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Impact of aspect on growth performances in afforestation of Taurus cedar (*Cedrus libani* A. Rich.)

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Abstract: In this study, aspectual impact of on growth performances in afforestation of Taurus cedar (*Cedrus libani* A. Rich.) was investigated based on tree height, diameter at base and diameter at breast height in 25-years afforestation established in Isparta region of the species to contribute and to discuss for afforestation and other forestry practices. 300 m^2 area was sampled from each north, south, east and west aspects. Averages of tree height, diameter at base ($\mathbf{D_0}$) and diameter at breast height ($\mathbf{d_{1.30}}$) were 6.4 m, 17.4 cm and 13.2 cm, respectively, while east aspect had the highest performances for tree height (7.6 m) and diameter at breast height (14.7 cm), and north aspect for diameter at base (19.6 cm). They were the lowest for tree height in south for tree height (5.5 m) and in west aspect for diameters [14.3 cm ($\mathbf{D_0}$) and 11.0 cm ($\mathbf{d_{1.30}}$)]. Aspects showed significant ($p<0.05$) differences for all the characteristics by analysis of variance results. Positive and significant ($p<0.05$) relations among the characteristics according to results of correlation analysis in all aspects.
Keywords: Correlation, Height, Diameter, Plantation, Variation

1. Introduction

Taurus cedar (*Cedrus libani* A. Rich.) is an important forest tree species economically and ecologically in Turkish forestry together with as a target species of national tree breeding and seed production programme (Koski and Antola 2003) by 0.5 million ha natural distribution of which is 22% in 23.3 million ha total forest area of which 41% is unproductive of Türkiye (OGM 2024). Afforestation practice is main tool in conversion of unproductive forest to productivity by sowing or planting. However, there could be many biotic or abiotic factors could impact on successful afforestation practices (Bilir 2004; Yazıcı and Turan 2016; Bilir et al. 2018; Yazıcı 2018; Bilir 2021; Yazıcı et al. 2022; Yazıcı and Bilir 2023). Aspect is an easily determinable factor in these. In this study, the aspects are compared for tree height, diameter at base and diameter at breast in 25-years afforestation of Taurus cedar (*Cedrus libani* A. Rich.) to contribute and to discuss for afforestation and other forestry practices such as tending of the species.

2. Material and Methods

2.1. Studied populations and data collection

Aspectual afforestations at 25 years established by 2.5x3 m were sampled from each north (N), south (S), east (E) and west (W) aspects at southern Türkiye. Tree height (**TH**), diameter at base ($\mathbf{D_0}$) and diameter at breast height ($\mathbf{d_{1.30}}$) were measured from 300 m^2 (30 x 10 m) sampled areas of each aspect (Table 1, Figure 1).

2.2. Data analysis

Aspects were compared based on the characteristics by following model of analysis of variance at SPSS (SPSS 2011).

$$Y_{ij} = \mu + P_j + e_{ij} \quad (1)$$

Where Y_{ij} is the observation from the j_{th} tree of the i_{th} aspect, μ is overall mean, P_i is the random effect of the i_{th} aspect, and e_{ij} is random error.
Phenotypic correlations (r_p) between the pairs of the tree height, diameter at base, diameter at breast height were estimated in each aspect as (Falconer 1989):

$$r_p = \frac{COV_{f(x,y)}}{\sqrt{\sigma^2_{f(x)}}\sqrt{\sigma^2_{f(y)}}} \quad (2)$$

Where $COV_{f(xy)}$ is the phenotypic covariance between characteristics x and y, $\sigma^2_{f(x)}$ and $\sigma^2_{f(y)}$ are the phenotypic variances for characteristics x and y, respectively.

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Table 1. Some details of sampled areas

Aspects	N*	Latitude (N)	Longitude (E)	Altitude (m)
North (N)	27	37°49'42"	30°27'82"	1456
South (S)	23	37°49'86"	30°27'67"	1426
East (E)	27	37°49'58"	30°27'90"	1399
West (W)	28	37°49'70"	30°27'65"	1390

*; Number of individual trees in the areas.

