Original Research Article   https://doi.org/10.20546/ijcmas.2018.707.396

Studies on Genotypic and Phenotypic Correlation Coefficient of Different Clones of Eucalyptus (*Eucalyptus tereticornis* Sm)

J.M. Bhatti[1], Y.Y. Sumthane[2*], A.U. Nimkar[2], N. K. Kapse[2] and Y.B. Tayde[2]

[1]*Department of Forestry, Dr. Panjabrao Deshmukh Krishi Vidyapeeth,*
Akola (Maharashtra), India
[2]*Department of Forest Products, Dr. Y.S. Parmar University of Horticulture and Forestry,*
Nauni (Solan) 173 230, H.P, India

*Corresponding author

A B S T R A C T

In present investigation was carried out for better understanding of yield components which helps to the tree breeder during indirect selection of plus trees from diverse populations. Correlation simply measures the mutual relationship among volume and volume contributing characters. The characters of Correlation coefficient parameters based on plant height (m), girth (m), leaf area (m), dry weight of leaf (cm), number of branches., stem volume was recorded for all the clones under study exhibited the mean value of 0.17 m^3 with a range of 0.13 to 0.21 m^3. The highest value for the volume exhibited by clone 316 and 2030 (0.21 m^3) followed by 07 (0.19 m^3). Whereas, the lower magnitude for the values of stem volume was recorded in for the clone 288 (0.13 m^3) for getting better result of correlation.

Introduction

Eucalyptus tereticornis has increasingly become the most widely planted, hardwood genus in the world (Turnbull, 1999). *Eucalyptus tereticornis* provide sawn timber, mine props, paper, pulp, fiber board, poles, firewood, charcoal, essential oils, honey, and tannin products. *Eucalyptus tereticornis* plantation growth rate is an important economic factor as fast growing trees will be available for processing earlier compared to slower growing trees. Tree growth and the ultimate production of wood is a product of

the interaction of genetic, silvicultural and environmental factors (Kozlowski and Pallardy, 1997) (Pallett and Sale, 2004) (Drew and Pammenter, 2006). The present status of eucalyptus in India is, there are some 170 species, varieties and provenances of eucalyptus were tried in India, out of which the most outstanding and favoured has been the *E*. hybrid, a form of *E. tereticornis* known as Mysore gum.

In Maharashtra the Forest Department started raising large scale plantations of eucalyptus from 1961 onwards; over 150,000 ha of

Eucalyptus plantations exist. The main species raised are *E. hybrid* and *E. camaldulensis* in the dry zone. In high rainfall areas *Eucalyptus grandis* followed by *E. robusta*and *Eucalyptus saligna* were found to be more suitable and in Goa, Daman & Diu during since 1963, some 5,000 ha of Eucalyptus plantations were raised to meet the shortage of fire wood. These clones were grown by Industrial corridor to utilize the pulp as a row material for paper making. The climatic and geographic conditions are satiable to this species in these semi-arid climatic reasons.

Materials and Methods

The present investigation was carried out with ten clones of Eucalyptus (*Eucalyptus tereticornis* Sm.) at Department of Forestry, Dr.Panjabrao Deshmukh KrishiVidyapeeth, Akola and the observations were taken from Eucalyptus clonal plantation in Yavatmal district established by Ballarpur Paper Industry Limited, Ballarpur, Maharashtra. The clones under study belonging to same age group. The soil of experimental site belongs to red sandy and shallow black soil depth is up to 1 to 1.5m.

Climate and weather conditions

Eucalyptus clonal plantation in Yavatmal district is situated at a distance of 3 Km from Yavatmal in Eastern direction of Yavatmal-Chandrapur Highway. The research station falls under the agro-climatic zone number IX north latitude at 20°24' N and 78⁰ 08' E longitude. The average range of temperature is 23.6°C to 38.6°C with mean annual rainfall of 886.4 mm.

Quantitative characters

The observations of quantitative characters were recorded on one randomly selected plant for each clone to representing treatment mean for that replication. Plant height (m):Plant height of randomly selected clone per replication was recorded in meter by using the altimeter. Girth (m): Girth of each clone was recorded from 1.37 m above the ground level at breast height in meter by using the measuring tape. Leaf area (cm^2):The leaves from the plants are separated and grouped into small, medium and large. One representative leaf from each group is inserted in leaf area meter. The instrument gives the direct leaf area reading. From this reading the total leaf area can be calculated. Dry weight of leaf (g):Dry weight of leaf of each clone was measured in hot air oven at the temperature of 80°for 4 hours in g. Number of branches:Numbers of primary branches of each clone were counted manually for each clone per replication. Volume (m^3):Volumeof each genotype was calculated by using the quarter girth formula given by Hoppu's rule (Chaturvedi *et al.,* 1991).

Analysis of variance for various characters

The analysis of variance was carried out to test the significance of difference between the clones for the characters under study as per the standard method given by Panse and Sukhatme (1954) and Singh and Chaudhary (1977).Based on above model, the table of analysis of variance (ANOVA) was setup and data was analysed. 'F' test was used to measure the significance of the differences among the clones. The standard error of differences S.E. (d) and critical difference (C.D.) between two means were also calculated for treatment comparison.

