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Comparative Evaluation of Date Palm Types (*Phoenix dactylifera* L.) under the Conditions of the Northern State, Sudan

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Abstract: This study was accomplished to assess the comparative performance of the dry, semi-dry and soft date palm types under the conditions of the Northern State, Sudan. Four date representative cultivars, grown in Elghaba Agricultural Scheme, were compared;.their age ranged between 30 and 34 years. The cultivars were Barakawi and Gondaila (dry), Wadkhteeb (semi-dry) and Madina (soft). Data recorded for vegetative growth parameters were stem circumference, leaf number and length, number of pinnae/leaf, length of pinnae, number of thorns/leaf and width of leaf base. Data were also collected for number of bunches, bunch weight and yield/palm. The results indicated significant differences between the four cultivars. Wadkhteeb excelled the other cultivars in number of leaves, bunch weight and yield/palm, without being affected by the phenomenon of alternate bearing. The superiority of Wadkhteeb in yield is indicative of the suitability of the semi-dry cultivars to the conditions of the Northern State.

Key words*:* Date palm; cultivars; adaptation; vegetative growth; yield

INTRODUCTION

The date palm (*Phoenix dactylifera* L.), a member of family Arecaceae, had been cultivated in northern Sudan since ancient times. Date palms are renowned for tolerance of xerophytic conditions. Numerous dry cultivars, in large populations, prevail in the Northern State. Due to the low moisture content, dry dates can be kept for a whole year, without loss of quality and are easy to store and transport under ambient conditions (Daoud and Ahmed 2006). Dry cultivars dominate the overall economic yield of dates in Sudan (Dirar 2003). Few semi-dry and soft cultivars are

grown, in limited populations, for family consumption. Most of Sudanese dry date cultivars are of inferior quality than the soft and semi-dry date cultivars in major date-producing countries. Accordingly, frequent proposals for shift from dry to soft and semi-dry cultivars had been made (Osman 2003), but date growers were not responsive due to shortages in supporting post harvest infrastructures necessary for efficient storage and transport.

In recent years, improvements in electricity supply, which is a necessity for refrigerated storage, coupled with the build-up of an efficient trans-country network of roads, revived the call for replacement of dry Sudanese cultivars by introductions of tissue cultured soft and semi-dry cultivars from neighbouring countries. Adoption of micro-propagation of date palm guarantees safe interchange of disease free desired clones between countries. However, comparative evaluation studies of the different types of date palms are meager under the conditions of Sudan. Such studies are necessary to support introduction decision-making process. Hence, the objective of this study was to compare the performance of dry, semi-dry and soft date palm cultivars under the conditions of the Northern State.

MATERIALS AND METHODS

The Northern State is located between latitudes 16˚ and 22˚N and longitudes 20˚ and 32˚E. It is characterized by a continental climate and arid conditions with annual rainfall below 100 mm. The maximum summer temperature is 45° and the minimum is 30°C, while the minimum winter temperature may fall to around 5°C.

This study was conducted in Elghaba Agricultural Scheme during two successive seasons (2006/07 and 2007/08). The overall performance of 30-34 years old fruiting date palms of four cultivars; namely, Barakawi and Gondaila (dry), Wadkhteeb (semi-dry) and Madina (soft type), was compared. The comparison was based on the complete randomized design. The replicates were five, and two trees of each cultivar were considered a replicate. Data of vegetative growth characters were collected in the first season on stem circumference, number of leaves/palm, leaf length, number of pinnae/leaf, length of pinnae, and

number of thorns/leaf, whereas data on some reproductive parameters, namely, number of bunches/palm, bunch weight and total yield/ palm were recorded for two seasons. The data were subjected to analysis of variance, and means were separated by Duncan's multiple range test at 95% confidence limit.

RESULTS

The four cultivars differed in their growth habit. The soft cultivar (Madina) possessed a significantly bigger stem circumference than the semi-dry (Wadkhateeb) and dry (Gondaila and Barakawi) cultivars, which were almost similar for this parameter (Table 1). The number of leaves was significantly higher in Wadkhteeb (Table 1) and the least number was recorded in Gondaila, whereas Barakawi and Madina shared an intermediate position. Madina and Gondaila were not significantly different in leaf length and had significantly higher number than Barakawi. The width of leaf base of Madina cultivar was significantly higher than that of the other cultivars which were not significantly different from each other.

