

Morphological characteristics of Kazdagi fir (*abies equi-trojani* aschers et sinten) seedlings

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ABSTRACT

This study was carried out on of Kazdagi Fir (*Abies equi-trojani* aschers et sinten) to contribute for nursery practices of the species. Seedling height, root-collar diameter, number of branches were examined in 0+2, 0+3 and 0+4 year of Kazdagi Fir seedlings sampled 100 from each age group in Balikesir Forest Nursery at the end of growing period of 2013. Seedling quality and relation among the characteristics were investigated.

Averages of seedling height, root-collar diameter, number of 0+2, 0+3 and 0+4 year old seedlings were 20.4 cm, 27.3 cm and 37.8 cm; 8.2 mm, 8.9 mm and 10.9 mm, 5.1, 6.8 and 7.5, respectively.

Most of the seedlings were in high quality class according to quality classes of Turkish Standard Institute. There were positive and significant ($p < 0.05$) relations among characters in pooled age groups based on results of correlation analysis. Results of the study were discussed for nursery practice of the species. © 2014 Trade Science Inc. - INDIA

KEYWORDS

Age;
Height;
Morphology;
Root-collar diameter;
Seedling quality.

INTRODUCTION

Turkish firs (*Abies* sp.) are important forest trees both taxa richness and distribution area (Figure 1)^[1]. They were *Abies nordmanniana*, *A. nordmanniana* subsp. *nordmanniana*, *A.n.* subsp. *bornmuelleriana*, *A.n.* subsp. *equi-trojani*; *Abies cilicica* subsp. *cilicica* and *A. cilicica* subsp. *isaurica*^[2,3].

Kazdagi Fir (*Abies equi-trojani* aschers et sinten) is one of most important of these taxa because of the fastest growing and endemic forest tree species in Turkish forestry. These taxa are used widely in forest plantation and conversion of unproductive forest to productive forest. Seedling quality is one of most important factor in plantation forestry and for the conversion.

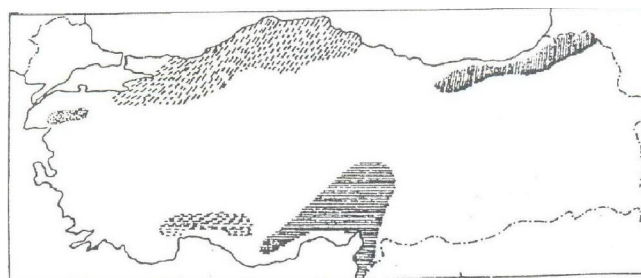


Figure 1 : Natural distribution of Turkish firs in Turkey
 ■ *Abies nordmanniana* subsp. *nordmanniana*; ■ subsp. *bornmuelleriana*;
 ■ subsp. *equi-trojani*; ■ *A. cilicica* subsp. *cilicica*; ■ subsp. *isaurica*.

Many studies were conducted on seedling quality on different forest tree species^[4-7]. However, studies on morphology and quality of Kazdagi fir were very limited^[8,9].

The purposes of this study were to determine seed-

ling morphology and quality on 0+2, 0+3 and 0+4 year seedlings of Kazdagi fir to contribute nursery practice and plantation forestry of the species.

MATERIALS AND METHODS

The study was carried out on seedling height (SH), root-collar diameter (RCD) and number of branches (NB) longer than 1 cm of 0+2, 0+3 and 0+4 year old of Kazdagi fir seedlings which were produced in Balikesir Forest Nursery (latitude 39°35'20"-39°36'00" N, longitude 27°25'45"-27°26'15" E and altitude 101m) (Figure 2). The morphological data was collected on 100 seedlings sampled randomly from each age group at the end of growing period of 2013.

The seedlings were distributed to quality classes of Turkish Standard Institute (TABLE 1)^[10].



Figure 2 : A view of the nursery

TABLE 1: Seedling quality classes of turkish standard institute

quality classes	SH (cm)	RCD (mm)	SH+RCD
0+2			
First class	12≤SH	2≤RCD	12≤SH + 2≤RCD
Second class	12> SH ≥10	-	12>SH ≥10 + 2≤RCD
Cull	10>SH	2>RCD	10>SH + 2>RCD
0+3			
First class	20≤SH	2≤RCD	20≤ SH + 2≤RCD
Second class	20> SH ≥17	-	20>SH≥17 + 2≤RCD
Cull	17>	2>RCD	17>SH + 2>RCD
0+4			
First class	30≤SH	2≤RCD	30≤ SH + 2≤RCD
Second class	30> SH ≥25	-	30>SH≥25 + 2≤RCD
Cull	25>SH	2>RCD	25>SH + 2>RCD

The following linear ANOVA model was used for comparison of the age groups for the morphological characters:

$$Y_{ij} = \mu + C_i + e_{ij}$$

Where Y_{ij} is the observation from the j^{th} seedling of the i^{th} age group, μ is overall mean, P_i is the random effect of the i^{th} age group, and e_{ij} is random error.

Correlations among the characters were calculated by Pearson's correlation.

RESULTS AND DISCUSSION

Seedling morphology

Averages, standard deviation and ranges of seedling height, root-collar diameter and number of branches for age groups were given in TABLE 2. There were large differences among age groups and within age group for the characters. Average of seedling height was 20.4 cm at 0+2 year. It reached 37.8 cm at 0+4 year (TABLE 2). Increment was the highest for seedling height from 0+2 year to 0+3 and 0+4 years. It was reported 27.3 cm height and 8.9 mm root collar diameter at three years old seedlings of the species^[9]. However, It was reported seedling morphology could be changed according to nursery^[4,6,7,11].

