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Research Article

Variability in Physical Properties of Eucalyptus Hybrid Wood

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ABSTRACT

In the present investigation the physical properties of Eucalyptus hybrid clones. The study was carried out in the Laboratory of College of Forestry, OUAT, Bhubaneswar, Odisha during the period 2017-2018. In the study the tree were harvested at the stump height and wood dices of 2 cm height are cut from the basal portion of the tree from fine section representing five year growth approximately and labeled as 1st, 2nd , 3rd, 4th, 5th yr respectively. The experiment resulted mean density (33.20 %) and specific gravity (0.95) is more in Titlagrah in comparison to density (31.80 %) and specific gravity (0.89) of Bissamcuttack. The result indicates its utility as preferred raw material for pulp and paper making.

Keywords: *Eucalyptus, Physical, Wood, Variability.*

INTRODUCTION

Eucalyptus is a diverse genus of flowering trees and shrubs in the myrtle family, Myrtaceae. The generic name is derived from the Greek words '*eu*' and '*kalypto'* which means "well" and "to cover" respectively, referring to the operculum on the calyx that initially conceals the flower. Many species, though by no means all, are known as gum trees because they exude copious 'kino' from any break in the bark. Eucalyptus is a fast growing, medium- sized to tall tree attaining 20- 50m in height and upto 2m in diameter and strongly coppicing tree possessing a wide range of soil and climatic adaptability. It is known for its drought hardiness, although annual rainfall of 800 mm is preferred. The species grows under a wide range of climatic/soil conditions from warm to hot, sub humid to humid and from good to degraded soil.

Interest in Eucalyptus research, in India from the point of view of utilization, dates back to Tippu sultan's period when seeds of different species were planted in Nandi Hills, and then successfully introduced to the Nilgiri hills in southern India.

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For the subsequent large-scale plantations the seed source from Nandi Hills became the center point for wide spread distribution in the afforestation programmes (Kaikini, 1961). Eucalyptus plantations were also raised under State and centrally sponsored schemes to meet the demands of local people in respect of the requirement of firewood, small timber, poles etc. Eucalypt was also accepted as a good farm forestry species for planting on field bunds, canal sides and in marginal agricultural lands. According to one estimate (Tewari, 1992) Eucalyptus plantations were raised to the tune of 4.28 lakh hectares primarily to meet the requirement of fuel wood and paper and pulp industries. The potential productivity is around 5 tons of biomass/ha/yr on an average, but the average production is some 2.5 ton/ha/yr.

Natural Eucalyptus hybrids have been developed from the above species like *E. grandis x E. camaldulensis, E. grandis x E. tereticornis, E. camaldulensis x E. tereticornis*etc which are also widely planted and clones of different species and their hybrids have also been developed by various paper industry and govt. organizations. Some studies were made on assessment of wood quality of different Eucalyptus species belonging to different localities of ordinary seed source and clones in India (Miranda & Pereira, 2002). The state of Odisha lies in the tropical zone between latitudes of 17^o 47^o N – 22^o 34^o N and longitudes 82^o 22^0E – 87^o $29^o$with 10 agro climatic zones. The physico-chemical property of wood depends on the presence, distribution, size, density of the anatomical structures of wood which vary with different localities. Eucalyptus trunks can present large spatial variation in terms of wood quality due to environmental and genetic factors (Raymond, 2002). By considering the usefulness of Eucalyptus wood for various purposes, such studies of the present work has been carried out to assess the variation in physical properties in wood of Eucalyptus hybrid clones in agroclimatic zone-5 and zone-9 of odisha.

MATERIALS AND METHODS

The present investigation was conducted during the 2017-2018. The experiment carried out in Laboratory of College of Forestry, OUAT, Bhubaneswar, Odisha, India.

Selection of sample Trees of *Eucalyptus* Hybrid

Selection of three sample trees was done from each five year old plantation of *Eucalyptus* hybrid (*Eucalyptus camaldulensis x Eucalyptus tereticornis*) clone JK-2 at Bissamcuttack and Titlagarh of Raygada and Bolangir District of Odisha respectively under agroclimatic zone 5 and 9. During sampling process, three healthy trees were considered on the basis of straightness of bole, less branching, devoid of insect pest infestation and diameter at breast height.