Figure 1. Sampled areas from four aspects

3. Results and discussion

Averages of tree height, diameter at base and diameter at breast height were 6.4 m, 17.4 cm and 13.2 cm, respectively, while performances of the characteristics changed for the aspects together with among individuals within aspect. For instance, there were about two times differences for tree height among individuals within aspect, and also it was more than that for other characteristics in some aspects (Table 2, Figure 2). It was between 4.4 m and 6.9 m for tree height, and ranged from 7.6 cm to 19.6 cm for diameter at breast height in north aspect (Table 2, Figure 3). Similar variations among individuals were also found for tree height and diameter at base in Taurus cedar (Bilir et al. 2018; Özel 2018; Yazıcı 2018; Özbey 2023). However, many biotic or abiotic factors could impact in these variation and success. For instance, slope (Yazıcı et al. 2022) and afforestation method (Bilir 2021) were effective on growth performances in Taurus cedar. The variations indicated importance selection of mother trees for higher growth performance and wood production in afforestation practices. Survival ranged from 56% (S) to 70% (W) based on spacing.

Table 2. Averages, ranges and coefficient of variations for the characteristics of the aspects

	N			S			E			W		
	TH (m)	D_0 (cm)	$d_{1.30}$ (cm)	TH (m)	D_0 (cm)	$d_{1.30}$ (cm)	TH (m)	D_0 (cm)	$d_{1.30}$ (cm)	TH (m)	D_0 (cm)	$d_{1.30}$ (cm)
Averages*	6.7^{b}	19.6^{c}	14.6^{c}	5.5^{a}	16.9^{b}	12.5^{a}	7.6^{c}	18.9^{c}	14.7^{a}	5.7^{a}	14.3^{a}	11.0^{c}
Ranges	4.8-9.2	14.7-28.3	8.9-23.2	4.4-6.9	12.5-25.2	7.6-19.6	5.7-9.6	12.8-27.2	9.3-22.7	3.8-8.2	9.7-19.5	6.9-16.3
CV%	16.1	18.6	20.7	13.5	19.1	23.8	15.1	20.3	21.0	21.4	19.6	22.9

*; Same letters are not significantly (*p>0.05*) different among the species.

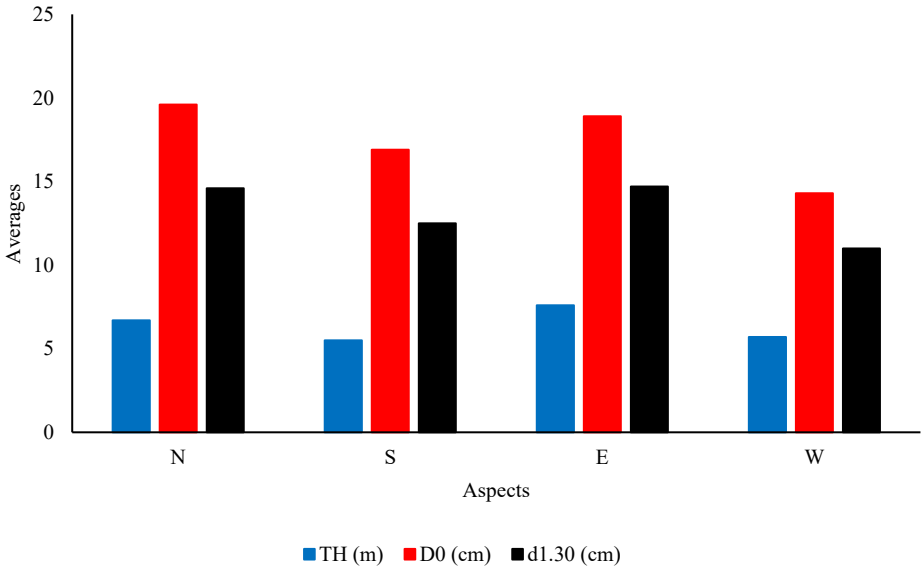

Figure 2. Averages of the characteristics for the aspects

Figure 3. Tree height differences among trees in south aspect

Aspects showed significant (*p≤0.01*) differences for the characteristics according to results of analysis of variance (Table 3). Similar variations were also reported for biotic and abiotic factors in afforestation of the species (Bilir et al. 2018; Yazıcı et al. 2022). The variations emphasized importance of afforestation practices for these factors.

