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A STUDY ON PHYSICAL PROPERTIES OF TWO BAMBSOO SPECIES BORAK (*Bambusa Balcooa* ROXB.) AND JAWA (*Bambusa Salarkhanii* ALAM) OF BANGLADESH

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Abstract: Bamboo, a renewable natural resource in villages and forests of Bangladesh, is widely used in almost all purposes by the poor people. Shrinkage, green density, ovendry density and moisture content of two bamboo species of Bangladesh - Borak (*Bambusa balcooa* Roxb) and Jawa (*Bambusa salarkhanii* Alam) were studied at different heights (top, middle and butt). Shrinkage of both wall-thickness and diameter were carried out and was found noticeable at ovendry condition. Although percentage of shrinkage decreased with the increase of height, and there was no significant difference between them. Mature bamboo had lower wall thickness shrinkage compared to that of immature bamboos. Again jawa had smaller shrinkage values in both wall-thickness and diameter compared to those of borak. Density variation was found among all the parameters but none of them was significant. Moisture content was found to vary between and within species. The difference was found to be statistically significant in case of species and maturity.

Key words: Shrinkage; *Bambusa balcooa; Bambusa salarkhanii;* Borak; Jawa; Bamboo

Introduction

Bamboo is a perennial grass made up of woody stems or culms. They occur mostly in natural vegetation of tropical, sub-tropical and temperate regions and they are abundant in tropical Asia (Purushotham 1963, Tewari and Singh 1979, Tewari 1981, George 1985). Some bamboos have been recorded from the latitude as far north as 46° and as far south as 47° and occurring at elevation as high as 4000 m (Soderström and Calderon 1979). The distribution of bamboo is rich in the areas between the Tropic of Cancer and the Tropic of Capricorn, especially for the clump forming bamboos (Uchimura 1987).

Bamboo is the most versatile material used for rural housing in Bangladesh. It is generally regarded as "poor man's timber". It is used in both round and split forms in rural construction work. Thick walled bamboos are used for house posts and rafters; and thin walled bamboos for walls and frames. Over 70 million people of Bangladesh live in houses made of bamboo (Latif *et al* 1987).

Unlike wood, bamboo starts shrinking during the initial stages of drying and has shown considerable shrinkage in wall thickness, as well as, in diameter of the culm (Rehman and Ishaq 1947, Kishan *et al* 1956). Most of the defects that appear in bamboo during seasoning are caused due to excessive or unequal shrinkage. So it is necessary to know the extent of the shrinkage with the variation of density and moisture content of bamboo before placing it into actual use. But two most important bamboo species of Khulna region namely borak (*Bambusa balcooa* Roxb.) and jawa (*Bambusa salarkhanii* Alam) have no such type of literature. This study was carried out with these two major bamboo species of which one was thick-walled, named borak (*Bambusa balcooa* Roxb.) and the other was thin-walled, named jawa (*Bambusa salarkhanii* Alam).

Materials and Methods

Investigations were carried out with borak and jawa as these two species are relatively important due to their utilization in the Khulna region. Six mature and immature culms of each species were collected from Batiaghata, Khulna. Six culms were collected as a precaution of splitting samples for diameter shrinkage while drying in the oven. The maturity of the bamboos was determined arbitrarily from their positions in the clump. Bamboos standing inside the clump were taken to be matured while those growing outside the clump were considered to be immature. Color and condition of the branches were also considered for determining the maturity of the bamboos.

The specimens for shrinkage study was collected from three different heights – butt, middle and top of the culm. After cutting the top portion, samples were collected from bottom, middle and top of the culm. The specimens for wall thickness shrinkage were in the form of 2.5 cm long rings while the specimens for diameter-shrinkage were 5 cm long ring of the culm of various lengths. In this way a total of six rings of

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which three were 2.5 cm long and the rest were 5 cm long from each of the two bamboo species and thus a total of 36 rings of 2.5 cm and 36 rings of 5 cm long were obtained from each of the species.