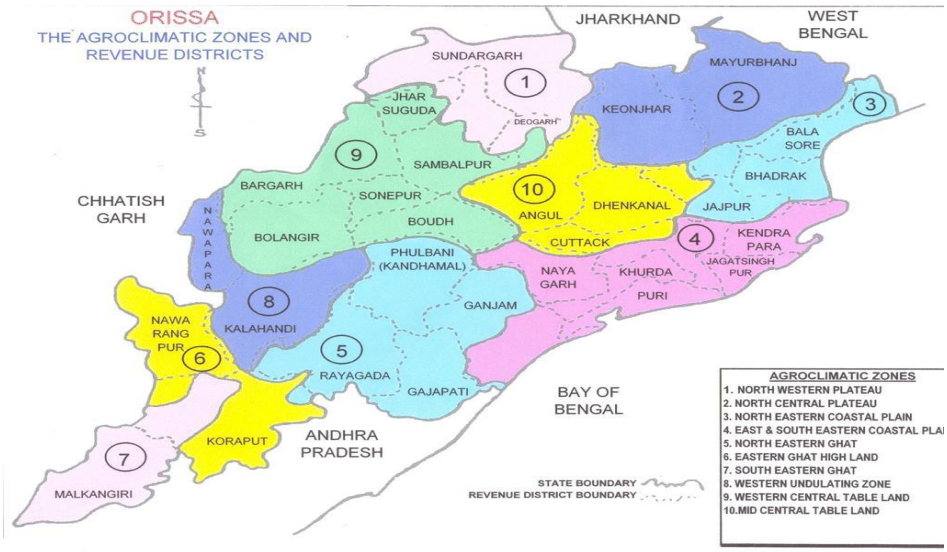

Fig. 1: Agrocliamtic Zones of Odisha, India

Table 1:The passport detail of the sample Trees

Sample Tree No.	Place of collection	Block	District	Agro climatic zone
R -1	Bissamcuttack	Bissamcuttack	Raygada	5
R -2	Bissamcuttack	Bissamcuttack	Raygada	5
R-3	Bissamcuttack	Bissamcuttack	Raygada	5
B -1	Titlagarh	Titlagarh	Bolangir	9
B -2	Titlagarh	Titlagarh	Bolangir	9
B -3	Titlagarh	Titlagarh	Bolangir	9

In case of physical properties, for estimation of density, length (cm), breadth (cm), height (cm) and weight (g) of cuboid derived from each disc is recorded.

Preparation of sample from wood discs

Sample Trees (Table.1) are harvested at stump height and wood discs of 2cm height are cut from the basal portion of the tree. The disc are dried in oven till achieve constant weight. Then from each disc a strip of 2cm (breadth) to be taken along the radius from pith to bark. Each strip is then divided into five sections representing five year growth approximately and labelled as 1st yr growth ring (Section- I), 2nd yr growth ring (Section- II) , 3rd yr growth ring (Section- III), 4th yr growth ring (Section- IV) and 5thyr growth ring (Section- V) respectively. From each section, one cuboid (Dimension- length of growth ring in 2cm x 2cm breadth x 2cmheight) is prepared and taken for estimation of density and specific gravity for each growth ring.

Density of wood sample

Density of wood cuboid sample is calculated by

Density = W/ L x B x H

Where,

W = Oven dry weight of wood cuboid

L = Length of wood cuboid

B= Breadth of wood cuboid

H= Height of wood cuboid (Zang et al., 2015)

Specific gravity of wood sample

Specific gravity of wood sample is determined by the formula

Specific Gravity = Wt. of the wood sample / Wt. of equal volume of water displaced by the wood sample at 4^{o}C (Zhu et al., 2006).

For determining specific gravity, weight (g) of wood cuboid and weight of water displaced by it is recorded.

