

Plus Tree Variation of Shisham (*Dalbergia sissoo*) in Different Agro-Ecological Regions of Haryana

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Received 17 November 2016 ; Accepted 6 December 2016 ; Published online 27 December 2017

Abstract Forty five plus trees of *Dalbergia sissoo* were selected from three agro-ecological regions on the basis of their morphological characters viz. diameter at breast height, total height, clear bole height, crown spread and straightness. Correlation among the character was also studied. Seed sources from dry sub humid region were found more promising than other two. Significant variations were observed among morphological traits and significantly positive correlation was found among the traits.

Keywords Plus trees, *Dalbergia sissoo*, Agro-ecological, Morphological characters, Correlation.

Introduction

Declining population of forest trees in their habitat increases the stress on existing forests and shifted

the interest of land users towards agroforestry and clonal planting for which genetically superior planting stock is required. Genetically improved planting stock can contribute immensely to meet the demand of timber and wood based products [1]. Selection of superior phenotypes or plus trees (PTs) is the first, most essential, critical and time consuming step in cloning process. These superior phenotypes can be selected for their superiority in a single or multiple traits of interest in a single individual. Several works have been done on selection of plus trees and identification of best individual for clonal trials. The candidate plus trees are selected and identified best individual for further clonal trials in six agroforestry species on the basis of growth superiority index [2]. Best seed sources of *Pongamia pinnata* was also selected on the basis of morphological characters [3]. In the present study *Dalbergia sissoo*, commercially important, multipurpose tree of indo-gangetic plains has been taken for plus tree selection and comparison of their morphological traits in different agro-ecological regions. Variation in morphological characters among different agro-ecological regions helps in identifying the promising individuals for a particular ecological site.

Materials and Methods

Study area

Three agro-ecological regions of Haryana viz., arid, semi-arid and dry sub-humid were selected for study.

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Table 1. Geographical information of *D. sissoo* plus trees, Haryana.

Sl. No.	Agro-ecological region	Latitude (°N)	Longitude (°E)	Altitude (m)	Rainfall (mm/annum)	Temp. Range °C (min-max)	No. of trees
1	Arid zone	28.08–29.54	75.03–76.58	200-264	319-490	5.3–41.7	15
2	Semi-arid zone	28.47–29.69	76.31–77.03	217–252	516–726	6–41	15
3	Dry sub-humid	30.10–31	76.78–77.28	260–656	1029–1108	6.4–40.6	15

In arid zone rainfall ranges from 319-490 mm, in semi-arid zone from 516 to 726 mm and in dry sub-humid the range is 1029-1108 mm (Table 1).

Criteria for selection of plus trees

The selection criteria for plus trees vary from species to species, but many of the basic characteristics remain the same. The individuals having diseases, dead branches, or attacked by any pathogen and pests were rejected in the initial stage of selection. Major characteristics considered for the plus tree selection for timber purposes were the straightness, cylindrical bole, non-forking, non-twisting bole, free from buttresses and flutes and minimum taper (Table 2). The selected tree should dominate the height and girth compared to its surrounding check trees of the same species and age. The objective is that the selected individual should have fast growth, well formed crown, natural pruning ability and free pests and diseases. In addition, the selected individuals should have thin branches with wide branch angles in case of *Dalbergia sissoo*.

Morphological characters viz. diameters at breast height (DBH), total height (TH), clear bole height (CBH), straightness and crown spread (CS) were measured and CBH : TH and TH : DBH were calculated for forty five plus trees i. e. fifteen from each region. Mean, standard errors, critical difference and coefficient of variation were calculated by using OPSTAT and correlation among different characters were also calculated.

Results and Discussion

Mean values of morphological characters for each agro-ecological region is given in Table 3. Standard error, critical difference and coefficient of variation were calculated for each character to find out variation among characters. Average performance of seed sources from dry sub-humid region was found better than other two regions as highest values of each character i.e. 38.57 cm diameter at breast height (DBH), 16.64 m total height (TH), 9.40 m clear bole height (CBH), 13.06 m crown spread (CS) and visual index (VI) value 6 for straightness were observed

Table 2. Plus tree characters of *D. sissoo* in different agro-ecological region.

Agro-ecological regions	Plus tree characters						
	DBH (cm)	TH (cm)	CBH (m)	CS (m)	Straightness	CBH: TH	TH: DBH
Arid-zone	27.17	11.37	2.99	7.89	4.83	0.27	0.41
Semi-arid zone	25.78	11.53	4.03	7.66	5.79	0.34	0.44
Dry sub-humid	38.57	16.64	9.40	13.06	6.13	0.57	0.44
SE (m)	0.53	0.48	0.20	0.35	0.26	0.02	0.02
SE (d)	0.75	0.67	0.28	0.50	0.37	0.03	0.03
CD	1.64	1.49	0.63	1.10	0.82	0.06	N/A
CV (%)	3.86	8.12	8.25	8.29	10.54	11.36	7.54

Table 3. Correlation coefficient among plus tree characters of *D. sissoo* seed sources.

	DBH	TH	CBH	CS	Straightness	CBH:TH
DBH	1.000					
TH	0.965**					
CBH	0.923**	0.924**				
CS	0.898**	0.844**	0.736*			
Straightness	0.408 ^{NS}	0.435 ^{NS}	0.716*	0.161 ^{NS}		
CBH:TH	0.800**	0.793*	0.960**	0.563 ^{NS}	0.719*	
TH:DBH	0.019 ^{NS}	0.243 ^{NS}	0.140 ^{NS}	0.078 ^{NS}	0.033 ^{NS}	0.080 ^{NS}

for dry sub- humid seed sources. Coefficient of variation which helps in comparing the variability for different characters exhibited that there is significant variation among characters for each region. Similarly, intensive survey was conducted in Haryana and adjoining states to select thirty one candidate plus trees (CPTs) of *Dalbergia sissoo* [4]. The selected 31 trees showed wide variation in plant height, clear bole and straightness.

All the traits except straightness were found significantly correlated with each other. Straightness was significantly correlated with clear bole height and the ratio of clear bole height and total height. Maximum correlation was observed between diameter at breast height and total height (9.65). Similar results were found in *Dalbergia sissoo* and *Pongamia pinnata* [5, 6]. Significant correlation of clear bole height and straightness were also observed in *Azadirachta indica* [7], *Pongamia pinnata* [8], *Melia azedarach* [9] and *Melia composite* [10]. This clearly indicates that all the traits influence the performance of each other in a positive direction.

Conclusion

Among three agro-ecological regions, dry sub-humid seed sources have higher DBH, total height, clear bole height, crown spread and straightness. Progeny trials can be done to confirm their superiority and

to raise clonal planting in Haryana region.

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