



## Growth of a plantation with giant sequoia (*Sequoiadendrongiganteum*) established by Lindgren's family in Turkey

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### ABSTRACT

This study was carried out in a plantation with Giant sequoia [*Sequoiadendrongiganteum* (Lindl.) Bucholz], planted by "Lindgren's Family" in Turkey. Averages of the seedling height and root-collar diameter at planting were 13.3 cm and 3.7 mm, respectively, and 118.5 cm and 53.5 mm at the fourth year after plantation at Isparta. Seedlings showed large differences for the traits. Only one seedling (7% of total seedling) had died at the end of fourth year. Results of the study were discussed for future plantation of the species. © 2014 Trade Science Inc. - INDIA

### KEYWORDS

Exotic;  
Height;  
Root-collar diameter;  
Seedling;  
Sequoia.

### INTRODUCTION

Giant sequoia [*Sequoiadendrongiganteum* (Lindl.) Bucholz], is the largest of all forest tree species and there are trees several thousand years old. It grows naturally at a restricted geographical range on the Sierra Nevada Mountains in California, USA between 1550 and 2500 meter asl.<sup>[1]</sup> It has been noted for its enormous size and age, and its rugged, awe-inspiring beauty. Because the species has broad public appeal and a restricted natural range, most groves of giant sequoia have protected status. Varying in size from less than 1 to 1619 ha groves occupy a total area of 14410 ha<sup>[2]</sup>. It has big timber producing potential<sup>[3]</sup>. Outside its natural range, both in the United States and in many other countries, giant sequoia is highly regarded as an ornamental and for attractive stands and shows promise as a timber-producing species. The species has social and cultural

importance as monumental tree in landscape planning because of long life and habitus more than 1500 years. It also introduced to Europe in 1853. The species grows up to 90 meter height and 11 meter diameter at breast height<sup>[4]</sup>. It is known some of the individuals of the species has 18 meter diameter. Giant sequoia is also resistant to insect, fungus and fire damages. The species is a candidate in future plantations because of these advantages. The species has also an importance for monumental tree and landscape planning. The Taurus mountain in Turkey have similarities with the natural environments sequoia grows in and is thus worth trying as an exotic. Also if it works it could be a good tree for memorial purposes.

The purposes of this study were to determine seedling height and root-collar diameter at a four year old plantation of giant sequoia to initiate a study of its suitability in the Taurus mountains in Turkey.

## MATERIAL AND METHOD

The seeds were obtained from given to Ministry of Environment and Forestry of Turkey and then to Forestry Faculty of SuleymanDemirel University, finally to Dr. Nebi Bilir by the seeds carried the identity from Prof. Dr. Bill Libby from USA. The code on the package with the seeds was S34.60-98 T14SR28E mDBm Blodgett forest. Blodgett forest is a research area where Giant sequoia is planted and studied.

The seeds were sown and raised to plants at the nursery of Atabey Vocational School of SuleymanDemirel University of Turkey in plastic containers with 24x19 cm size and grown at 2008-2009 (Figure 1).

The seedlings were planted at five sites (TABLE 1). The reported plantation was close to Sparta city and planted by each member of Lindgren's family and some Turkish collaborators (Figure 2) at southern part of Turkey at end of the vegetation period of 2009. At the other plantation sites two have failed. Dedegul at the top of a mountain may have been too high and too exposed. At Atabey all plants dies in a few days. At Golcuk wild animals damaged the buds but there are shrub-like survivors.



**Figure 1:** Seedlings of the giant sequoia for the plantation when taken from the nursery at Atabey Vocational School September 2009

Holes were dug, an identification tag of aluminum placed at the bottom, some organic material put into the holes. The holes were filled with material dug up, compacted by foot and some water given. A protection metal net cage was placed around the plants with an additional identification tag (Figure 3). After some years the cage was removed and the identification tag moved to the plant (Figure 3).

Seedling heights ( $SH_p$  &  $SH_4$ ) and root-collar diameter ( $RCD_p$  &  $RCD_4$ ) at plantation (p) and fourth year (4) were examined at experiment of Botanic Garden of



**Figure 2:** Planters behind a planted plant: From left, Mehmet, Huseyin, Nebi, Dag, Idun, Jan, Katarina, Wilhelm, Olof, and in front Linnea, Mira and Anna

TABLE 1 : Summary of sites

Location	Latitude (N)	Longitude (E)	Altitude (m)	Explanation
Golcuk Lake	37° 43'	30° 29'	1397	animal damage
Botanic Garden	37° 50'	30° 31'	1012	Examination reported here
Davraz Sky Center	37° 47'	30° 45'	1628	unexamined
Atabey Vocation School	37° 56'	30° 39'	1021	No survival
Dedegul Mountain	37° 40'	31° 20'	1984	No survival



Figure 3 : View of the seedlings at the experiment site



Figure 4 : A view of the four years old seedlings at the Botanic garden

SuleymanDemirel University (Figure 4) at end of 2013.

### RESULTS AND DISCUSSION

Averages and ranges of seedling height and root-collar diameter for plantation and fourth year were given in TABLE 2.