Table 1. Means of circumference, number of leaves/palm, leaf length and width of leaf base of four date palm cultivars

Cultivar	Circumference (cm)	No. of leaves/palm	Leaf length (cm)	Width of leaf base (cm)
Wadkhteeb	170.7^{b}	115.7^{a}	350.3^{ab}	19.2^{b}
Madina	220.7^{a}	70.70^{c}	383.9^{a}	28.9^{a}
Gondaila	169.0^{b}	64.86^{c}	370.0^{a}	16.2^{b}
Barakawi	168.0^{b}	82.52^{b}	326.5^{b}	16.2^{b}

Means within a column with the same letter(s) are not significantly different at P=0.5.

The number of pinnae/leaf of Madina and Wadkhteeb was almost similar and significantly higher than the numbers recorded for Gondaila and Barakawi (Table 2). Wadkhteeb and Madina also had significantly longer pinnae than the other two cultivars; the shortest pinnae were recorded for

the Barakawi cultivar. The number of thorns/leaf was significantly higher in Gondaila, intermediate in Barakawi and Wadkhteeb, and significantly least in Madina.

Table 2. Means of number of pinnae/leaf, length of pinnae and number of thorns/leaf of four date palm cultivars

Cultivar	No. of pinnae/leaf	Length of pinnae (cm)	No. of thorns/leaf
Wadkhteeb	185.0[a]	52.30[a]	24.60[b]
Madina	186.0[a]	51.04[ab]	20.45[c]
Gondaila	172.1[b]	49.55[b]	29.65[a]
Barakawi	170.1[b]	46.75[c]	25.20[b]

Means within a column with the same letter(s) are not significantly different at P=0.5.

There was no significant difference in the number of bunches/palm between the four cultivars in the first season (Table 3). However, in the second season, Gondaila and Barakawi produced significantly smaller number of bunches than Wadkhteeb and Madina.

With regard to bunch weight, Wadkhteeb recorded significantly the highest mean in both seasons. In the first season, Gondaila ranked second, while Barakawi and Madina ranked third. However, in the second season, Madina was the second and Gondaila shared the bottom rank with Barakawi (Table 3).

Wadkhteeb was the best yielder in both seasons compared with the other cultivars (Figure 1). In the first season, Gondaila ranked second, while Madina and Barakawi were the least yielders. In the second season, Madina ranked second and the productivity of Gondaila dropped significantly, even below Barakawi.

Table 3. Mean number of bunches/palm and weight of bunch of four date palm cultivars

Cultivar	No. of bunches/palm		Bunch weight (kg)	
	Season 1	Season 2	Season 1	Season 2
Wadkhteeb	12.34[a]	11.44[a]	16.27[a]	20.40[a]
Madina	11.70[a]	11.54[a]	06.87[c]	11.40[b]
Gondaila	14.80[a]	08.08[b]	12.53[b]	04.48[c]
Barakawi	11.78[a]	09.58[b]	07.70[c]	05.64[c]

Means within a column with the same letter are not significantly different at P=0.5.

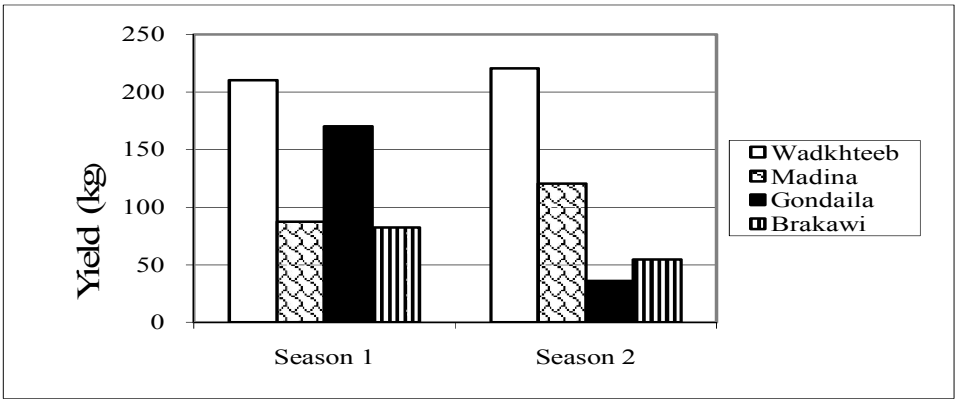

Figure 1. Mean yield of four date palm cultivars in two successive seasons (2006/07 and 2007/08)

