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Correlation and path analysis studies in teak, *Tectona grandis* L for stem volume production

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ABSTRACT

The present investigation entitled 'Correlation and path analysis studies in teak, *Tectona grandis* L for stem volume production' was carried out during the year 2011-12 in the Department of Forestry, Dr PDKV, Akola, Maharashtra and the observations were taken from teak seed orchard, Mohghata, district Bhandara, Maharashtra. The study was undertaken for thirty clones of teak using randomized block design with three replications. The teak plantation was established in the year 1977 at a spacing of 8 x 8 m. In each treatment there were three plants of each clone in one replication. One plant per treatment was selected randomly to record observations for six characters. The genotypic and phenotypic correlation studies between stem volume contributing traits revealed that stem volume per plant was closely associated with plant height and number of branches which exhibited positive and significant correlation. Path analysis revealed positive direct effect on volume per plant through plant height, leaf area and number of branches. Hence these characters may be given consideration while formulating selection indices for the improvement of teak.

Keywords: Correlation; path analysis; stem volume; teak

INTRODUCTION

Teak, *Tectona grandis* L belongs to the family Verbenaceae having chromosome number 2n= 36 (Kedarnath and Raizada 1961). The names *Tectona* and teak have been derived from the Portuguese name Teca a derivative of Greek word Tekon, 'a carpenter' and Grandis in Latin means 'large' (Cowen 1965). Simple correlation is the association between the characters and is of three types viz phenotypic, genotypic and environmental. The correlation coefficient is not expression of the character changes with the environmental fluctuations and hence such correlation coefficient gives an idea regarding inherent association between different characters (Singh and Chaudhary 1977). In evaluating the relative influence of yield components upon yield the method of path analysis is used. The path

coefficient measures the importance of a given path of influence from cause to effect. The path coefficient analysis technique was first published by Wright (1921). He also mentioned that path coefficient does give a method of working out the logical consequences of a hypothesis as to the casual relations in a system of correlated variables.

Teak is considered as the 'King of trees' due to its versatile uses. Teak leaves are simple, ovate, or elliptical. In such type of leaves variation in leaf area largely depends upon the length and breadth of leaf (Murugesh et al 1998). The large deciduous tree, teak though found extensively in India, Myanmar, Indonesia and Thailand has been planted extensively in warm climate throughout the world both inside and outside its natural zone. Indian region has its distribution over a million hectare (Tewari 1992) and is considered as a center of diversity of teak. The region is considered to be primary centre of genetic diversity and variability of teak with distribution over 8.9 million ha (Tewari 1992). It has a considerable commercial value as timber since it exhibits good grains for decorative works. The timber from moist areas exhibits strength properties equivalent to teak of Myanmar. In present investigation the correlation coefficient and path coefficient were studied for better understanding of yield components. Correlation simply measures the mutual relationship among volume and volume contributing characters. Path coefficient analysis also enables detailed examination of specific forces acting to produce a given correlation and also measures the relative importance of each casual factor.

MATERIAL and METHODS

Experimental site: The observations were taken from teak seed orchard, Mohghata, Bhandara district and the analysis of data was done at Department of Forestry, Dr Panjabrao Deshmukh Krishi Vidyapeeth, Akola (MS). All thirty clones of teak (*Tectona grandis* L) under study were originated from Allapalli, Maharshtra established in 1977. The soil of the region is sandy loam type and soil depth is up to 1 to 1.5 m. The teak seed orchard, Mohghata research station is situated about 35 km from Bhandara in eastern direction of Bombay-Kolkata National Highway number 6. The statistical analysis of quantitative data and qualitative characters was done using randomized block design (RBD) as described by Nilisha Jibhakate (2010). The entire data generated from the present investigation were put to statistical analysis in accordance with procedure outlined by Fisher (1958).

Details of layout

Experimental design	:	Randomized block design
Number of replications	:	03
Number of treatments (clones)	:	30
Spacing	:	8 m x 8 m
Number of plants per treatment	:	1
Year of plantation	:	1977

Characters studied: The observations were recorded on single tree of each clone randomly selected in each replication. The overall correlation observed between two attributes is a function of series of direct and indirect relationship between those attributes.

