A NOTE ON HEARTWOOD PROPORTION AND WOOD DENSITY OF 8-YEAR-OLD TEAK

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Introduction

Teak (*Tectona grandis*) is one of the most preferred species in intensive plantation forestry. Knowledge of wood properties of 8-year-old teak is essential for the efficient utilisation of wood from second mechanical thinning and early tree harvesting in the recently launched commercial and intensive forestry schemes in India. While estimation of heartwood proportion helps assessing the differences in durability and decorative value, density (or specific gravity) determination can be rapid and simple method of an early assessment of timber strength and pulp yield.

The present study attempts to answer the two major questions: firstly, whether 8-year-old teak is inferior in wood quality to mature or older trees in terms of heartwood content and wood density and secondly, whether faster growth affects these wood quality parameters.

Materials and Methods

As Nilambur (Kerala) is one of the most important locations of teak plantations in India, trees were sampled in 8-year-old plantations of the Nilambur Forest Division. Sampled trees extended over an area of 2,500 ha of assorted age, part of which represented the second rotation plantations. About 10 cm thick cross sectional discs were cut at breast height (BH) level (1.37 m from the stump level) from 102 trees. As per the experimental design of a defoliation study (Nair *et al.*, 1985), these trees represented two populations, viz. protected from insect defoliation for the previous four years and unprotected as control plantations. Two stands represented each population with the replica of 2 plots each.

Ring width was measured from two opposite radii of the cross sectional discs in the laboratory, covering the eccentricity, if any, to determine the ring width of individual growth rings with the help of a stereo microscope. Whole discs were used to determine basic wood density (o.d. weight to green volume) by gravimetric method. To estimate the heartwood percentage by volume, heartwood area and disc area were calculated by measuring four radii at right angles to one another and four measurements were averaged for each disc.

Results and Discussion

The mean ring width values indicate that growth rate decreases with age and the ring in 8-year-old wood is considerably greater than in the wood of older trees (Table 1).

Table 1

Comparison of certain wood properties of 8-year-old teak with published values in older trees

Property	8 yr old		27-yr old *	51-52-yr old **
	Mean	CV%	Avg.	Avg.
BH diameter (cm)	10.5	18.1	-	35
Ring width	5.7	43.8	4.3	3.3
Density (kg/m^3)	582.1	7.0	551	612
Heartwood %	30.1	37.6	-	76.6

* Sanwo (1987), ** Bhat *et al.* (1985).

Heartwood percentage : The mean heartwood content is 30% which is less than half the value reported for 51-52-year-old trees sampled from the same geographic location (Table 1). This implies that longer than 8-year rotation needs to be prescribed when higher heartwood content is desired to enhance the natural durability and decorative value of teak wood products.

Heartwood percentage showed a significant positive correlation with ring width and BH diameter (Table 2). This indicates that faster growth is associated with higher heartwood content and lower sapwood proportion disproving the general notion that faster grown timber always has higher sapwood content.

Wood Density : Basic wood density varied from 520 to 683 kg/m^3 among the 102 trees sampled with a mean value of 582 kg/m^2 (Table 1). The mean density of 8-year-old is therefore only 5% lower than the average wood density reported for 51-52-year-old trees grown in the same geographic location (Bhat *et al.*, 1985; 1989). However, this is comparable with the wood density of suppressed trees of age 51-52 years (Bhat *et al.*, 1987) and 6% greater than the density of 27-year-old teak grown in Nigeria (Sanwo, 1987). Apparently, juvenile wood in teak is not always inferior to mature wood in properties like density and strength as shown by Sanwo (1987).

Table 2

Correlation coefficients for interrelationships between certain properties

Diameter *vs* Heartwood%	0.456^{**}
Ring width *vs* Heartwood %	0.728^{**}
Diameter *vs* Density	0.031^{ns}
Ring width *vs* Density	0.040^{ns}
Density *vs* Heartwood %	-0.127^{ns}

Significant at 1% level; ^{ns} Not significant.

