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APPROPRIATENESS OF *Eucalyptus camal / dulensis*, Casuarina *equisetifolia* AND *Olea europaea* TREES IN SHELTERBELT OF AL-ASHRAF NAJAF CITY

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ABSTRACT

The research has conducted on shelterbelt of Al-Ashraf Najaf city to explore suitability of four *Eucalyptus camaldulensis* Dehnh. Forms and two other tree species; *Casuarina equisetifolia* and *Olea europaea* to the local dominant sever conditions. Development in growth was studied through the interval of five years. Growth parameters included height, DBH stem diameter, main stem height, crown diameter, and stem girth were investigated. Distance from water supply was inspected, too. Results showed superiority of *E. camaldulensis* upon other species. Investigations showed weakness in growth of *C. equisetifolia* where most of trees could not resist because of their position in opposite to sandy wind stream that deposited sand on plants. So survival percentage was lower than that of the two other species. *O. europaea* trees did not show a rate of growth required for such purpose but it might be beneficial for an economic objectives through olive fruit production. Forms of *E. camaldulensis* revealed lesser relative differences in growth parameters than observed before five years. Form no. II possessed distinctive tree height and stem diameter, while form III gave smallest growth traits. Other form parameters did not different significantly. The most effective factor was the distance from water source where far trees (300 m) had smaller growth traits than those located at 200 m and 100 m distances, that's might because inefficiency of the used drip irrigation system.

INTRODUCTION

Shelterbelt is a single or multiple rows of trees or shrubs that are established mainly for environmental purposes. They are generally founded to protect or shelter nearby leeward areas from troublesome winds. They reduce wind erosion, protect growing plants (crops and forage), managed snow, and improve irrigation efficiency. They also protect livestock, provide wildlife habitat, improve aesthetics, and provide tree or shrub products. In addition, when used as a living screen, they control views and lessen noise (NRCS, 1997).

They are placed on the windward side of the land to be protected, and are most effective when oriented at right angles to the prevailing winds. Very dense windbreaks may do more harm than good since they will tend to create strong turbulence that will scour the soil on the windward side and damage crops on the leeward side. Conversely, gaps in the trees will channel the wind, actually increasing the velocity on the leeward side and promoting soil erosion and damaging crops (Ramachandran Nair, 1993).

Large portion of Iraqi areas are desserts or semi desserts with arid and semi-arid dominant climates. Sand dunes are present in territories adjacent to the west dessert; they are forming as a result to wind erosion of naked surface soil. Experimental and practical attempts were conducted for dun fixation since 70th of last century. Some of applications were succeeded in

stopping sand crawling, as in project of Baiji among Salahaddin governorate. Unstable conditions in the country that were dominant during the last three decades negatively affected these projects, so most of them were completely destroyed.

Since few years, some cities and towns started doing shelterbelts by planting a number of tree rows around them, Holy Najaf and Karbala were the pioneers in this field. These two cities are lying on Al- Najaf plateau; a part from western plateau which is an extension to the dessert of Arab Peninsula. It takes triangle shape with Karbala and Al- Razzaza lake represent its northern heads, while on southern end lies Al- Najaf city (Al- Abbasi, 2013). The whole area of Karbala-Najaf plateau is about 3000 Km2, Najaf governorate possesses 1750 Km2 of it with maximum elevation of (176 m) above sea level (Ali and Alwan, 2013). Dominant climate is that of semi dry regions with almost sand soil which can be satisfied requirements of colored glass industry (Al-Ajeel *et al*, 2010).

Main species in the shelterbelt is *Eucalyptus camaldulensis* Dehnh. which comprises about 90% from the hole project till now. It is perennial, single-stemmed, large-boled and medium-sized to tall tree to 30 m high (Bren and Gibbs, 1986). It exhibits considerable morphological variation throughout its range, and consequently a number of infra-specific taxa have been described (CSIRO, 2004, Brooker, *et al*. 2002). Chemical and genetic variation has also been recorded in *E. camaldulensis* (Doran and Brophy, 1990; Stone and Bacon, 1994; Butcher *et al*., 2002). The variation in trees of studied area could not be considered as hybrid or a clonal variation since they belonged to the same species, and not propagated vegetative. Such individuals with minor form variation within the same species could be regarded as forms. McComb, 2007 differentiated a group of *E. camaldulensis* individuals by a specific number referred to a certain form. These variations were the subject of study, so, in addition to growth investigation of *Casuarina equisetifolia* L. and *Olea europaea* L., aim of study was to explore the most suitable form of *E. camaldulensis* to the local environmental conditions in order to be selected and propagated for further planting processes in the region.

