

## Comparison Study on Barhee Cultivar and Two Strains of Barhee Palm Seedling Trees

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**Abstract:** This study was carried out during two successive seasons 2007 and 2008 at the Experimental Research Station, Fac. Agric. Giza, Egypt. Two strains of Barhee seedling palms were used in this trial compare with Barhee cultivar. Results indicated that morphological characters of date palm Barhee cultivar and the studied strains were similar statistically concerning trunk girth, length of frond base zone and spines number and length. Whereas, strain 2 recorded the highest values of spine zone length of frond and leaflet length. On the other hand, Barhee cultivar and strain 2 produced similar statistically results of frond and leaflet length. On the other hand, the highest leaflet zone of frond was obtained with Barhee cultivar leaves. In addition, there is no significant differences were obtained in strands numbers per inflorescence between Barhee cultivar and the other two palm strains under study. Strain two produced the longest strand followed by Barhee cultivar and strain one. Concerning fruit retained percentage and bunch weight, strain 2 produced the highest values in this regard while Barhee cultivar produced the lowest values in this concern. Also, strain 2 produced the highest weight of fruits, flesh, seed and the percentage of seed/fruit weight; whereas, Barhee cultivar produced the lowest values in this regard. Moreover, fruit length (L), diameter (D), L/D ratio, size and fruit firmness did not differ significantly within Barhee cultivar and the studied strains. Regarding to fruit chemical properties, there is no significant differences were detected between Barhee cultivar and the strains under study concerning fruit moisture, acidity, chlorophyll A and B and carotene. Also, there is no significant differences were found between different sources of Barhee in their fruit contents of TSS in the two seasons. On the other hand, strain two produced the highest total and non-reducing sugars of fruit content comparing with Barhee cultivar and strain one. Whereas, strain one produced the highest fruit content of reducing sugars comparing with fruits of Barhee cultivar and strain two. Sensory evaluation revealed that two strains of seedling Barhee palm that compared during this study with Barhee cultivar were similar in all studied attributes with scoring excellent except fruit chewiness for strain two that achieved very good score.

**Key words:** Barhee · Chemical properties · Date palm · Evaluation · Fruit · Physical properties · Sensory · Strains

### INTRODUCTION

The date palm (*Phoenix dactylifera* L.) is considered to be the most important fruit trees in most of the Arabian countries [1]. Because of genetic differences and variable growth conditions, dates show wide variations in their final appearance and quality. With respect to consumers, important quality criteria are color, size and shape condition and absence of defects) mouth feel or texture, flavor and nutritional value [2, 3]. Morphological studies about different date palm cultivars and strains are still meager [4]. The differences between cultivars or strains of date palm may be due to either cytological differences between them [5] or to the more-genotypes that produced from seeds [6]. Morphological characters for leaves and fruits could be used for identification and description of date palm cultivars. The leaf length, leaf base width,

spines length and width, pinnae width and percentage of pinnae base distance are considered the most important vegetative characters (which represented 28% from the variance between cultivars). Also, spathe, length and weight of spathe, length of strand and mean number of flowers on strand represented about 41% from the variances among cultivars. Fruits properties such as, fruit weight, length, size, color and contents of TSS, total sugars, tannins and fiber of fruit represented 31% from variances [3, 5-15]. In addition, Mohamed [13] concluded that the physical and chemical characteristics of date palm fruits depending upon cultivars and environmental conditions.

This study was carried out to compare the relationship between Barhee cultivar and those palm strains which developed from Barhee seeds. Also, to evaluate the yield, physical and chemical

characteristics of the two strains fruits in relation to Barhee cultivar.

