this study, teak is in the super luxury class that can be utilized for different purposes. All respondents buy timber from free trade and 97% of those respondents purchase timber for furniture manufacturing, while only 3% of respondents purchase timber for reselling. Consumers purchase teak for manufacturing beds,



wardrobes, sofas, chairs and other wooden accessories. According to the survey, 89% of respondents wanted to have 6 m or above length in logs and 70% of respondents preferred the 0.71-1.5 m girth range and 32% of respondents preferred to have teak from Kurunegala district, 28% from Ampara district, 25% from Puttalam district and 11% from Batticaloa district, due to the quality of the log, grain pattern and price. The survey also revealed that 89% of respondents preferred to have 6 m or above length. However, consumers preferred to have logs between 0.71-1.5 m mid girth. However, it is suggested to conduct this survey annually as the consumer preference may vary depending on the end use and site quality of plantations released in previous year.

Descriptive Statistics of Sample Logs

The mean length, mid girth, P₁ and P₂ of logs were reported in Table 2. Those logs are usually from the very first log of the tree bole. This result demonstrated that logs are bucking in an average of 6 m or above. Paired statistics proved that unit volume sales price of P₁ and P₂ had increased significantly after converting S grade logs into PR grade (P<0.05) (Table 2). Hence, it strongly suggests that improving the grade of defective logs by removing defects less than 15% from length is profitable than selling defective logs. Accordingly selling outside the region is more profitable than selling within the region. The mid girth of the produced logs was highly depending on the site specification, growth parameters and silvicultural practices.

Table 2. Descriptive statistics of sample logs

Site	Variable	Before bucking	After bucking
Wiharakanda	Length (m)	6.43±0.45	5.67±0.82
	Mid girth (m)	1.12±0.32	1.09±0.31
	P ₁	63.36±21.84*	72.69±23.37*
	P ₂	67.54±23.16*	76.7±24.64*
Athugalpura	Length (m)	6.32±1.15	5.48±1.06
	Mid girth (m)	1.01±0.25	0.96±0.23
	P ₁	53.94±18.43*	62.56±18.05*
	P ₂	57.94±19.81*	66.45±19.19.54*

*P1: Sales price within the production region for unit dm³ volume (Rs.), P2: Sales price outside the production region for unit dm³ volume (Rs.), * represents significant values(P<0.05)*

Bucking Recommendation

According to field observations, the very first logs taken from the bole of the tree can be easily converted into PR, due to the presence of a uniform cylindrical stem. Defect percentage and defect type of the logs vary from log to log, due to site specifications and decision of the field officers. Removing of buttress resulted in the highest amount of volume than other defects. It is recommended to remove less than 1 m length due to practical constraints. When producing PR grade logs, the knots, splits, rots and checks in the face of the log should be cut and removed.

It is further recommended that the log should be cut as straight as possible and maximum length (around 7.2 m) of the log should be obtained, whenever possible. In cases where the maximum length cannot be obtained due to the defects of the logs, it should be cut into 4 m, 4.4 m, 5.6 m etc. (multiples of 7 and 6 feet) in length. It is suggested to carry out further research in all teak growing areas to identify optimum bucking length that can be removed without profit loss for each girth class.



CONCLUSIONS/RECOMMENDATIONS

It was confirmed that conversion of S grade logs into PR grade logs, increases the profit. However, removing parts should not exceed more than 1 m in length. The extent of defects also varied with the site specifications and practical constraints. Defective S grade logs can be sold as PR grade logs by eliminating deformities, which is more productive. Results revealed that customer preference relies upon quality of logs with maximum timber volume and final end products. Thus, practically defective S grade logs can be converted into PR grade by removing defective parts of less than 15% of length without any profit loss. Further, this study has to be carried out in the dry zone area to develop more accurate bucking and grading techniques.

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