MATERIALS AND METHODS

Shelterbelt of Holy Najaf city is a planting project extending to a distance of 14 km length in northern margin of the city. It is divided in to seven stages; 2 km for each, characterized by the presence of 30 rows of *E. camaldulensis* and two rows of *C. equisetifolia* planted at the northern edge of the belt opposite to prevailing wind direction, and two other rows of *O. europaea* in midway from the two edges. Project has been started at 2007, using ground water by drip irrigation with spacing of 2 x 4 meters.

Selected trees in shelter belt were subjected to study since 2009. There were 4 forms that could be distinguished and recognized according to phenotype (Alkinany, *et al*., 2010). This research is dealing with variations in growth and other changes in shelterbelt composition after five years from first study. The effects of species, form, and location on growth parameters were investigated. Five trees from each form of *E. camaldulensis* were marked in each location. Three locations different in distance from water source (100, 200, and 300 m) were inspected. Trees were measured for height, stem diameter, crown diameter, main stem height, and girth diameter. Height was measured by long wooden measure stick, diameter by caliper; main stem height, stem girth, and crown diameter were measured by measuring tape. Average of two perpendicular measures were taken for each of stem and crown diameters. Difference between the three species has discussed without statistical analysis because it has no mean since variations were too large and incomparable. Analysis was performed on forms *E. camaldulensis* where data were analyzed statically using factorial CRD design for testing

two factors; first *E. camaldulensis* forms (4 levels), and second the location (3 levels) with four replications for each treatment combination. Duncan multiple range test was applied for test differences between variables.

RESULTS AND DISCUSSION

After five years from first investigation of Al-Najaf shelterbelt status, it was easily observed that significant variations occurred between species. *C. equisetifolia* which comprised two rows facing to wind direction were the worst. Although some of trees of the species were died at 2009, others could not resist during last five years. Survived plants were scattered, weak, and small-sized plants. In some visits, it was noticed that crawling sand raised and covered high part of plant stems especially after days of strong northern wind blowing, the reason that forced project managers to do frequent removal processes of deposited sand. In case of *O. europaea* trees were healthy, dense-branched, with height range of 230-280 cm and crown diameter range of 175-185 cm. Position of *O. europaea* lines is not optimum for wind breaking since there are many lines of larger *E. camaldulensis* trees before them in opposite to wind stream. Certainly, they can enhance opportunities of project success by offering additional income through fruit and seed production.

In general, mean of *E. camaldulensis* forms showed no significant differences in growth traits after seven years of development (Tab. 1). In previous investigations at 2009, Al-Kinany, *et al*., 2010 observed some distinct variations between tree forms; it seemed that after five years of additional growth these variations were declined. Interaction between form and tree location has occurred. In location (A), Form II showed superiority in tree height upon others, i.e. when availability of water is there, this form could doing best. In contrast, trees of

Table 1: Differences in tree height and stem diameter of *E. camaldulensis* trees according to form and distance from water source.

	Location	Tree Form				Mean
		I	II	III	IV	
Height of Tree (m)	A	7.84(ab)	8.03(a)	5.90(b)	7.32(ab)	7.18(a)
	B	7.43(ab)	6.83(ab)	7.73(ab)	7.17(ab)	7.29(a)
	C	6.25(ab)	5.70(b)	7.03(ab)	6.10(ab)	6.27(b)
	Mean	7.06(a)	6.86(a)	6.89(a)	6.85(a)	6.91
Stem Diameter (cm)	A	9.55(abc)	11.72(a)	7.52(bcd)	9.60(abc)	9.59(a)
	B	10.37(ab)	8.35(bcd)	7.63(abc)	8.08(bcd)	8.61(a)
	C	6.17(d)	6.95(cd)	7.65(bcd)	7.43(bcd)	7.05(b)
	Mean	8.69(a)	9.00(a)	7.60(b)	8.37(ab)	8.42

Note: Mean values having same letter are not different significantly at P≥ 0.05.

form III in same location (A) had lowest height despite water availability. Similar trend was found in stem diameter, form II in location (A) resulted in 55% higher diameter than form III, but when taken as a mean of the three locations the difference between two forms was about

18%. These two interactions (A × II), and (A × III) were distinctive in main stem height, crown diameter, and stem girth, too (Tab 2, 3). The first produced trees with 2.10 m main stem, 4.22 m crown diameter, and 35.7 cm of stem girth. In contrast, the second interaction (A × III) resulted in 1.52 m, 2.91 m and 24.7 cm for main stem, crown diameter and girth of stem, respectively.

