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One-year Field Performance of Some *Acacia* and *Prosopis* Species in Saudi Arabia

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Abstract: The present study is devoted to the assessment of field growth of eleven *Acacia* and three *Prosopis* species in central Saudi Arabia. Stem diameters, tree heights and crown diameters were measured. According to the measurable data obtained, growth pattern was significantly different, in spite of the same circumstances. *A. ampliceps* has shown the best performance as far as all studied parameters. While *A. nilotica*, *A. seyal* and *A. salicina* share the second best result. Other studied species of *Acacia* and *Prosopis* are of moderate or sluggish growth, reflected in the small values of measured parameters. Accordingly, the first three species are recommended for plantations in Saudi Arabia for environmental purposes and other benefits. It seems that other species are not promising under these conditions.

Key words: *Acacia*, *Prosopis*, sapling growth, microclimate

INTRODUCTION

Acacia and *Prosopis* are wide-spread genera that belong to *Mimiosoideae* subfamily of *Leguminosae* (El Amin, 1990). Due to their wide distribution in the arid lands and their many uses that include fodder and fuel besides the environmental values of soil fixation and soil fertility, they form two of the most important genera in these regions including Saudi Arabia (Thirakul, 1984; Collenette, 1985; Elkhalifa, 1996). *Acacia* and *Prosopis* species are found throughout the world, however most of the species cultivated in Saudi Arabia are native and some come from nearby countries such as Sudan or come from India, Australia and South America. There are many diverse forms within the genera. These range from large trees to prostrate shrubs. Many of these plants in cultivation are noted for their adaptability and cultural tolerance (Chaudhary, 1983). In general, such species are well adapted to hot climates and a wide range of soil types and annual rainfall (150-1200 mm). They are often described as hardy because they can tolerate droughts and waterlogging, low nutrient soils and highly saline or alkaline soils (ADEH, 2003).

However, few works had been carried on their silviculture, particularly in Saudi Arabia. Some efforts have been done on such species, for example Al-Zoght and Tag Eldin (1995). This study is a comparative study investigating the early field growth performance for some indigenous or exotic species of the two genera. The specific objective set to achieve this aim is to check measurable morphological data of stem diameter, height and crown width for eleven *Acacia* and *Prosopis* species after one year of field growth.

MATERIALS AND METHODS

Acacia and *Prosopis* seeds were prepared from the seed collection at the forestry laboratory, College of Agriculture, King Saud University. Seeds of eleven Acacias and three *Prosopis* species were prepared for the experiment. The Acacias were, *Acacia nilotica* subsp. *tomentosa* (L.) Willd. ex Del., *A. seyal* var. *seyal* Del., *A. gerrardii* var. *najdensis* Zoh., *A. tortilis* (Forsk.) Hayne var. *spirocarpa*, *A. etbaica* as indigenous species, while *A. amplicips*, Maslin, *A. farnesiana* (L.) Willd., *A. salicina* Maslin, *A. iteaphylla*, F. Muellex Benth, *A. victoriae* Benth and *A. karoo* Hayne as exotix ones. The *Prosopis* species were *Prosopis alba* Griss, *P. glandulosa* Torr. and *P. specigera* Linn.

The experiment was carried out at Deirab, 35 km southwest of Riyadh, Saudi Arabia, where the Research and Agricultural experiments Station of the King Saud University is located. This site, in general, is of an average temperature ranging from 10°C during winter to 40°C during summer. The average of annual precipitation is very low and most of it fall throughout winter. The microclimate of this year (October 2004-October 2005) was worked out and illustrated in Fig. 1. Its soil is sandy clay loam with average contents of 61.23 and 15% of sand, silt and clay, respectively (Al-Mefarrej, 2001).

On October 2004, Seedlings were planted in the field with tendency. After one year, the parameters of stem diameter (cm), height (cm) and crowns' diameter (cm) were measured for all saplings. The experiment was designed as a randomized block design (fourteen species×five replicates) for each studied parameter. The obtained data

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were checked according to sound statistical analysis where LSD test was used to explore the comparisons of the treatments' means.

RESULTS

Results showed that the analyses of variances express highly significant differences amongst stem diameters, heights and crown diameters of both *Acacia* and *Prosopis* species ($p<0.01$). Results of the undertaken experiment are presented in Fig. 2-4 as means for stem diameters, tree heights and crown diameters, respectively, whereas, means' separation is manifested in Table 1.

The exotic species *Acacia ampliceps* resulted in the best growth throughout the course of the experiment. It gave the largest stem mean diameter (13.8 cm) mean height (298 cm) and crown diameter (303 cm), which are significantly better than those of all other studied species (Table 1). Thus, it surpassed all the indigenous and the other exotic *Acacia* species under study.

