ISSN 2394 - 7837

ARTICLE

Variation in Density and Moisture content in Bamboo culms, *Bambusa vulgaris var. striata* (Lodd.ex Lindl.) before and after the sprouting in vegetative propagation

Sreeja Devi, P.S., Jijymol, K.K., Neethu, S. Kumar, Santhoshkumar, R.* and Raveendran, P.B.

Received 16/01/2016 Accepted 13/04/2016

Abstract

The study was mainly focused on the influence of density and moisture content in the culm of *Bambusa vulgaris Var. striata* (Lodd. ex Lindl.) before and after the sprouting in vegetative propagation methods. For this study, the portions of the culms were collected and analysed at different height level such as base, middle and top portions. The result shows that the physical properties varied in before and after the sprouting. The moisture content in the culms increased; however, the density was decreased after the sprouting of the culms.

Keywords: Sprouting, Propagation, Instruments

Introduction

Bamboo is one of the oldest building materials used by the mankind (Latif *et al.*, 1990). It is the longest, evergreen, giant perennial, hollow woody stem bearing plant. Usually the stems have thicker walls than those of the green stem group. This group is often distinguished as *Bambusa vulgaris Var. striata*. Bamboos play an important role in daily life of rural people especially tribals in numerous ways, from house construction, agricultural implements to provide food, fodder etc. The products are food containers, skewers, chopsticks, handicrafts, toys, furniture, flooring, pulp and paper, boats, charcoal, musical instruments and weapons. In Asia, bamboo is quite common for bridges, scaffolding and housing, but it is usually a temporary exterior structural material.

Lee *et al.* (1994) determined the physical and mechanical properties of giant timber bamboo (Phyllostachys bambusoides) grown in South Carolina, USA. This study concluded that moisture content, height location in the culm, presence of nodes and orientation of the outer bark affect the mechanical and physical properties. Average green moisture content of the bamboo species studied was 137.6%, with a green specific gravity of 0.48. It was found that there were no significant differences of the moisture content and specific gravity between the different locations of the culm and between the different stems. Santhoshkumar and Bhat (2014) reported that the variation in density and its relation to anatomical properties of *Bambusa bambos* clearly. Their study was mainly focused on the distribution of tissue proportion and its influence on density in the culms of *B. bambos* (L.) Voss. For this study the culms or the portions of the culms were collected and analyzed such as outer, mid and inner portions of the culm wall, base, mid and top portions of the culm. The result shows that the anatomical properties as well as physical properties varied in relation to different portions of the culm wall, height levels and age of the culm. In addition to these the anatomical properties such as percentage of tissues proportions may influence the physical properties. They also reported that age is one other important factors influence the density. Physical properties changes up to a particular age of the culm and then the change was negligible or stabilized. Santhoshkumar and Bhat (2015) reported that Variation in density and its relation to the distribution, frequency and percentage of tissues in culms of Dendrocalamus strictus

An experimental investigation of the effects of moisture content on the mechanical properties of bamboo and cane was carried out by Okhio *et al.* (2010) bamboo and cane samples of varying moisture contents were subjected to increasing loads to the point of failure. The stress and deformation of the samples were recorded to analyse the impact of moisture content on their mechanical properties. The distribution of moisture content in bamboo and cane specimens, dependent on the specimen type (raw or processed) along with other factors, may affect the normal and shear stress concentration gradients in the specimens. The distribution of moisture in bamboo and cane specimen exists in two forms; one- moisture filling the cell cavities and two-vapours chemically bound by hydrogen bonding to the cellulose of the bamboo and cane cell walls. Roh *et al.* (1985) claimed that the mechanical properties of five-ply veneer-Bamboo zephyr composites decrease significantly with moisture content above 12% (a common MC in laboratory conditions)

Post Graduate Department and Research Centre of Botany, Mahatma Gandhi College, Thiruvananthapuram, Kerala, India
*Corresponding Author email: santhoshkumar30576@gmail.com

Materials and Methods

For checking the density and moisture content, samples were collected from three height levels of the culms; base, middle and top. These samples were used for the study. The moisture content and density were calculated before planting the culms and again these physical properties were calculated after the sprouting of the culms.