Analysis of covariance

Fisher and Yates (1958) suggested a method for partitioning the variance and covariance into its heritable and non-heritable components as per below.

i) Genotypic variance

$$\sigma^2 g = \frac{MSg - MSe}{r}$$

ii) Phenotypic variance

iii) Environmental variance

$$\sigma^2 p = \sigma^2 g + MSe$$

The genotypic, phenotypic and environmental covariance's were estimated on similar lines.

$$\sigma^2 e = MSe$$

Variability parameters studies

It was estimated by the formula given by Burton (1952)

$$G.C.V. = \frac{\sqrt{\text{Genotypic variance}}}{\overline{X}} \times 100$$

$$P.C.V. = \frac{\sqrt{\text{Phenotypic variance}}}{\overline{X}} \times 100$$

$\overline{X}$ = Mean of the character
G.C.V. = Genotypic coefficient of variation
P.C.V. = Phenotypic coefficient of variation

Results and Discussion

Correlation

The genotypic and phenotypic correlation, correlation coefficient among the different characters has been presented in Table 1. Mean performance of eucalyptus clones for selected quantitative traits.

Table.1 Genotypic and phenotypic correlation and correlation coefficient among the different characters

Serial Number	Treatments (Clones)	Plant height (m)	Plant girth (m)	Leaf area (cm^2)	Dry weight of leaves (g)	Number of branches	Volume (m^3)
1	316	14.21	0.48	64.70	0.44	13.33	0.21
2	288	13.52	0.39	57.47	0.38	13.67	0.13
3	526	14.06	0.41	54.70	0.37	11.00	0.15
4	413	14.65	0.43	61.33	0.41	12.33	0.17
5	07	14.17	0.47	71.57	0.50	13.33	0.19
6	2030	14.90	0.48	56.57	0.37	13.67	0.21
7	415	14.31	0.40	69.07	0.48	13.33	0.15
8	2070	14.75	0.41	56.43	0.38	12.67	0.16
9	2130	14.13	0.43	62.03	0.41	14.00	0.16
10	411	14.72	0.41	61.53	0.41	13.33	0.15
	Mean	14.34	0.43	61.54	0.42	13.07	0.17
	Rang	13.52-14.90	0.39-0.48	54.47-71.57	0.37-0.50	11.00-14.00	0.13-0.20
	Se(m)	0.25016	0.0194	1.75754	0.01549	0.40521	0.01708
	CV	3.O214	7.8089	4.9466	6.4382	5.3713	17.536
	Cd5%	0.7433	0.0576	5.22212	0.04602	1.20399	0.05074

Table.2 Analysis of variance of selected quantitative traits in eucalyptus

Sources of variation	Degree of freedom	Plant height (m)	Girth (m)	Leaf area (cm^2)	Dry weight of leaf (g)	Number of branches	Volume (m^3)
Replication	2	0.0872	0.0028	0.3906	0.00012	0.23333	0.00209
Treatment	9	0.5229*	0.0032*	93.885**	0.00632**	2.2814**	0.00233*
Error	18	0.1878	0.0011	9.266	0.00072	0.49259	0.00087

* Significant at 5 %
** Significant at 1 %

Table.3 Genotypic and phenotypic correlation coefficient (r)

Sr. No.	Characters		Girth (m)	Leaf area (cm^2)	Dry weight of leaf (g)	Number of branches	Volume (m^3)
1)	Plant height (m)	G	0.221	-0.142	-0.162	-0.041	0.340
		P	0.399	-0.056	-0.075	-0.048	0.481
2)	Girth (m)	G	–	0.297	0.309	0.296	0.992
		P	–	0.275	0.269	0.100	0.991
3)	Leaf area (cm^2)	G		–	0.997	0.399	0.253
		P		–	0.986	0.368	0.239
4)	Dry weight of leaf (g)	G			–	0.307	0.265
		P			–	0.333	0.232
5)	Number of branches	G				–	0.344
		P				–	0.098
6)	Volume (m^3)	G					–
		P					–

* = Significant at 5% level (361)   G = Genotypic correlation
** = Significant at 1% level (463)   P = Phenotypic correlation

In conclusion, the genotypic and phenotypic correlation coefficient studied between stem volume and its contributing character indicated that girth exhibited positive and significant correlation with volume at phenotypic and genotypic level (Table 2 and 3). The girth exhibited positive and non-significant correlation with dry weight of leaf at genotypic and phenotypic level. Leaf area showed exhibited positive and significant correlation dry weight of leaf at genotypic and phenotypic level. Dry weight of leaf exhibited a positive and non-significant correlation with number of branches at genotypic and phenotypic level.

References

Burton GW. 1952. Quantitative in haritance in grasses, Proc. 6th International Grassland Congress. 1: 277-283.

Chaturvedi AN. and. KhannaLS. 1991. forest mensuration. International Book Distributors, DehraDun. pp 95-100.

Drew DM and Pammenter NW. 2006. Vessel frequency, size and arrangement in two eucalypt clones growing at sites differing in water availability. *New Zealand Journal of Forestry* 51:23-28.

Fisher RA and Yates F. 1958. Statistical tables for biological, agricultural and medical research. 5th edn. Hafner Publ. Co., New York.

Kozlowski TT and Pallardy SG. 1997. Physiology of Woody Plants. Second edition. San Diego: Academic Press. pp. 1-6.

Pallett RN and. Sale G. 2004.The relative contributions of tree improvement and cultural practice towards productivity gains in Eucalyptus pulpwood stands. Fort. Ecol. Manage. 193:33-43.

Panse VG. and Sukhatme PV. 1954. Statistical methods for agricultural workers, ICAR Publications. New Delhi. pp 72-96.

Singh RK and ChaudharyBD. 1977. Biometrical methods in quantitative genetic analysis, Kalyani Publishers, New Delhi. 200-223.

Turnbull JW. 1999. Eucalyptus plantations. New Forests. 17:37-52.