2x Cell wall Thickness

Runkel Ratio =

Lumen diameter

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Physical Traits, Treatment Responses, and Fiber Properties of Dendrocalamus brandisii and Dendrocalamus asper

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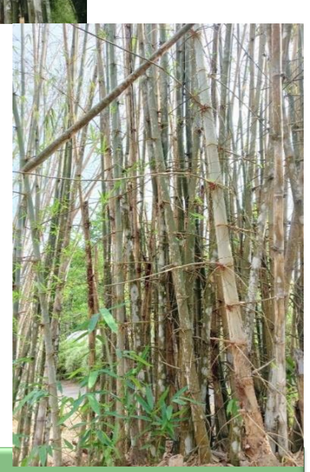
INTRODUCTION & AIM

- *Dendrocalamus brandisii* and *Dendrocalamus asper* are commercially significant bamboo species within the *Dendrocalamus* genus, widely utilized in building and construction.
- To optimize their use for various purpose, it is essential to thoroughly explore and understand their properties.
- Understanding the moisture content and density variations among these species is crucial for evaluating their performance in different environments and applications.
- Similarly investigating the volumetric shrinkage and preservative retention of these bamboo species to determine their stability and durability when subjected to treatment
- So the study was aimed to understand their physical properties, fiber characteristics & to investigate how various treatment methods affect the properties of both species.

D. brandisii



D. asper

METHOD

Three culms of each species *Dendrocalamus brandisii* and *Dendrocalamus asper*, was collected from Bambusetum at Field Research Center of KFRI at Velupadam. Each culm was further divided into bottom, middle, and top sections with total 12 replicates for each test.

Physical properties: The bamboo sections were tested for Moisture content, density and volumetric shrinkage as per the IS: 6874 (2008).

Bamboo Treatment: Round culms were treated with Boric acid/Borax by butt end, diffusion & pressure treatment as per the IS: 401(2001).
After treatment, preservative retention in treated bamboo was calculated as per Dhamodaran *et al*., (2020) and Anon. (2006).

Butt End

Diffusion treatment

Pressure treatment

Untreated sample

Treated sample

Fiber characteristics: Maceration was carried out with the 2 mm thick slivers of bamboo samples by treatment with a mixture of equal quantities of 30% hydrogen peroxide and glacial acetic acid & Measurement of length, width, wall thickness and lumen diameter of 100 unbroken fibres from each portion were taken with help of Leica Image Analyzer. Fiber length was measured at a magnification of 2.5x, while the fiber and lumen diameter was measured at 40x and fiber characteristics were derived as:

Runkle Ratio =2w / l
Slender ratio=L / d
Flexibility coefficient= l / d.
Rigidity coefficient=2w/d

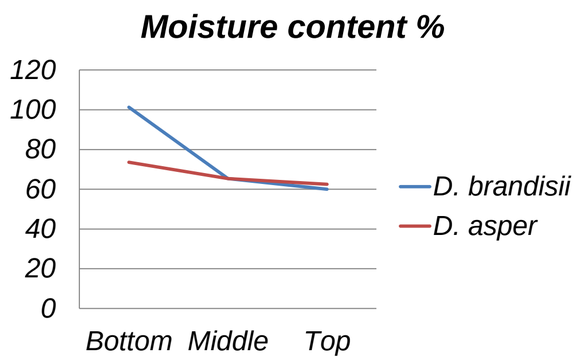
Notation:
w- fiber wall thickness,
l- lumen diameter
L- Fiber length
d- Fiber diameter