Physical properties

Basic Density

The study mainly focused on the variation of density in the culms of *Bambusa vulgaris* before planting and after the sprouting the culms. The volume of culm samples was determined by water displacement (ASTM, 2002).The samples were kept in a hot air oven at 1050C for about 48 hours (ASTM, 2002) for drying. After cooling the samples in a desiccator, the oven dry weight was determined. Basic density was calculated using the formula,

Basic density = Oven dry weight(kg)/Green volume(m3)

Moisture Content

Moisture content was determined according to Indian standard, IS: 1708-1986(BIS, 1986).After determining the initial weight, the samples were kept in an oven at 1050C for 48 hours and weighed after cooling in desiccators. Percentage of moisture content was calculated using the following formula,

Moisture Content(%) = [Initial weight-Oven dry weight/ Oven dry weight] X 100

Results

Variation in density

Variations in density before and after the sprouting of the culms at different height levels are presented in Table 1. The result showed that the density was varied before and after the sprouting. The Table shows that the density of the culms was decreased after the sprouting the culms. There was no earlier reports were available in connection with these type experiment.

Table 1. Variation in density before and after the sprouting the culms

Height levels	Density(kg/m^3)	
	Before	After
Base	862.43	676.06
Middle	741.94	459.46
Top	333.33	111.11

Variation in moisture content

Variations in moisture content before and after planting, sprouting of the culms are presented in Table 2. The result showed that large variation in the percentage of moisture before and after the sprouting. The moisture content was increased after the sprouting the culms.

Table 2. Variation in moisture content before and after the sprouting the culms

Height levels	Moisture content (%)	
	Before	After
Base	14.11	70.14
Middle	21.74	126.47
Top	140	800

Discussion

There was a definite variation was noticed in density and moisture content in the culms of bamboo species before and after the sprouting. However, this was the first attempt to study the variation in density and moisture during the period of vegetative propagation in bamboo culms.

Conclusion

The density and moisture content was varied before and after the sprouting, and it was an interesting to the further studies in bamboo species. The actual reason was not studied during the period experiment.

Acknowledgement

We are grateful to Dr. K. G. Ajit kumar, Head of the Department of Botany, Mahatma Gandhi college Kesavadasapuram, Thiruvananthapuram, Kerala for providing the necessary facilities. We record my thanks to all my teachers and friends for their suggestions and encouragement. We also acknowledge the library facilities provided by my college. The first author of this is article grateful to her dear ones of her family, mainly to her father Sri. Soman Nair, K and to her husband Sri Ajith, C.R. for the valuable help in the completion of the work and supported both morally and financially.

References

1. ASTM (American Society of Testing Materials). 2002. Standard Test Methods for specific gravity of wood and wood – based materials. Designation: D 2395 – 02. ASTM. International, West Conshohocken, PA, USA.8pp.
2. IS: 1708-1986 (BIS, 1986): Indian Standard Method of Testing of small clear specimen of Timber (Second Revision). Indian Standard Institution Manak Bhavan, 9, Bahadur Shah Zafar Marg, New Delhi, 110002. 62pp.
3. Latif, A. M, Tarmeze, W.A. and Fauzidah, A. 1990. Anatomical features and mechanical properties of three Malaysian bamboos. Journal of Tropical Forest Science 2(3):227-234.
4. Lee, A.W.C, Xuesong, B. and Perry, N.P.1994. Selected physical and mechanical properties of giant timber bamboo grown in South Carolina. Forest Prod. J. 44(9): 40-46.
5. Okhio, C. B., Waning, J. and Mekonnen, Y. T. 2010. Journal of Selected Areas in Biomaterials, Cyberjournals, December 2010.
6. Roh, J. K. and Ra, J. B. 1985. "Effect of moisture content and density on the mechanical properties of veneer- Bamboo and cane and Cane zephyr composites," Forest Products Journal. Article No.10395
7. Santhoshkumar, R., K. V. Bhat. (2014) Variation in Density and its Relation to Anatomical Properties in Bamboo Culms,Bambusa Bambos (L.) Voss. Journal of Plant Sciences. Vol. 2, No. 3, 2014, pp. 108-112. doi: 10.11648/j.jps.20140203.12
8. Santhoshkumar, R. and Bhat, K.V. (2015). Variation in density and its relation to the distribution, frequency and percentage of tissues in Bamboo culms, Dendrocalamus strictus Nees J. Indian bot. Soc. Vol. 94 (1&2) 104-110