

Wood properties among three *Eucalyptus* species planted for pulpwood production in Indonesia

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Introduction

Eucalyptus is one of the fast-growing plantation tree species. Wood of this species is mainly used as raw material for pulp and paper. However, the price of wood as pulp and paper is not always expensive compared to that for lumber production. On the other hand, it is known that cross breeding among *Eucalyptus* species results in improvement of their wood quality. In this study, investigation on wood properties of *E. urophylla*, *E. grandis*, and *E. pellita*, was performed to promote using the wood of these species as raw materials for lumber production.

Experiments



Note: A, Location and plantation stand; B, dynamic Young's modulus of logs measurement; C, disc samples. Thirty-eight trees in a plot were measured for stem diameter (D), tree height (TH), and stress-wave velocity (SWV). In addition, 9 trees were felled for measuring dynamic Young's modulus of logs (DMOE) and basic density (BD).

Results

Table 1. Results of analysis of variance

Trait	<i>E. urophylla</i> (n=19)				<i>E. grandis</i> (n=8)				<i>E. pellita</i> (n=11)				ANOVA p-value
	Max	Mean	Min	SD	Max	Mean	Min	SD	Max	Mean	Min	SD	
D (cm)	17.8	13.1	9.4	3.1	17.6	14.0	11.3	1.9	20.8	16.8	12.2	3.2	0.008
TH (m)	18.5	12.1	7.2	3.0	27.0	17.1	12.3	5.0	24.1	16.7	12.9	3.2	0.001
SWV (km/s)	3.83	3.18	2.64	0.29	3.55	3.15	2.9	0.23	3.89	3.35	2.96	0.30	0.206
DMOE (GPa)	13.68	12.70	11.15	1.36	14.12	11.65	9.08	2.52	9.94	9.27	8.44	0.76	0.115
BD (g/cm^3)	0.52	0.45	0.41	0.07	0.45	0.41	0.39	0.03	0.50	0.47	0.44	0.03	0.371

Note: D , stem diameter; TH, tree height; SWV, stress-wave velocity; DMOE, dynamic Young's modulus; BD, basic density; n , number of trees; SD, standard deviation

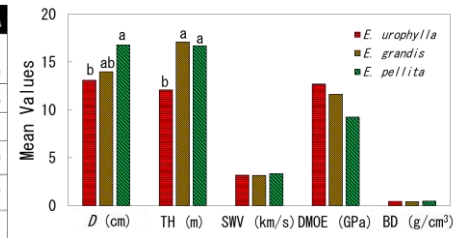


Fig. 1. Variations in growth characteristics and wood properties.

Note: Different letters on the top bars indicate significant differences among three *Eucalyptus* species (Tukey Kramer test)

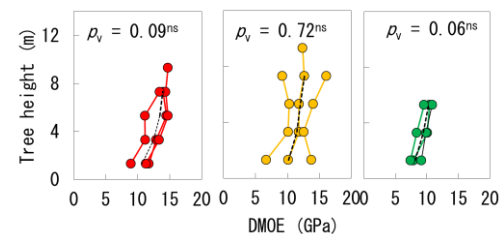


Fig. 3. Axial variation of DMOE.

Note: ρ_v , probability value from ANOVA test

Fig. 2. Relationships between diameter and SWV (A), tree height and SWV (B), radial variation of BD (C), and relationship between SWV and DMOE of logs (D).

Conclusion

- Improvement in growth rate will not lead to reduction in mechanical strength of the three *Eucalyptus* wood. Therefore, to support lumber production, the trees with faster in growth rate should be selected as the mother trees.
- SWV is effective to be used as a non-destructive selection tool for grading the mechanical properties of wood.
- Variation in basic density was constant from pith to 3 cm, then increased toward the bark.
- DMOE of logs slightly increased from base to the top of the stem. However, those values were not statistically different.
- The BD ranged from 0.41 to 0.52 g/cm^3 and the DMOE from 8.44 to 14.12 GPa, suggesting that the three *Eucalyptus* woods can be used as interior furniture or structural design. However, another mechanical testing should be carried out to confirm this result.
- Based on the results, cross-breeding among the three *Eucalyptus* species will result in significant improvement in their growth rate.