Acacia salicina is the second best as far as stem diameter is concerned (Fig. 1). However, it is of height and crown diameter similar to that of *Acacia seyal* and *Acacia nilotica* which are the best of the indigenous species (Fig. 2 and 3). These three species are not significantly different in their heights and quite close to each other in crown diameters (Table 1). Other Acacias are either of fair growth (*Iteaphylla*, *Farnesiana* and *Gerrardii*) or sluggish (*Etbaica*, *Victoriae*, *Karoo* and *Tortilis*), especially in heights and crown diameters.

As far as *Prosopis* growth is concerned, significant differences were also detected among the three species studied. *Prosopis alba* showed the best growth concerning all parameters measured, followed by *Prosopis glandulosa* and then *P. specigera* (Fig. 1-3). Mean stem diameter, height and crown diameter of the former two species are significantly better than the third one, but they are not significantly different from each other (Table 1).

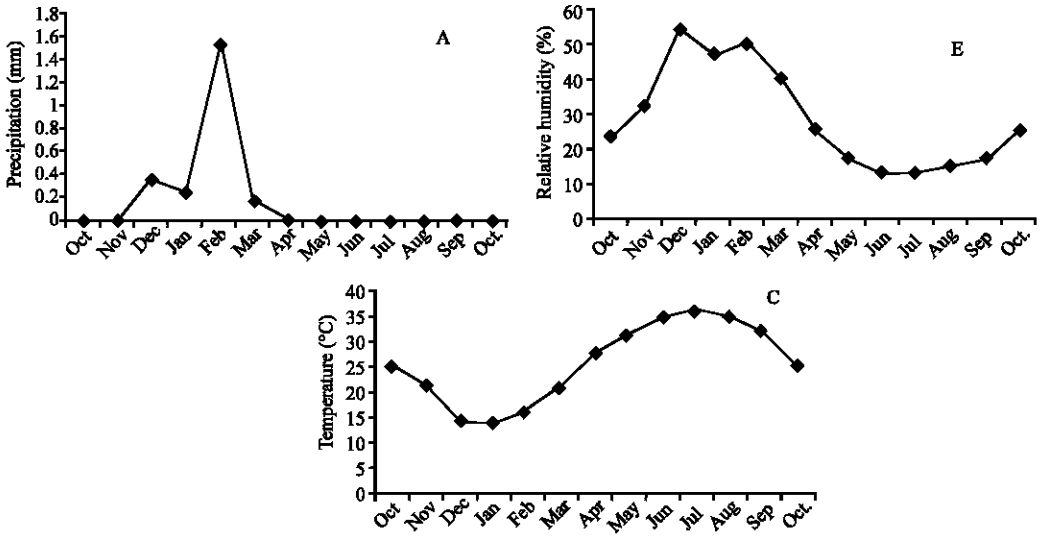

Fig. 1: Average precipitation (A), relative humidity (B) and temperature (C) of the study area during October 2004 to October 2005

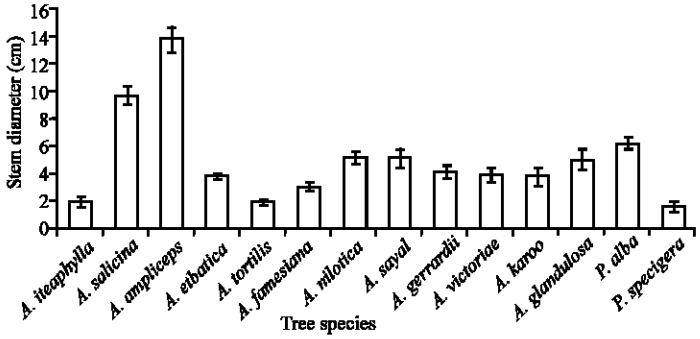

Fig. 2: Mean stem diameters of some *Acacia* and *Prosopis* species after one year growth

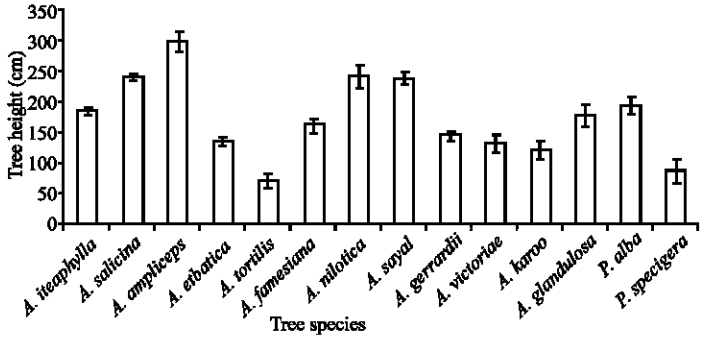

Fig. 3: Mean heights of some *Acacia* and *Prosopis* species after one year growth

