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Short Communication

Variation in Basic Density and Tissue Proportions of *Eucalyptus Tereticornis* SM. Clones

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Abstract

The basic density and tissue proportions of five clones of Eucalyptus tereticornis developed by ITC Bhadrachalam were reported. The five clones represented by four trees each of four and half years old, were from Sarapaka, Andhra Pradesh. Significant variation has been found among the five clones except fibre percentage. Basic density was not influenced by any tissue percentage. The results obtained in this study have shown the suitability of raw material for paper and pulp where the required basic density is met with. Mainly these clones are primarily tried to meet the requirements of paper and pulp industry.

Keywords: Basic density, tissue proportions, clones, paper and pulp.

Introduction

Eucalyptus tereticornis, known as Mysore gum in India and forest gum in Australia, is one of the most extensively planted eucalypt species in India. It is planted to meet the ever increasing demand for pulp wood and solid wood requirements of the Industry. ITC, Bhadrachalam Paper Boards Ltd., Andhra Pradesh, has come out successfully, after a number of trails, with some commercial clones of this species with improved productivity[1,2]. There are only a few studies made on assessment of wood quality of *Eucalyptus tereticornis* from India belonging to different ages and localities of ordinary seed source[3-10]. Initiated work on the assessment of the wood quality of *Eucalyptus tereticornis* clones. In this paper where studies made on basic density, fibre and vessel morphology of five commercial clones of ITC, Bhadrachalam which are about 4-5 years of age and grown in a clonal demonstration plot under rain fed conditions at Sarapaka, Andhra Pradesh are presented.

Material and Methods

Materials for this study were four trees from each of the five clones of ITC, Bhadrachalam numbered 3,4,6,7 and 10. These clones planted at an espacement of 1m x 1m except one clone (clone 10) where the espacement was 3m x 2m in red soil under rainfed conditions at Sarapaka, Andhra Pradesh, India the trees were cut at 10 cm above ground level and 1m length billets up to the height of 3m were collected for Investigation. The average mid-girths of the billets of the different clones were 43.5 cm (clone 3), 31 cm (clone 4), 38 cm (clone 6), 33 cm (clone 7), 42 cm (clone 10). At the time of felling, the trees were four and half years old. From each billet a part (0.25 cm) of it was cut and set aside for paper and pulp studies and 5 cm thick discs were cut to study percentage of heartwood and sap wood, general features and gross structure. From the remaining part 2.5 cm wide radial strips were prepared. From these strips 1 cm on either side of the pith was removed and from the remaining lengthwise sticks were prepared. From these sticks 11 blocks were made and 10 blocks were used to find the basic density which was determined by using oven-dry weight / green volume of the sample. The eleventh block was used for anatomical studies. Only one side of the radius was sued for the study as our earlier findings showed non-significant difference on both sides of the pith[10]. The eleventh block approximately 1cu.m. in size were used. Each specimen was softened by boiling in water for 10 to 15 minutes. Cross, radial and tangential section of 20 m thick were prepared using Reichert microtome. The sections were stained in Heidenhain's haematoxyline and safranine for 20 minutes. The stained sections were washed in acetone and xylene-acetone of 1:1 ratio for 10 minutes to ensure complete dehydration and subsequently in xylene. The permanent slides were prepared in DPX mountant. One-way ANOVA and Tukey's test was performed to compare the clones. A simple correlation coefficient was performed to examine the inter-relationships among the anatomical properties and density.

Results and Discussion

Vessel percentage, ray percentage, parenchyma percentage significantly differed between clones at 1% level where as fibre percentage was non-significant (table 1). Maximum Vessel percentage found in clone 3 and minimum in clone 10. Clone 3 and Clone 4 were significantly different from other three clones.

Maximum ray percentage were found in clone 10 and minimum in clone 3. Clone 3, clone 7 and clone 4 and clone 7 were significantly different from other clones. Maximum parenchyma

percentage was found in clone 10 minimum in clone 3 and clone 4. Clone 6, clone 7 and clone 10 have shown significant different from other clones. Where as maximum fibre percentage was found in clone 7 minimum was found in clone 6. Where the fibre percentage was non-significant compared to other tissue proportions. From the data it can be seen that percentage of vessel was found to vary significantly. Variation in percentage of fibre was due to related variations and consequent differences in the other cell types.

Rays which are meant for radial transportation and translocation of the food materials which are main reservoirs of synthesized food material and also responsible for heart wood formation. These are main contributors of shrinkage property of the wood and important component of the wood structure. Variation in the percentage of vessel, parenchyma, ray was found exception being fibres. The quantitative differences are the result of spatial adjustments required in relation to the other cell types and their dimensions. Since the material studied were juvenile phase, how these cell types vary with age is a matter of conjecture. With the advancement of age fibre percentage is expected to increase resulting in proportional changes in their cell types.

There are few studies related to tissue proportions to either growth rate or specific gravity in general[11-14]. Eucalyptus in particular[15,16]. Wilkes J.[17] provided data on percentage without developing any relationship. Taylor F.W. while studying African grown *Eucalyptus grandis* came across no obvious patterns of tissue type variation with height and with minor tree to tree differences. Thus the data enlights the possible role in utilization for paper and pulp.

Inter-relationship between Basic density and Tissue proportions: A negative correlation was found between vessel percentage and ray percentage (r=0.864) and Parenchyma percentage (r=0.847) where as positive co-relation between ray percentage and parenchyma percentage (r=0.793). The various correlations and no influence of basic density on tissue proportions as found in the present study were suggestive of complex inter relationship existing between these newly introduced clonal materials.

Conclusion

Significant variations in tissue proportions and basic density were observed in five clones of four and half years old trees except for fibre percentage. Basis density was not influenced by any tissue percentage.

Table-1
Basic density and Tissue Proportions of Eucalyptus tereticornis clones

	Clone number					
Property	**3**	**4**	**6**	**7**	**10**	**Significance**
Basic density (g cm-3)	0.514 a	0.583 b	0.550 c	0.529 d	0.541 e	* *
Vessel percentage	33.74 a	33.66 a	29.04 b	32.33 c	25.78 d	* *
Ray percentage	14.28 a	14.99 ab	18.21 c	14.65 a, ab	19.35 d	* *
Parenchyma percentage	10.52 a	10.52 a	12.56 a,ab	11.20 a, ab	13.21 ab	* *
Fibre percentage	41.46	40.86	40.38	41.76	41.61	NS

NS = not significant ** Significant at 1% level, The values sharing common alphabet do not differ significantly at 0.05 probability level.

Table-2
Correlation coefficients between basic density and tissue proportions

	Basic density	**Vessel percentage**	**Ray percentage**	**Parenchyma percentage**	**Fibre percentage**
Basic density	1				
Vessel percentage	-0.111	1			
Ray percentage	0.249	**-0.864 ** **	1		
Parenchyma Percentage	0.127	**-0.847 ** **	**0.793****	1	
Fibre percentage	-0.215	-0.199	-0.260	-0.175	1

N = 20. Bold type indicates significance at the 0.01 probability level

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