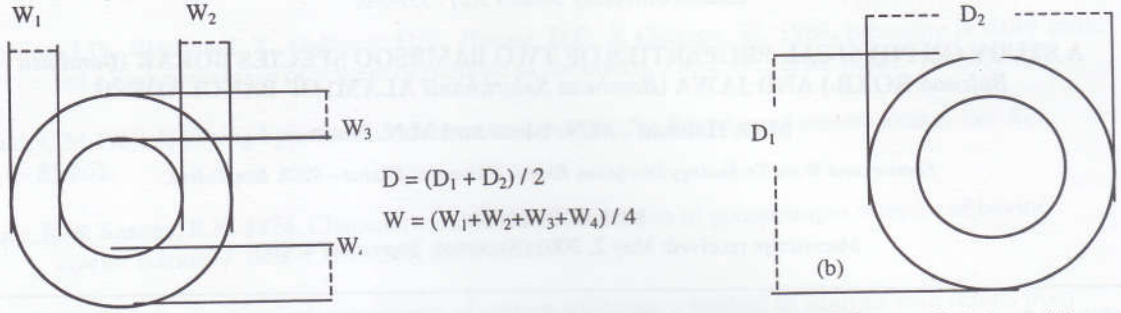

Fig. 1. The position of data collection from a sample. (a) Measurement for wall- thickness - shrinkage (b) measurement for diameter shrinkage (Talukder and Sattar 1980).

The wall thickness was measured at four perpendicularly positions to each other while the diameter shrinkage was measured along two diameters perpendicular to each other (Fig. 1.). Wall thickness and diameter measurements were made with a slide callipers to the nearest 0.002 cm. Therefore the samples were placed in an electric oven maintained at 60° C and then temperature was gradually raised to 103°C ± 2 in order to avoid drying defects. The samples were weighed at regular intervals after 24 hours until the weights became constant. The measurements in wall thickness and diameter were then taken. A small number of samples both diameter shrinkage and wall thickness shrinkage study was found splitted while drying in the oven.

Samples for moisture content and density determination were taken in the form of a specimen of 5 cm long ring from top, middle and butt. Density was determined on the basis of both green and ovendry basis. For determination of green volume the sample was weighted just after felling. The dried sample was soaked in melted paraffin and the ovendry volume was determined. The weight measurements were taken in an electric balance to an accuracy of 0.001 gm. In both the cases the volume was ascertained by the water displacement method.

Results and Discussion

Shrinkage of wall thickness and diameter was expressed as percentage of green dimensions. The density was articulated as gm/c^3. The average value of wall-thickness-shrinkage and diameter-shrinkage were 6.95, 17.86 for borak hence 7.85, 11.23 for jawa respectively. The average density of green and ovendry condition was 0.65, 0.52 and 0.76, 0.71 gm/c^3 for borak and jawa respectively. The average green moisture content was 102.44% for borak and 84.34% for jawa.

Shrinkage of wall-thickness percentage is shown in Fig. 2. Shrinkage of wall-thickness of jawa at different height of both mature and immature bamboo were not significant at both 5% and 1% level of significance. For borak, shrinkage of wall-thickness within mature and immature bamboos at different height positions was not significantly different. Although significant variations were observed between species at 5% level of significance.

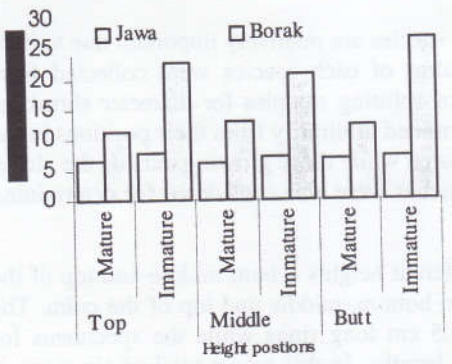

Fig.2. The wall-thickness-shrinkage of bamboos at different maturity and different height positions