Analysis of Variance (ANOVA) shows that wood density did not differ significantly either between the two populations (protected vs unprotected plantations from insect defoliation) or between the plots (Table 3). The relatively low value of coefficient of variation (Table 1) indicates that tree-to-tree differences are small with low phenotypic variation. The influence of environmental factors like locality on wood density is reported to be greater than the seed source of 36-year-old teak (Purkayastha *et al.*, 1973; Purkayastha and Sathyamurthy 1975). This may be one reason why Nigeria-grown teak showed comparatively low density. Density is also not related either to BH diameter, ring width or heartwood percentage (Table 3).

Conclusions and Recommendations

1. There is no large difference in the wood density between 8-year-old and mature (older) teak trees.

2. As the heartwood percentage is lower than half the value of 51-52-year-old trees, longer than 8-year-rotation may be necessary when higher heartwood content

Table 3

F values of ANOVA for 8-year-old teak

Source of variation	d.f.	Density	BH diameter	Heart-wood (%)
Populations (Protected *vs* unprotected from insect defoliation)	1	1.024^{ns}	0.183^{ns}	0.092^{ns}
Plots	3	0.996 ^{ns}	0.727^{ns}	0.128^{ns}
Residual	3	167.125		
Total	7			

is desired for the renowned natural durability and decorative value of the teak wood products. However, lower heartwood content is desirable for pulping and preservative treatment of thinning material for longer durability.

3. Faster growth in plantation-grown teak in Nilambur at age 8-years does not affect wood density but increases heartwood percentage considerably. A word of caution is however necessary, as the relationship between growth rate and wood properties seems to be complex and often specific to heredity and growing conditions, including silvicultural techniques.

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SUMMARY

Three wood properties, viz. ring width, basic density and heartwood percentage were studied in breast height in 102 trees sampled from four plots of 8-year-old teak (*Tectona grandis* L.f.) plantation in Nilambur (Kerala). Heartwood proportion by volume was only 30%, which is lower than half the value recorded for 51-52-year-old trees grown in the same geographic location. Mean basic density (582 kg/m^3) was only about 5% lower than the average density reported for 51-52-year-old trees grown in the same location. On the other hand, the density value is about 6% greater than the recorded for 27-year-old teak grown in Nigeria. Faster growth was associated with higher heartwood percentage while wood density was independent of growth rate.

आठ वर्षीय सागौन के सारकाष्ठ समानुपात और काष्ठ घनत्व पर एक टिप्पणी

के०एम० भट्ट

सारांश

तीन काष्ठ गुणों अर्थात् वलय की चौड़ाई, आधारभूत घनत्व और सारकाष्ठ समानुपात का अध्ययन नीलाम्बूर (केरल) रोपवनों के 8 वर्षीय सागौन (*टैक्टोना ग्रांडिस* लि० वत्स) के चार भूखण्डों से नमूना निकाले 102 वर्षों की वृक्ष ऊँचाई पर किया गया। आयतन से सारकाष्ठ का समानुपात केवल 30% था जो अधिक पुराने 51-52 वर्षीय वृक्षों से, जिन्हें उनके समान भौगोलिक दशाओं में उगाया जा रहा था, समानुपात में आधे से कम है। माध्य आधारभूत घनत्व (582 किग्रा/घन मीटर) उसी स्थान में उग रहे 51-52 वर्षीय वृक्षों के लिए सूचित की गई औसत आधारभूत घनता से केवल लगभग 5% कम है। इसके विपरीत, नाइजीरिया में उगाए जा रहे सागौन के 27 वर्षीय वृक्षों के लिए आलेखित घनता से ये लगभग 6% अधिक है। अधिक वृद्धि को सारकाष्ठ के अधिक प्रतिशत से जोड़ा गया है जबकि काष्ठ घनत्व को बढ़ने की गति से स्वतन्त्र पाया गया है।

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