RESULTS and DISCUSSION

Determination of the phenotypic and genotypic correlations among the six quantitative traits in teak

Genotypic correlation: Girth showed a positive and significant correlation with volume while positive but non-significant correlation with leaf area, number of branches and negative and non-significant correlation with dry weight of leaf. Leaf area showed a positive and significant correlation with number of branches and volume. It showed a negative but significant correlation with dry weight of leaf. Number of branches showed a positive and significant correlation with volume. Results obtained in present study revealed that plant height exhibited positive and significant correlation with volume at genotypic level (Table 1).

***Phenotypic correlation*:** Association between two variables which can be directly observed is termed as phenotypic correlation. It indicates both genotypic and environmental effects and therefore differs under different environmental conditions. The plant height exhibited positive and significant correlation on stem volume and number of branches. It exhibited positive and non-significant correlation with girth, leaf area and dry weight of leaf. Girth exhibited positive and significant correlation on stem volume but exhibited positive and non-significant correlation with leaf area and number of branches. It exhibited negative and non-significant correlation with dry weight of leaf. Leaf area exhibited positive and non-significant correlation with dry weight of leaf, number of branches and volume. Dry weight of leaf exhibited positive but non-significant correlation with number of branches and negative but non-significant correlation with volume. Number of branches exhibited positive and significant correlation with volume (Table 1).

Determination of direct and indirect effect of six quantitative traits for stem volume production in teak

Path analysis studies: Direct effect: It is revealed from Table 2 that the height exhibited highest positive direct effect (r= 2.302) on stem volume followed by leaf area (r= 2.206), dry weight (r= 0.995), girth (r= 0.304) and negative direct effect was observed for number of branches (r= -3.373) Table 2 (Wright 1921).

Indirect effect: The girth exhibited highest positive indirect effect (r= 0.863) on volume that was followed by plant height (r= 0.654), leaf area (r= 0.482), number

Table 1. Genotypic and phenotypic correlation coefficient of six quantitative characters

Character		Plant height (m)	Girth (m)	Leaf area (cm^2)	Dry leaf weight (g)	Branches (#)	Volume (m^3)
Plant height (m)	G	-	0.215	0.656**	0.568**	0.997**	0.653**
	P	-	0.221	0.199	0.251	0.783**	0.595**
Girth (m)	G		-	0.172	-0.254	0.017	0.863**
	P		-	0.156	-0.234	0.033	0.867**
Leaf area (cm^2)	G			-	-0.475**	0.753**	0.482**
	P			-	0.048	0.202	0.187
Dry leaf weight	G				-	0.329	-0.054
(g)	P				-	0.207	-0.138
Branches (#)	G					-	0.553**
	P					-	0.369*
Volume (m^3)	G						-
	P						-

G= Genotypic correlation, P= Phenotypic correlation

*Significant at 5% level, **Significant at 1% level

Table 2. Direct and indirect effects of characters on stem volume production

Character	Plant height (m)	Girth (m)	Leaf area (cm^2)	Dry leaf weight (g)	Branches (#)	Volume (m^3)
Plant height (m)	2.302	0.495	1.516	1.307	2.295	0.654
Girth (m)		0.304	0.052	-0.077	0.005	0.863
Leaf area (cm^2)			2.206	-01.047	1.661	0.482
Dry weight (g)				0.995	0.328	-0.054
Branches (#)					-3.737	0.553

Residual effect = 0.537

of branches (r= 0.553) and negative indirect effect was observed for dry weight (r= -0.054) (Table 2) (Wright 1921).

CONCLUSION

The correlation amongst the volume attributes indicates that plant height and number of branches were in positive direction and they were helpful and advantageous for improvement in volume. Path analysis indicated the importance of volume contributing characters like plant height followed by girth, leaf area, dry weight of leaves and number of branches which had directly and indirectly influenced all the correlations of volume with its components. Thus it is concluded that selection pressure can be exercised on the genotypes possessing more plant height and more number of branches that would be useful in identifying the genotypes as parents for further improvement in teak. Hence these characters may be given consideration while making selections for the improvement of teak.

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