Annual increments were 30 cm and 13.4 mm for

height and root-collar diameter in the seedlings. It could be said that the increments were higher than natural species of the region such as Taurus cedar (*Cedruslibani* A. Rich., and Black pine (*Pinusnigra* Arnold.) of the region<sup>[5]</sup>.

There were large differences among seedlings for height and diameter (TABLE 2). It showed importance of genetic structure of seedling material and individual

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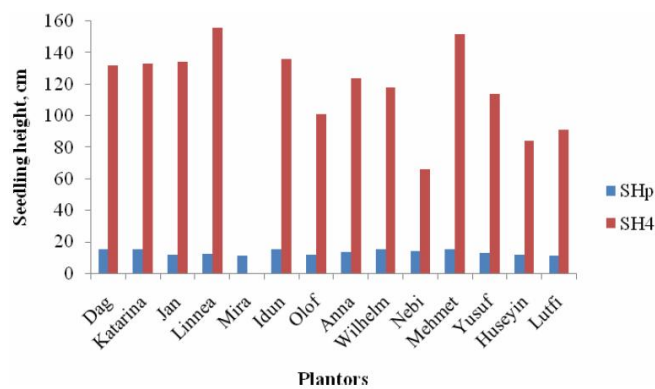


Figure 5

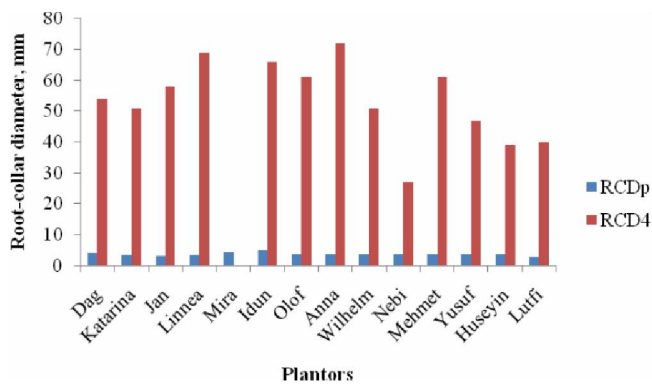


Figure 6

TABLE 2: Averages and ranges of the characters

PlantIdentification	SH <sub>p</sub> (cm)	RCD <sub>p</sub> (mm)	SH <sub>4</sub> (cm)	RCD <sub>4</sub> (mm)
DagLindgren	15	4.0	132	54
KatarinaLindgren	15.5	3.5	133	51
Jan Lindgren	11.5	3.25	134	58
Linnea Lindgren	12.5	3.46	156	69
Mira Lindgren	11.0	4.4	-	-
Idun Lindgren	15.5	4.85	136	66
Olof Selander	11.5	3.84	101	61
Anna Lindgren	13.5	3.82	124	72
Wilhelm Selander	15.0	3.87	118	51
Nebi Bilir	14.0	3.66	66	27
Mehmet Topal	15.0	3.66	152	61
Yusuf Bilir	13.0	3.7	114	47
Huseyin Fakir	11.5	3.6	84	39
M. Lutfi Baydar	11.0	2.7	91	40
Average	13.3	3.7	118.5	53.5
Ranges	11-15.5	2.7-4.85	66-156	27-72

mother tree as also emphasized in different forest tree species<sup>[6,7]</sup>.

Average seedling height increased nine times in four years (from 13.3 cm to 118.5 cm). It was about fifteen times in root collar diameter (from 3.7 mm to 53.5 mm)(TABLE 2). The differences among seedlings were larger in the plantation than that of planting stage (TABLE 2 &Figure 5).

While Linneas's seedling showed highest increment for seedling height from 12.5 cm to 156 cm, It was Anna's seedling for root collar diameter (from 3.82 mm to 72 mm) (TABLE 2, Figure 5 and Figure 6). It was lowest for Nebi's seedling for both traits. Performances of studied species were higher than that of other forest tree species<sup>[3,8,9,10]</sup>. Averages of seedling height and root-collar diameter were 37.8 cm and 10.9

mm 0+4 year old seedlings of Kazdagi Fir (*Abiesequi-trojani*aschers et sinten), respectively<sup>[11]</sup>. They were 27.3 cm height and 8.9 mm root collar diameter at three years old seedlings of Kazdagifir<sup>[12]</sup>.

There was significant ( $pe < 0.05$ ) and positive correlation between SH<sub>4</sub> and RCD<sub>4</sub> ( $r=0.808$ ) according to results of correlation analysis, while there were no significant relation among the other traits such as SH<sub>p</sub> & SH<sub>4</sub>. The results of correlations between height and diameter were mainly in accordance with previous study in the species<sup>[13]</sup>. However, it was known that seedling morphology could be changed according to age, species, nursery, site and seedling type<sup>[14,15]</sup>.

In the present study, growth data were collected from only one year of one experiment site belongs to one provenance. Therefore, more data are needed make conclusions. Establishment of plantations has not been very successful, but it would be premature to conclude that the species is not of interest.

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