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Chestnut-leaved oak (*Quercus castaneifolia*) seedling growth rates in primary four-year growing period

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Abstract

Quercus is the largest genus in the family *Fagaceae* with about 300-600 species. This genus includes evergreen and deciduous shrubs and trees extending from cold latitudes to tropical Asia and Americas. It is the most common genus of *Fagaceae* in forests of Iran. The genus shows a remarkable morphological variation in these forests. *Quercus castaneifolia* is one of the most important species of Iran`s native oaks, distributed in the Hyrcanian Forests. As a main species of the Hyrcanian forests, it forms two important forest communities in this zone: *Querco-Buxetum* in the Caspian coast plains and *Querco-Carpinetum* in the lowlands (Fig. 1). Ten 4-year-Seedlings were collected from a field spread in the Kandesar Village, Roudsar District, Gilan Province, Iran with area about 5 ha (with same growing condition such as aspect, light and soil) in North Iran with loam and silty loam soil. According to the above research and evaluation with SAS System, we find that the annual growing of (*Quercus castaneifolia)* in 4th year was longer than 2, 3 and 1. Annual growing in 3rd year was about 2.35 cm more than 2nd year. There reason of this difference was different in annual precipitation in those years.

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Introduction

Caspian forests are the most valuable forests in north of Iran covering the northen slopes and foothills of Alborz mountain range in southern part of the Caspian Sea.*Quercus castanefolia* (C.A.Mey.) is one of the most prevalent species growing in these forests (Jafari, 1977).

Quercus is the largest genus in the family *Fagaceae* with about 300 (Lawrence, 1951) -600 species (Soepadmo, 1972). This genus includes evergreen and deciduous shrubs and trees extending from cold latitudes to tropical Asia and Americas. It is the most common genus of *Fagaceae* in forests of Iran (Sabeti, 1994). The genus shows a remarkable morphological variation in these forests (Panahi *et al*., 2011).

Quercus castaneifolia is one of the most important species of Iran`s native oaks, distributed in the Hyrcanian Forests (Table 1) (Panahi *et al*., 2011). As a main species of the Hyrcanian forests, it forms two important forest communities in this zone: *Querco-Buxetum* in the Caspian coast plains and *Querco-Carpinetum* in the lowlands (Panahi *et al*., 2011).
Annual Rate of seedling height was influenced by seed size and growing area in forest trees (Cannell *et al*., 1978). S*eedling growth* affected by different factors such as *Seed morphology, Seed germination,* seed color, seed size and seed weight (GINWAL *et al*., 2005).

Reduction of standing volume as well as defect of natural regeneration in *Quercus* stands has made concerned Iranian silviculturists. To this reason, its natural regeneration problem has led forest managers to use the artificial regeneration, where regeneration establishment is difficult (Resaneh *et al.,* 2001).Some factors negatively affect growth and establishment of artificial regeneration. In literature has been referred that weeds directly compete with seedlings for soil moisture and nutrients and have a negative effect on its survival and growth (Davis *et al*., 1999).

Likewise, strong radiation can limit plant survival and growth by photo damage (Methy *et al*., 1996) and by reducing soil water content through evaporation and transpiration (Rey Benayas, 1998). Numerous studies have addresses the issues of how the performance of planted or naturally established woody seedling are affected by shade (Bardon *et al*., 1999; Cardillo and J.Bernal, 2006; Guo and Werger, 1999; McLaren and McDonald, 2003; Morris *et al*., 1993; Rey Benayas *et al*., 2005; Ziegehagen and Kausch, 1995) herb competition (Caldwell *et al*., 1995; Holl, 1998; Jose *et al*., 2002; Morris *et al*., 1993; Rey Benayas *et al*., 2005) and irrigation (Fotelli *et al*., 2000; Kolb and Steiner, 1990). Seed germination and establishment are critical phases in plant growth and development. The establishment of canopy cover is often restricted due to low moisture available in coarse textured soils, particularly in field (Akhter *et al*., 2004). The natural distribution of plants and trees species may be strongly influenced by the resistance of seedlings to drought (Kamis, 1977).

The interaction of irrigation, shading and weeds on this performance is complicated (Amirjani, 2012). For instance, shading may have a positive direct effect on seedling establishment and humid content (Madsen 1995) but a negative indirect effect mediated by an enhancement of weed growth . In addition, weeds directly compete with seedling for resources (especially water and nutrient) a negative effect, but they also diminish radiation and may increase low winter temperatures at the ground level, indirect positive effects that may facilitate seedling establishment and increase seedlings growth (Rey Benayas *et al*., 2005).Furthermore, soil moisture may have a negative effect due to enhancement of weed growth, but a positive effect on seedling growth and establishment.

The establishment stage of the plants consists of three parts: germination, emergence, and early seedling growth (Hamdy *et al*., 2002). When seeds are placed in the soil, germination can only be

observed as emergence, which may be affected by the water content and structure of the top soil. Much information is available in literature about the effects of water quality, soil texture and soil Yearinity on germination and emergence (Grillot, 1957; Maas, 1986).

Much less information is available about growth speed and collar growth of seedling during early seedling growth, the approach taken this study was to measure two quality of growth as same as annual length growth and seedling collar growth for this three research seedlings.