Positive and significant (*p≤0.05*) phenotypic relations among the characteristics were found according to results of correlation analysis (Table 4). Similar findings were reported in plantation areas of the species (Bilir 2004; Bilir et al. 2018; Özel 2018; Yazıcı 2018). The results could be used afforestation and other forestry practices such as forest tending, and future studies in the species.

Table 3. Results of analysis of variance for the characteristics of the aspects

Characteristics	Source of variation	df	Mean Square	F	*P value*
TH	Between Groups	3	25.064	21.679	.000
	Within Groups	101	1.156		
	Total	104			
D_0	Between Groups	3	157.570	13.580	.000
	Within Groups	101	11.603		
	Total	104			
$d_{1.30}$	Between Groups	3	87.119	10.308	.000
	Within Groups	101	8.452		
	Total	104			

Table 4. Phenotypic correlations among the characteristics in the species

	r	**TH**	**D_0**
N	**D_0**	.701**	-
S		.709**	-
E		.743**	-
W		.777**	-
N	**$d_{1.30}$**	.771**	.935**
S		.789**	.929**
E		.781**	.927**
W		.854**	.899**

**; Correlation is significant at the 0.01 level.

4. Conclusions

Results of the study belong to limited area and characteristics of the species. New studies should be carried out in different areas and characteristics. Variations among aspects and within aspect could be used such as selection in afforestation and forestry practices of the species. Relations among the characteristics could be used for future studies in the species.

References

Bilir N (2004). Phenotypic age-age correlations for height, diameter and volume in *Cedrus libani* A. Rich. Journal of Forestry Faculty of Süleyman Demirel University, 1:12-18.

Bilir N (2021). Growth performances in the planting and seeding areas of Taurus cedar (*Cedrus libani* A. Rich.). Agriculture and Forestry, *67*(4):81-88.

Bilir N, Yazıcı N, Ozel HB (2018). Examination of Taurus cedar (*Cedrus libani*) afforestation in Isparta province of Turkey. International Conference Reforestation Challenges, June 20-22, Belgrade, Serbia.

Falconer DS (1989). Introduction to Quantitative Genetics, Longman Scientific Technical, Longman Group U.K. Limited.

Koski V, Antola J (1993). National Tree Breeding and Seed Production Programme for Turkey 1994-2003. The Research Directorate of Forest Tree Seeds and Tree Breeding.

OGM (2024). Forest Inventory-2023. General Directorate of Forestry, web site (www. ogm.gov.tr).

Özbey Y (2023). Growth performances of some forest tree specıes in afforestatıon areas. The Institute of Graduate Education, Isparta University of Applied Sciences, M.Sc. Thesis, Isparta.

Özel S (2018). Silvicultural evaluation of plantations in Isparta-Yalvaç district. Graduate School of Natural and Applied Science, Süleyman Demirel University, M.Sc. Thesis, Isparta.

SPSS (2011). IBM SPSS Statistics for Windows, Version 20.0., NY: IBM Corp.

Yazıcı N (2018). Effect of species and environmental factors on growth performances in afforestation of *Cedrus libani* and *Pinus brutia*. Fresenius Environmental Bulletin, 27(10): 6913-6917.

Yazıcı N, Bilir N (2023). Growth variation in forest tree species in Afforestation of gradoni Terracing. 4th International Latin American Congress on Natural and Applied Sciences, March 13-15, Rio de Janeiro, Brazil, p.65-71.

Yazıcı N, Turan A (2016). Effect of forestry afforestation on some soil properties: A case study from Turkey. Fresenius Environmental Bulletin, 25(7):2509-2513.

Yazıcı N, Babalık AA, Bilir N (2022). Effect of slope on growth of a Taurus Cedar (*Cedrus libani* A. Rich.) afforestation: A case study from Dinar. Anatolian Journal of Forest Research, 8:1-5.