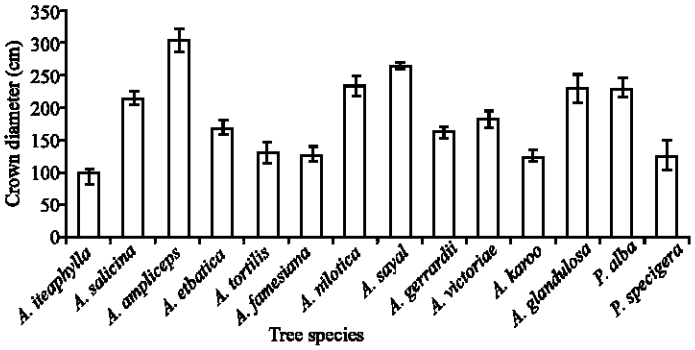

Fig. 4: Mean crown diameters of some *Acacia* and *Prosopis* species after one year growth

Table 1: Comparisons of the mean stem diameters, heights and crown diameters of the *Acacia* and *Prosopis* species after one year growth

Species	Stem diameter (cm)	Species	Height (cm)	Species	Crown width (cm)
A. ampliceps	13.8a	*A. ampliceps*	298a	*A. ampliceps*	303a
A. salicina	9.68b	*A. nilotica*	242b	*A. nilotica*	264bc
A. nilotica	5.14c	*A. salicina*	240b	*A. salicina*	234cd
A. seyal	5.14c	*A. seyal*	238b	*A. seyal*	214d
A. gerrardii	4.1c	*A. iteaphylla*	186c	*A. iteaphylla*	182de
A. victoriae	3.9cd	*A. farnesiana*	160cd	*A. farnesiana*	167.5e
A. etbaica	3.73cd	*A. gerrardii*	144cde	*A. gerrardii*	161ef
A. karoo	3.7cd	*A. etbaica*	135de	*A. etbaica*	131f
A. farnesiana	3cd	*A. victoriae*	130de	*A. victoriae*	127fg
A. iteaphylla	1.92d	*A. karoo*	120de	*A. karoo*	125fg
A. tortilis	1.78d	*A. tortilis*	70f	*A. tortilis*	94g
P. alba	6.2a	*P. alba*	193a	*P. alba*	230a
P. glandulosa	5a	*P. glandulosa*	178a	*P. glandulosa*	229a
P. specigera	1.64b	*P. specigera*	87b	*P. specigera*	125b

Means of the same small letter(s) at the same column are not significantly different (p = 0.05)

DISCUSSION

Due to the importance of the *Acacia* and *Prosopis* species in the arid regions' vegetation and the scanty published information on their seedlings and saplings' growth, the present work has been carried out to compare the growth of eleven Acacias and three *Prosopis* species that exist in central Saudi Arabia. This is of paramount importance in regeneration and conservation projects and to build up information of silvicultural interest. Such work was not preceded in the Saudi Arabia and might facilitate tree selection in the region and also help assess timber growth.

The present work could be looked at as a quantitative proof that adds to and elaborates on that of Al-Zoght (1990), Al-Zoght and Tag Eldin (1995) which were qualitative ones observing the adaptability of some Prosopis and Acacia species, respectively to Riyadh area.

It also confirms some works in neighboring countries e.g., the efforts of Foget (1995) and Ahmed (2000) in the Sudan.

Acacia ampliceps showed the best performance in this first year of growth, this is in agreement with Doran and Turnbull (1997) on their work on *Acacia ampliceps* that rated best at saline site in Pakistan as it exhibited 96% survival with good growth habit and form.

The superiority of the growth of *Acacia ampliceps* compared to all other Acacias studied might be related to its genetical tolerance to the hard environment conditions and the large-sized leaves of this unspiny Acacia. The largest crown diameter, in particular, might be attributed to the mode of growth of this species in an umbrella form, while most of the acacias studied have an upright growth habit.

Acacia salicina, Acacia seyal and *Acacia nilotica* showed best second results, compared to all other species studied. Similar growth is also attained by *Prosopis alba* and *Prosopis glandulosa*. Thus, these *Acacia* and *Prosopis* species which grow well in central Saudi Arabia despite the harsh environment, reflected in Fig. 1, are recommended together with the above *Acacia ampliceps* for afforestation projects that aim at fodder, fuel, wood production or harbour honey bees as well as for environmental purposes.

The present results confirm that of Altaf and Gul (1991) which recommended local tree species including *Acacia nilotica* and some exotics such as *Acacia ampliceps* for planting under saline and sodic conditions provided the soil is properly worked and weed competition is decreased.

Acacia ampliceps and *Acacia salicina* might also be considered as promising timber species as they gave high stem mean diameter in one year of growth, this needs more confirmation by following their growth during the coming few years. The other *Acacia* and *Prosopis* species showed sluggish growth at this first year of growth and not really recommended.

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