Statistical Analysis

The data regarding the variation in the anatomical properties of wood were subjected to Analysis of variance (ANOVA) as described by Snedecor and Cochran (1980). The data were analyzed in statistical package MStatC.

RESULTS AND DISCUSSION

The results obtained during the present course of investigation for the studies on variation in density of wood samples in growth rings *Eucalyptus* hybrid collected from Bissamcuttack and Titlagarh of Rayagada and Bolangir district respectively were found significant.

The density of wood sample collected from Titlagarh varies from 952 kg/m^3-986 Kg/m^3. The maximum density (986 Kg/m^3) was recorded in the section-I whereas the minimum density (952 kg/m^3) was recorded in section-III of the wood disc (Table.2). Similarly, the density of wood sample collected from Bissamcuttack varies from 886 Kg/m^3- 950 Kg/m^3. The maximum density (950 Kg/m^3) was recorded in the section-III whereas the minimum density (886 Kg/m^3) was recorded in section-II of the wood disc. Among Bissamcuttack and Titlagarh, the mean density is more in Titlagarh (972.4 Kg/m^3) in comparison to Bissamcuttack (911.8 Kg/m^3).

The site effects reflects in trees a combined effects of edapic and climate condition (Zhang et al., 2012). Variation in growth rate in this study is attributable in part to geography, soil quality, annual precipitation etc. Precipitation and fertile soil may be the reason to explain theses difference in wood quality and quantity.

Table 2: Variation in Oven dry Density of wood samples of *Eucalyptus H*ybrid

Place of Sample collection	Oven dry Density(Kg/m^3)					Mean
	I	II	III	IV	V	
Bissamcuttack	913a	886 b	950 d	916a	894 b	**911.80**
Titlagarh	986c	974	952 d	968	982c	**972.40**
Mean	**949.5eg**	**930.0**	**951. e**	**942.0 fg**	**938.0f**	
CD value						
Factor A(Site)	4.400					
Factor B (Growth ring)	7.795					
Factor(A X B)	11.367					

Table 3: Variation in Oven dry Specific Gravity of wood samples of *Eucalyptus* Hybrid

Place of Sample collection	Oven dry Specific Gravity					Mean
	I	II	III	IV	V	
Bissamcuttack	0.89 ef	0.86 a	0.92 bdf	0.90 bd	0.88 ae	**0.89**
Titlagarh	0.97 c	0.95 b	0.93 b	0.95 bc	0.97 c	**0.95**
Mean	**0.93h**	**0.90g**	**0.92gh**	**0.92gh**	**0.92gh**	
CD value						
Factor A(Site)	0.01					
Factor B (Growth ring)	0.02					
Factor(A X B)	0.03					

The studies on variation in Specific gravity of wood samples in growth rings *Eucalyptus* hybrid collected from Bissamcuttack and Titlagarh of Rayagada and Bolangir district respectively were found significant.

The Specific gravity of wood sample collected from Titlagarh varies from 0.93-0.97. The maximum Specific gravity (0.97) was recorded in the section-I and section-V whereas the minimum Specific gravity (0.93) was recorded in section-III of the wood disc (Table.3). Similarly, the Specific gravity of wood sample collected from Bissamcuttack varies from 0.86 – 0.92. The maximum Specific gravity (0.92) was recorded in the section-III whereas the minimum Specific gravity (0.86) was recorded in section-II of the wood disc. Among Bissamcuttack and Titlagarh, the mean Specific gravity is more in Titlagarh (0.95) in comparison to Bissamcuttack (0.89). This result indicates wood might be related to higher cellulose and lower lignin content (Biswal & Rout, 2015).

CONCLUSION

The wood sample wood collected from five year old Eucalyptus hybrid clone JK-2 grow at Titlagrah found to be better than same clone at Bissamcuttack with the mean oven dry at density (972.40 Kg/m^3) and mean oven dry specific gravity (0.95). The results shows that the physical properties of wood in this species can be improved proper silvi cultural site specific management and suggested that the wood after maturing must be preferred for utilization of this species.

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