TABLE 2 : Averages, standard deviation and ranges of the characters for age groups

	0+2			0+3			0+4		
	SH	RCD	NB	SH	RCD	NB	SH	RCD	NB
Average	20.4	8.2	5.1	27.3	8.9	6.8	37.8	10.9	7.5
Minimum	12	5	2	24	5.1	3	32	6.5	3
Maximum	24	13.4	14	31	13.8	14	48	15.4	15
Standard deviation	2.9	1.6	2.2	1.9	1.9	2.4	4.3	1.8	2.5

There were large differences among individual seedlings within age group. But the differences were lower for SH than that of RCD and NB (TABLE 2). For instance, SH was ranged from 12 cm to 24 cm at 0+2 age group. It showed importance of genetic structure of seedling material and individual mother tree. Similar results were also reported in different forest tree species^[12-15]. Statistically significant differences ($p \leq 0.05$) were also found among age groups for the characters based on results analysis of variance.

Seedling quality

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About all of the seedlings was first quality class for classifications of Turkish Standard Institute (TABLE 3). Root collar diameter was 2 mm for all species and ages of quality classifications of Turkish Standard Institute^[10]. However, It was known that seedling morphology could be changed according to age and species and seedling type^[4,5,16]. So, new quality classed should be improved for age groups and species especially for root- collar diameter.

TABLE 3 : Distribution of seedlings to quality classes of turkish standard institute

Age group	SH			RCD	
	First class	Second class	Cull	Quality	Cull
0+2	12≤SH	12≤SH<10	SH <10	2≤RCD	RCD<2
Distribution (%)	99	1	-	100	-
0+3	20≤SH	20≤SH<17	SH <17	2≤RCD	RCD<2
Distribution (%)	100	-	-	100	-
0+4	30≤SH	30≤SH<25	SH <25	2≤RCD	RCD<2
Distribution (%)	100	-	-	100	-

Relations among characters

The relations among the characters were given for age groups in TABLE 4. The relations among the characters showed differences for age groups, while there were positive and significant ($p \leq 0.05$) relations in polled age groups (TABLE 4). For instance, SH and RCD showed positive and significant ($p \leq 0.05$) relations only at age 0+2. Generally, positive and significant ($p \leq 0.05$) relations were reported in seedlings of forest tree species^[17,18].

TABLE 4 : Relations among the characters for age groups

	SH	RCD
0+2		
RCD	0.029 ^{NS}	-
NB	0.228($p \leq 0.05$)	0.242($p \leq 0.05$)
0+3		
RCD	-0.053 ^{NS}	-
NB	0.108 ^{NS}	0.031 ^{NS}
0+4		
RCD	0.225($p \leq 0.05$)	-
NB	-0.032 ^{NS}	0.996($p \leq 0.05$)
Total		
KBÇ	0.512($p \leq 0.05$)	-
DS	0.372($p \leq 0.05$)	0.249($p \leq 0.05$)

^{NS}; correlation was not significant

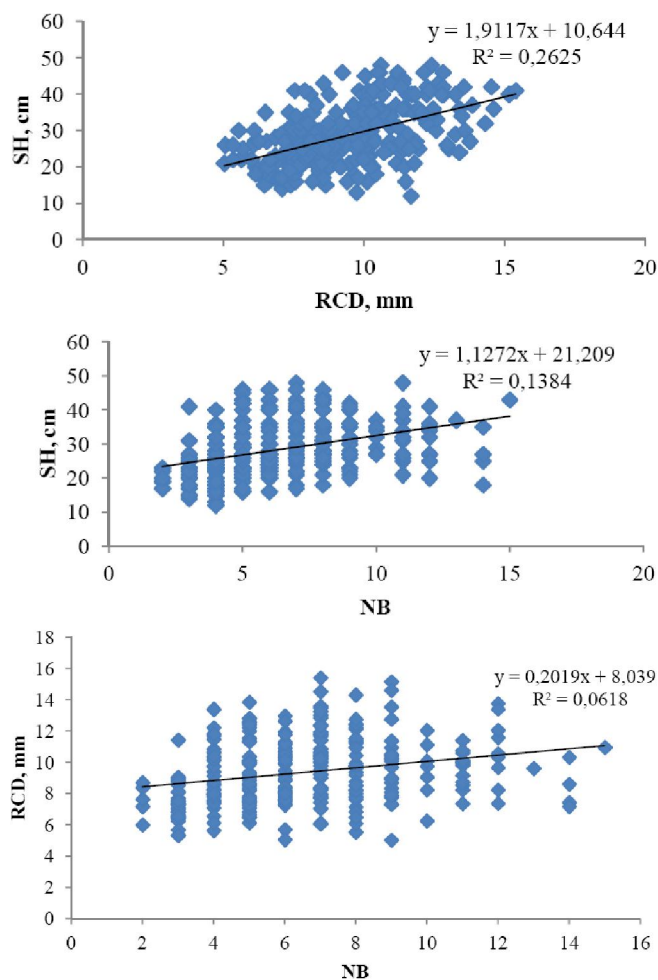


Figure 3 : Relations among the characters for polled age groups

Relations among the characters were showed in Figure 3 for polled age groups.

Results of correlation analysis emphasized similar findings could be found with less studied characters in future studies.

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