Fellowship report

A study on the milling and strength properties of branchwood suggests that logging residues could be used to help meet the timber demands of the downstream processing sector

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Economizing: the horizontal mobile bandmill known as the woodmizer was used for the primary breakdown of branchwood into lumber. *Photo: © R. Okai*

TIMBER from the natural forest in Ghana is dwindling at a rapid rate, posing a threat to the raw material base of the timber industry. In order to ensure that timber harvesting in Ghana's natural forest is sustainable, the annual allowable cut (AAC) has been set at one million m^3 of round logs (Foli et al. 1997). However, the demand for wood is increasing at such an alarming rate that this AAC is insufficient. The current annual extraction of logs by the mills is estimated to be nearer 3 million m^3 (Birikorang et al. 2001).

One way of meeting the supply demands of industry is through the reduction of waste in timber processing. In this regard, the whole-tree concept, which utilises stem, branches, stump, buttress log and so on, may be useful. In Ghana, it is estimated that for every tree felled, nearly 50% of the tree volume is left in the forest in the form of branches, crownwood and stumps (Adam et al. 1993).

Objective and methodology

The study reported here was conducted in Ghana under an ITTO fellowship to determine the suitability of branchwood as a raw material for downstream processing. Under the study, the moisture content, specific gravity, sawing characteristics and strength properties of the branchwood of *Terminalia ivorensis* (idigbo) and *Aningeria robusta* (asanfona) were assessed.

Samples of branchwood and stemwood of these two species were extracted from the moist semi-deciduous and dry semi-deciduous forest zones in Ghana; the diameters of the branches were in the range 10–25 cm. The strength properties at moisture content *w* were converted to strength properties at 12% moisture content for comprehensive analysis of the experimental results. The machine used for log breakdown was a horizontal mobile bandmill known as a woodmizer *(see photo)*. The saw blade (spring-set) had the following dimensions: tooth pitch 22 mm, width 30 mm, kerf 1.6 mm, gullet depth 5 mm. The logs were grouped into four diameter classes and sawn into boards of dimensions 2.5 cm × 7.5 cm × 200 cm using live and cant sawing methods. The surfaces of the sawn lumber were examined for defects such as woolly or fuzzy grain, knots, pinworm holes and washboard.

Show of strength

Table 1: Specific gravity and strength properties of *Terminalia ivorensis* and *Aningeria robusta* at 12% moisture content

Species	Wood type	Specific gravity	Bending		Compression parallel to grain (N/mm²)	Shear parallel to grain (N/mm²)
			Modulus of elasticity (N/mm²)	Modulus of rupture (N/mm²)		
T. ivorensis	Branchwood	0.459	9200	82.42	49.58	12.81
		(0.020)	(1068)	(3.24)	(2.54)	(2.13)
	Stemwood	0.433	9443	85.31	45.22	11.95
		(0.055)	(1237)	(2.17)	(4.68)	(1.75)
A. robusta	Branchwood	0.562	12450	88.64	63.04	18.13
		(0.022)	(896)	(2.41)	(3.96)	(5.39)
	Stemwood	0.502	12783	90.48	56.55	14.94
		(0.015)	(904)	(4.20)	(3.91)	(3.00)

Note: Values in brackets are the standard deviations.

Results

Moisture content and specific gravity: the branchwood of *T. ivorensis* and *A. robusta* contained more moisture than their corresponding stemwood, with the branchwood of *T. ivorensis* exhibiting the highest amount of moisture. The specific gravity of the branchwood of the two species was also higher than that of the corresponding stemwood. In the branchwood of both, the heartwood had a higher specific gravity than the sapwood. The reverse was found in the stemwood of both species: that is, the sapwood had a higher specific gravity than the heartwood.

Sawing characteristics: all other things being equal, large-diameter logs generate a higher yield than small-diameter logs. Since branchwood is usually of a relatively small diameter, the lumber yield of branch logs is expected to be low. Thus, any investigation of the role of branchwood in downstream processing should include both volume and value yields.

In this study, the mean lumber value yields for first and second (FAS) grade boards of *A. robusta* and *T. ivorensis* branches were 25% and 20% respectively, while the mean lumber volume yield was 40% and 32% respectively. A high proportion of sapwood and the occurrence of washboard in *T. ivorensis* contributed to that species' relatively low lumber value and volume yield. The sawing technique used had no significant effect on yields.

Strength properties: *Table 1* presents data showing the strength properties of *T. ivorensis* and *A. robusta* at 12% moisture content for both branchwood and stemwood. It can be seen that under static bending, the modulus of rupture and modulus of elasticity of the branchwood of *A. robusta* and *T. ivorensis* are lower than that of their corresponding stemwood. However, the shear strength parallel to the grain and the compression strength parallel to the grain of the branchwood of *T. ivorensis* and *A. robusta* were higher than that of their corresponding stemwood.

Conclusion

Judging from the results presented here, it is clear that the branchwood of *A. robusta* and *T. ivorensis* has considerable potential for use in downstream processing. A seminar held recently at the Forestry Research Institute of Ghana presented the results of this research and, already, some timber companies have accepted the challenge to process branchwood. However, national and regional workshops and other extension activities are needed to further increase awareness about the need to utilise branchwood and the potential of such wood to contribute to timber supplies. Further studies on branchwood are also warranted, particularly into drying (especially kiln drying) and anatomical properties, the development of prototype products (eg furniture, floorings) and the economics of lumber and charcoal production from logging residues.

References

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Eligible activities include:

- participation in short-term training courses, training internships, study tours, lecture/ demonstration tours and international/ regional conferences;
- technical document preparation, publication and dissemination, such as manuals and mongraphs; and
- post-graduate studies.

Priority areas: eligible activities aim to develop human resources and professional expertise in one or more of the following areas:

- improving the transparency of the tropical timber market;
- improving the marketing and distribution of tropical timber species from sustainably managed sources;
- improving market access for tropical timber exports from sustainably managed sources;
- securing the tropical timber resource base;
- improving the tropical timber resource base, including through the application of criteria and indicators for sustainable forest management;
- enhancing technical, financial and human capacities to manage the tropical timber resource base;
- promoting increased and further processing of tropical timber from sustainably managed sources;
- improving the marketing and standardisation of tropical timber exports; and
- improving the efficiency of tropical timber processing.

In any of the above, the following are relevant:

- enhancing public relations, awareness and education;
- improving statistics;
- research and development; and
- sharing information, knowledge and technology.

Selection criteria: Fellowship applications will be assessed against the following selection criteria (in no priority order):

- consistency of the proposed activity with the Program's objective and priority areas;
- qualifications of the applicant to undertake the proposed fellowship activity;
- the potential of the skills and knowledge acquired or advanced under the fellowship activity to lead to wider applications and benefits nationally and internationally; and
- reasonableness of costs in relation to the proposed fellowship activity.

The maximum amount for a fellowship grant is US$10 000. Only nationals of ITTO member countries are eligible to apply. The next deadline for applications is **4 September 2002** for activities that will begin no sooner than December 2002. Applications are appraised in May and November each year.

Further details and application forms (in English, French or Spanish) are available from Dr Chisato Aoki, Fellowship Program, ITTO; Fax 81–45–223 1111; itto@itto.or.jp (see p 2 for ITTO's postal address).