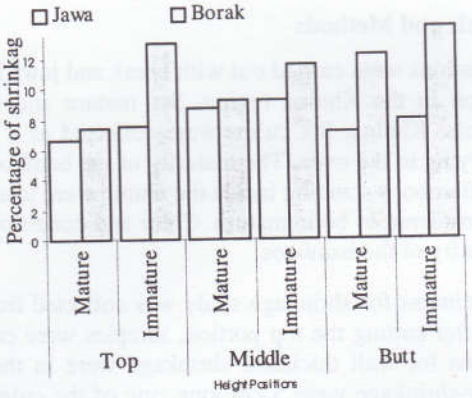

Fig.3. The diameter-shrinkage of bamboos at different maturity and different height positions

Shrinkage of diameter percentage is shown in Fig.3. Mature jawa at top showed the lowest diameter shrinkage and immature borak at butt showed the highest diameter shrinkage. Diameter shrinkage had showed the same trend of wall-thickness shrinkage. Talukdar and Sattar (1980) reported that height factor was not to be significant on wall-thickness shrinkage for bariala (*Bambusa vulgaris*) and mitinga (*Bambusa tulda*).

Density values (Fig.4) were perceptibly different between the values of mature and immature bamboos. Such differences were also observed between the species. But this difference was not statistically significant. Like shrinkage, no statistical variation was found in case of density with the change of height.

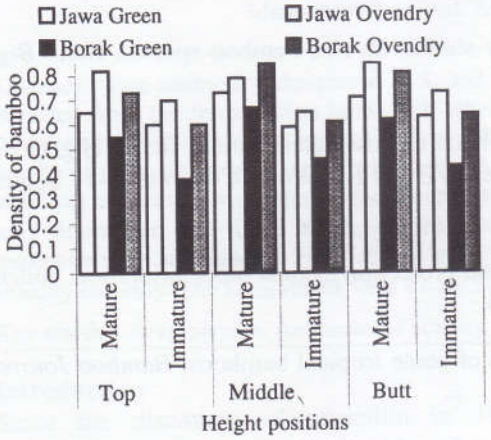

Fig. 4. The density of bamboos at different maturity and different height positions.

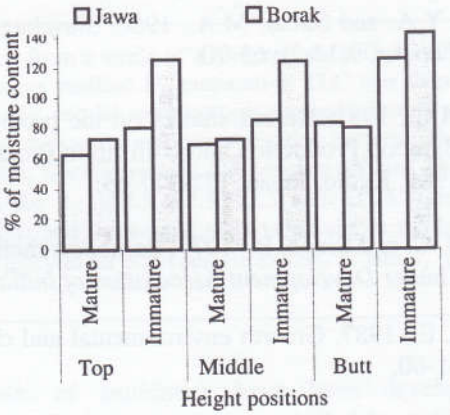

Fig. 5. The moisture content percentage of bamboos at different maturity and different height positions.

The moisture content was found to vary between and within species (Fig.5). It varied with height and maturity. The difference was found to be statistically significant in case of species and maturity at 5% level of significance but not for different heights. But none of the differences was however found to be statistically significant for bariala (*Bambusa vulgaris*) and mitinga (*Bambusa tulda*) (Talukdar and Sattar 1980).

Table 1. Variance analysis on various properties of bamboo

Factors	*Shrinkage*		*Density*	*Moisture content*
	Wall-thickness	Diameter		
Height	NS	NS	NS	NS
Maturity	NS	NS	NS	*
Species	*	*	NS	*

NS – Not Significant, * Significant at 5% level

Conclusion

Density, shrinkage percentage and moisture content are the most important physical properties for the end-uses and the studied bamboos are also the most important species in the Khulna region. From the study it was clear that shrinkage, density and moisture content of borak (*Bambusa balcooa* Roxb.) and jawa (*Bambusa salarkhanii* Alam) were not significantly affected by the height of the culm whereas maturity of bamboo significantly affected only the moisture content. Shrinkage of both wall thickness and diameter and moisture content of bamboo differed significantly with species but density didn't differ significantly.

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