Material and Methods

Area description

Soil was a fine sandy loam with a pH of 6.25 in 0-30cm depth (BELLO and Igbokwe, 2013) and organic carbon content of 2.19% soil. N, P, K content of soil were 0.15%, 19.79 ppm and 200 ppm in 0-30 cm depth, respectively. Primary four-year growing period of *Quercus castaneifolia* were studied in North Iranian forest area. The study area is latitude 37° 10' N and longitude: 50° 23' 20" E with about elevation -10 m (Negative Ten). Annul precipitation of study area is about 1580 mm with average temperature 14.8°C (IranianMeteorology, 2013).

Fig. 1. *Quercus castaneifolia* 4 years seedling.

Sampling method

Ten random 4-year-Seedlings were collected from a field spread in the Kandesar Village, Roudsar District, Gilan Province, Iran with area about 5 ha (with same growing condition such as aspect, light and soil) in North Iran.

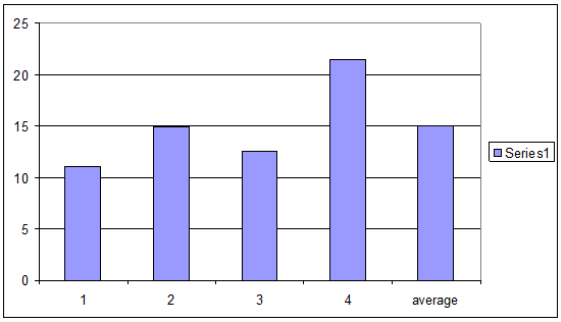

Fig. 2. Average annual growing in four years (*Quercus castaneifolia*).

Results and discussion

Result for seedling growing shown in Table 2. Result show Pr>F and < 0.0001 so annual growing was significantly different with themselves and CV=26.19 That show the experimental accuracy is acceptable.

According to Duncan test, mean annual growing in 4th year was 21.500 cm that this growing was maximum growth in four years and 2, 3 and 1 annual growing was decreased, respectively (Fig. 2). We find significant difference for annual growing in year 4 with 2, 3 and 1 and we cannot find significant difference with 2, 3 and 1 years. This research was performed under non-compete weeds. If there is competition, the annual growth of trees was similar to that in the present study(Varamesh and Tabari, 2010). The results of the study, the opposite of the eruption. An annual growth of cases that can be cited for the species studied in this area , good growing conditions is such as soil type , moisture conditions and light non-compete other species such as trees and weeds.(Sanchez *et al*, 2005).The results showed that the change in annual precipitation can affect on the growth of seedling annually. This effect is content of soil moisture (Sanchez *et al*, 2005).The annual growth of the seedlings in the first year of the study period is less than two years. This difference may be due to lack production is due to low seedling leaf

area and seedling growth in the first year the network more robust to the root itself. The result will become some of the research; an annual longitudinal growth of *Oak* seedling in the first year compare to second year of a four- year period, growth is very low.

Table 1. Scientific name and Classification of *Quercus castaneifolia* (USDA, 2013).

Kingdom	*Plantae* – Plants
Subkingdom	*Tracheobionta* – Vascular plants
Superdivision	*Spermatophyta* – Seed plants
Division	*Magnoliophyta* – Flowering plants
Class	*Magnoliopsida* – Dicotyledons
Subclass	*Hamamelididae*
Order	*Fagales*
Family	*Fagaceae* – Beech family
Genus	*Quercus* L. – oak
Species	*Quercus castaneifolia* C. A. Mey – Chestnut-leaved oak

Table 2. The SAS System GLM Procedure Dependent Variable for *Quercus castaneifolia*

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	634.718750	211.572917	13.69	<.0001
Error	36	556.525000	15.459028		
Corrected Total	39	1191.243750			
	R-Square	Coeff Var	Root MSE	X Mean	
	0.532820	26.19015	3.931797	15.01250	
Source	DF	Type III SS	Mean Square	F Value	Pr > F
Year	3	634.7187500	211.5729167	13.69	<.0001

Table 3. The SAS System Duncan's Multiple Range Test for *Quercus castaneifolia*

NOTE: This test controls the Type I comparisonwise error rate, not the experimentwise error rate.

Alpha	0.05
Error Degrees of Freedom	36
Error Mean Square	15.45903

Number of Means	2	3	4
Critical Range	3.566	3.749	3.868

Means with the same letter are not significantly different.

Duncan Grouping	Mean	N	Year
A	21.500	10	4
B	14.900	10	2
C B	12.550	10	3
C	11.100	10	1

Hence the need for two years of operation to release cutting the weed seedling is very important(Lof *et al.* 1998; Lhotka & Zaczek 2001; Duplissis *et al.* 2002; Benayas *et al* ., 2005).However, due to increased longitudinal growth in the third and fourth years , you can release cutting period longer than the first two years of growth assessment.

Conclusion

According to the above research, we find that the annual growing of (*Quercus castaneifolia)* in 4th year was longer than 2, 3 and 1. Annual growing in 3rd year was about 2.35 cm more than 2nd year. There reason of this difference was different in annual precipitation in those years.

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