DISCUSSION

The genetic makeup of cultivars within the same species affects plant morphology, adaptation to the agro-climatic conditions, yield and yield components. According to Soliman (2006), the behaviour of date palm cultivars is influenced by the environmental conditions. Several investigators have evaluated date palm cultivars to determine their suitability for certain locations (Osman 1984; Nour *et al.* 1986; Hussein

et al. 2001; Soliman 2006). The overall analysis of morphological and yield parameters, in this study, revealed differences between cultivars. This result is in line with the findings of the study conducted by Hammadi *et al.* (2009) who reported cultivars identification based on morphological traits. Similar suggestion was also advanced by Rizk *et al.* (2003). The dry date palm cultivars (Gondaila and Barakawi) are thought to have originated in the Northern State (Osman 2003), while Wadkhteeb and Madina are exotic.

The soft cultivar (Madina) scored the highest values for stem circumference, leaf length, width of leaf base and number of pinnae/leaf, and there seems to be a correlation between stem circumference and the width of leaf base. However, it had the least number of thorns/leaf. Few thorns with dense foliage characters do not favour adaptation to the hot dry environment of the Northern State. The endogenous dry date cultivars recorded the highest number of thorns/leaf and low vegetative biomass which can be explained as adaptations to the prevailing hot dry conditions of the State. It had been reported that date palm cultivars possess specific morphological and physiological traits to counteract water deficit (Elshibli 2009). As Wadkhateeb ranked intermediate for the measured vegetative characters, this can be considered an indication of intermediate adaptation to the xerophytic conditions of the Northern State.

Under the conditions of Alghaba Scheme, which is an exception, adequate regular irrigation is practiced the year-round. Besides, the large population of palms and other cultivated crops constitute a micro-environment within the overall dry desert conditions of the State. Therefore, date palms are not subjected to drought stress in the study area. Nevertheless, the endogenous dry cultivars exhibited their drought resistance traits of reduced thorny foliage. However, high leaf number in soft and semi-dry cultivars had been reported by Howijem (2003). Moreover, variations in morphological characters of date palm cultivars, whether within or between dates groups, were also reported (Alsaeed *et al.* 1986; Nour *et al.* 1986). The high bunch weight of Wadkhteeb may be due to the high ratio of functional leaves to the number of bunches (Daoud and Hussein 2003).

Regarding the alternate bearing phenomenon, differences were detected among cultivars in the two successive seasons. Yield fluctuation was pronounced in Gondaila and, to a lesser extent, in Barakawi and Madina, whereas stable yield in the two seasons was recorded for the semi-dry cultivar Wadkhteeb. Yield stability is an important selection trait in date palm breeding. In conclusion, satisfactory vegetative growth in the semi-dry date cultivar, coupled with high stable yields compared with other cultivars, indicates that the semi-dry dates may be candidates for future expansion. Yet, further comparative quality, post harvest handling and marketing studies are needed for comprehensive assessment.

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مجلة جامعة الخرطوم للعلوم الزراعية : المجلد العشرين – العدد الاول ، 2012م

تقييم مقارن لطرز نخيل التمر تحت ظروف الولاية الشمالية بالسودان

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المستخلص: أجريت هذه الدراسة بغرض تقييم الأداء المقارن لطرز نخيل التمر الجافة وشبه الجافة والرطبة تحت ظروف الولاية الشمالية بالسودان. أجريت المقارنة لأربعة أصناف ممثلة لطرز مزروعة فى مشروع الغابة الزراعى، تراوحت أعمارها بين 30 و34 سنة. الأصناف المقارنة هى البركاوى والقنديله (جافة)، ودخطيب (شبه جاف) ومدينه (رطبة). سجلت بيانات عن النمو الخضرى شملت محيط الساق وعدد وطول الأوراق وعدد الخوص فى الورقة وطول الخوص وعدد الأشواك فى الورقة وعرض قاعدة الورقة. كما جمعت بيانات عن عدد السبائط ووزن السبيطة وانتاجية النخلة. أوضحت النتائج وجود اختلافات معنوية بين الأصناف الأربعة. تفوق الصنف ودخطيب على الأصناف الأخرى فى عدد الأوراق ووزن السبيطة والانتاجية بجانب عدم تأثر هذا الصنف بظاهرة تبادل الحمل. تفوق ودخطيب فى الانتاجية مؤشر لملاءمة الأصناف شبه الجافة لظروف الولاية الشمالية.

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