The most significant factor was the distance from water source. First two locations (A and B) revealed comparable results. They both significantly differed from the faraway location (C) which produced shorter and thinner trees comparing with first two. Height of tree, stem diameter, crown diameter, and stem girth at location (C) were lower than that of location (A) by 15%, 36%, 34%, and 32% and that of location (B) by 16%, 22%, 22%, and 29%, respectively.

Table 2: Differences in main stem height and crown diameter of E. camaldulensis trees according to form and distance from water source.

	Location	Tree Form				Mean
		I	II	III	IV	
Main stem height (m)	A	1.81(ab)	2.10(ab)	1.52(ab)	1.87(ab)	1.82(a)
	B	1.42(b)	1.58(ab)	1.62(ab)	1.70(ab)	1.57(a)
	C	1.66(ab)	2.23(a)	1.70(ab)	1.47(ab)	1.76(a)
	Mean	1.63(b)	1.97(a)	1.61(b)	1.68(b)	1.72
Crown Diameter (m)	A	3.59(b)	4.22(a)	2.91(bc)	3.88(a)	3.65(a)
	B	3.69(ab)	2.65(bc)	3.68(ab)	3.28(abc)	3.33(a)
	C	2.59(bc)	2.38(c)	3.16(abc)	2.78(bc)	2.72(b)
	Mean	3.29(a)	3.08(a)	3.27(a)	3.32(a)	3.23

Note: Mean values having same letter are not different significantly at P≥ 0.05.

Height of main stem did not show significant differences between the three locations. Field notifications referred that moist areas around trees were smaller in location (C) i.e. less amount of water. Depression in water pressure with distance normally shortened the share of plant from irrigation water.

Table 3: Differences in stem girth diameter of *E. camaldulensis* trees according to form and distance from water source.

	Location	Tree Form				Mean
		I	II	III	IV	
Stem Girth Diameter (cm)	A	30.33(a)	35.67(a)	24.67(bc)	31.33(abc)	30.50(a)
	B	34.67(ab)	26.33(abc)	31.67(ab)	27.33(abc)	30.00(a)
	C	20.67(c)	22.33(c)	25.00(abc)	24.66(bc)	23.16(b)
	Mean	28.56(a)	28.11(a)	27.11(a)	27.78(a)	27.89

Note: Mean values having same letter are not different significantly at P≥ 0.05.

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مدى ملائمة أشجار الأوكالبتوس camal / dulensis، كاسوارينا equisetifolia وأوليا europaea في الحزام مدينة النجف الاشرف

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الخلاصة

أجري البحث على الحزام الاخضر لمدينة النجف الاشرف لدراسة ملائمة أربعة أشكال (Forms) من اليوكالبتوس .Eucalyptus camaldulensis Dehnh مع نوعين اخرين هما الكازورينا Casuarina equisetifolia L. والزيتون Olea europaea L. للظروف القاسية السائدة في المنطقة. تم قياس التطور الحاصل في نمو الاشجار من حيث ارتفاع الشجرة ، قطر الساق (DBH) ، طول الساق الرئيسي، محيط الساق وقطر التاج خلال فترة خمس سنوات من بعد دراسة سابقة أجريت على الموقع. كما تم البحث في تاثير بعد الشجرة عن مصدر المياه على نموها . اظهرت النتائج تفوق اليوكالبتوس على النوعين الآخرين وظهر التأثير الكبير على اشجار الكازورينا المواجهة للريح السائدة التي أدت أحيانا الى تغطية اجزاء النبات بالرمال فكانت نسبة النجاة فيها أقل من النوعين الآخرين. لم يعط الزيتون نموا وحجما بؤهله للاستخدام في هذا المجال اذا ما اغفلنا الجانب الانتاجي المتمثل بدعم المشروع اقتصاديا من خلال انتاج ثمار الزيتون.

بينت النتائج ان التباينات في النمو بين أشكال اليوكالبتوس التي ظهرت قبل خمس سنوات قد انخفضت بحيث تقاربت بيانات النمو من بعضها مع تميز ملحوظ للشكل رقم II من ناحية طول الشجرة وقطرها في حين أعطى الشكل رقم III أقل القيم من حيث معدلات النمو ولم تظهر اشكال اليوكالبتوس الاخرى فروقا معنوية. التأثير المعنوي الواضح كان لبعد الشجرة عن مصدر المياه حيث كانت بيانات النمو للاشجار البعيدة (٣٠٠ م) أقل من نظيراتها للاشجار متوسطة البعد والقريبة من المصدر ربما بسبب كفاءة نظام الري بالتنقيط المستخدم في المشروع.