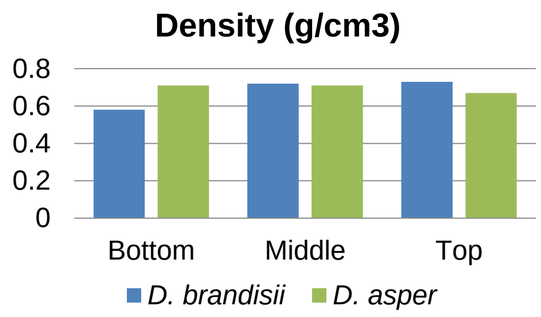
Macerated fibers

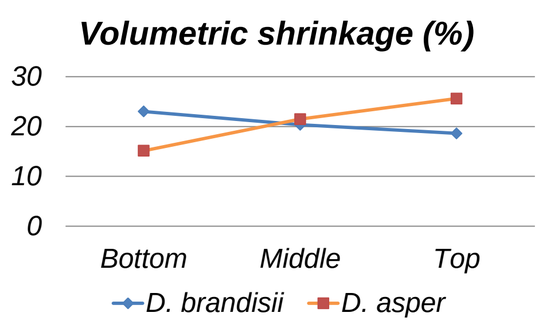
Fibers under microscope

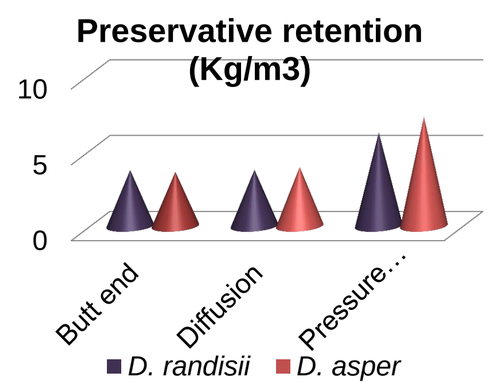
RESULTS & DISCUSSION

Physical properties









Fiber characteristics

Section	*Part*	Runkle ratio		Flexibility coefficient	
		D. brandissi	*D. asper*	*D. brandissi*	*D. asper*
Bottom	Inner	6.40 ±3.54	4.34 ±2.32	0.17 ±.09	0.22 ±0.11
	Middle	5.83 ±2.59	4.55 ±2.92	0.17 ±.08	0.23 ±0.12
	Outer	5.46 ±3.36	6.45 ±3.46	0.19 ±.09	0.15 ±0.06
Middle	Inner	5.30 ±2.56	4.01 ±2.22	0.18 ±.06	0.25 ±0.14
	Middle	6.41 ±2.85	4.46 ±2.46	0.15 ±.06	0.22 ±0.11
	Outer	5.95 ±2.65	5.73 ±2.25	0.16 ±.06	0.17 ±0.08
Top	Inner	5.12 ±2.92	4.45 ± 2.13	0.19 ±0.08	0.22 ±0.11
	Middle	5.57 ±2.60	6.09 ±2.72	0.17 ±.08	0.23 ±0.12
	Outer	5.05 ±2.35	7.46 ±3.46	0.18 ±0.06	0.15 ±0.06

Section	*Part*	*Slenderness ratio*		*Rigidity coefficient*	
		D. brandissi	*D. asper*	*D. brandissi*	*D. asper*
Bottom	Inner	0.11 ±.05	0.21 ±0.10	0.82 ±.09	0.77 ±0.11
	Middle	0.13 ±.05	0.17 ±0.08	0.82 ±.08	0.76 ±0.12
	Outer	0.13 ±.06	0.13 ±0.04	0.80 ±.09	0.84 ±0.06
Middle	Inner	0.09 ±.05	0.19 ±0.10	0.81 ±.06	0.74 ±0.14
	Middle	0.10 ±.04	0.12 ±0.04	0.84 ±.06	0.77 ±0.11
	Outer	0.10 ±.042	0.12 ±0.04	0.83 ±.06	0.82 ±0.08
Top	Inner	0.12 ±0.11	0.12 ±0.05	0.80 ±0.08	0.78 ±0.10
	Middle	0.11 ±.05	0.15 ±0.07	0.82 ±0.08	0.83 ±0.08
	Outer	0.11 ±0.05	0.13 ±0.04	0.81 ±0.06	0.86 ±0.04

CONCLUSION

- The moisture content of the studied bamboo species ranged from 60.02% to 101.28%, indicating variability in their water retention properties.
- Density values were found between 0.588 g/cm³ and 0.731 g/cm³, suggesting differences in structural composition among the species.
- *D. brandisii* demonstrated lower volumetric shrinkage compared to *D. asper*, highlighting its stability in varying moisture conditions.
- Preservative treatments using boric acid and borax yielded retention values from 3.58 kg/m³ to 7.22 kg/m³, reflecting the effectiveness of different treatment methods
- Fiber characteristics revealed that *D. asper* had superior dimensions, with notable variations in fiber diameter across different culm sections, emphasizing its potential for industrial applications.

FUTURE WORK

Future work should focus on the long-term durability of treated bamboo and the influence of environmental factors on fiber characteristics and moisture retention.

REFERENCES

- Anon. 2006. Training manual TM 05 07/06, Preservation of Bamboo published by National Mission on Bamboo Applications, Technology Information, Forecasting, and Assessment Council (TIFAC), Department of Science and Technology (DST) Government of India
- Dhamodaran T. K., Jino Johny and Ganesh Gopal T.M 2020. A manual for preservative treatment of bamboo, Kerala Handbook no. 18, Published by: Kerala Forest Research Institute, Peechi, pp 20
- IS 401: 2001. Preservation of timber- code of practice (Fourth revision), Bureau of Indian Standards, Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
- IS 6874:2008. Indian Standard. Method of tests for bamboo (First Revision). Bureau of Indian Standards, Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002