### MATERIALS AND METHODS

This study was carried out during two successive seasons (2007 and 2008) at the Experimental Research Station, Faculty of Agriculture, Cairo University, Giza, Egypt. Two strains of Barhee seedling palms were used in this trial comparing with vegetative Barhee cultivar. Strains palm are grown into two groups. All palms in each group and Barhee cultivar received the normal agricultural practice. In this study, the groups were numbered as a strain one and two. Three palms of each strain and Barhee cultivar under investigation were productive, aged about 17 years and were pruned at 8:1 leaf / bunch ratio [16]. The mature male spathes were collected from the selected male date palm and dried at room temperature for 24 hour to reduce the humidity within the individual strands which 10 of them were used for hand pollination of one female inflorescence at 4 days after spathe cracking in the 4<sup>th</sup> week of March in both seasons. Three female palm trees of each strain and Barhee cultivar were used in this work. Each palm was treated as a one replicate. Twelve bunches were left on each female palm in both seasons.

The obtained data were subjected to analysis of variance. The mean values were compared using LSD method at 5% level. The data were tabulated and statistically analyzed according to one way analysis method [17]. The percentages were transformed to the arcsine to find the binomial percentages [18].

The fruit yield of this experiment was harvested at maturity stage 15/9/2007 and 20/9/2008 [19].

#### The Following Data Were Recorded:

- Palm trunk girth was measured at 2.0 m from aerial fibrous roots.
- Lengths of frond, zone of frond base, pinnae zone, spine zone, leaflet and spine were measured. Also, leaflet width and spines numbers were estimated of mature leaves.

- Strand length and numbers were also determined.
- Fruit retained percentage was calculated at harvest using this equation:

$$\text{Fruit retained} = \frac{\text{Total number of retained fruits per bunch}}{\text{Total scores number per bunch}} \times 100$$

- Bunch weight was estimated as Kg.
- Fruit physical properties: Samples each of 50 fruits were taken from each replicate randomly to determine fruit weight (g), flesh weight (g), seed weight (g), seed/fruit weight (%), fruit length (cm), fruit diameter (cm), fruit length/diameter (L/D ratio) and fruit size (cm<sup>3</sup>).
- Fruit firmness was tested by using pressure tester apparatus with drill diameter 0.3 cm (Kg/cm<sup>2</sup>) for the individual 15 fruits of each replicate per treatment.
- Fruit moisture content percentage [20].
- Fruit acidity percentage [20].
- Total soluble solids content (TSS) percentage [20].
- Total soluble sugars percentage [21] in the methanol extract using the phenol sulfuric acid method and the concentration was calculated as g /100 g fresh weight.
- Reducing soluble sugars in the methanol extract [20, 22] as g /100 g fresh weight.
- Non-reducing sugars (%) was determined by the difference between total and reducing sugars.
- Fruit chlorophylls A, B and carotene content (%) [23].

**Sensory Analysis:** To evaluate and compare the two strains and Barhee cultivar fruits, a taste panel was conducted using the sensory procedure developed by Ismail *et al.* [3]. Ten adult volunteers with prior experience in sensory testing underwent sensory training to evaluate 10 defined quality attributes of fruits using a simple modifying as follows: (poor, satisfactory, good, very good and excellent) that later was transformed to quantities scores according to scoring guide for date fruits established by Ismail *et al.* [24] as shown in Table 1. Three training sessions were carried out at three different times (4 days apart) to anchor points.

Table 1: Quantitative scoring guide for date fruits

| Attribute           | Poor | Satisfactory | Good | Very good | Excellent |
|---------------------|------|--------------|------|-----------|-----------|
| Color               | 3.4  | 7.0          | 10.0 | 13.5      | 17.0      |
| Appearance          | 3.0  | 6.5          | 9.0  | 13.0      | 15.9      |
| Fruit size          | 2.9  | 5.0          | 8.0  | 9.6       | 11.5      |
| Shear force         | 1.2  | 2.5          | 3.7  | 5.0       | 6.2       |
| Flesh thickness     | 1.4  | 2.8          | 5.0  | 6.6       | 9.0       |
| Mouth feel          | 1.3  | 2.5          | 3.8  | 5.0       | 6.3       |
| Chewiness           | 1.6  | 3.2          | 4.7  | 6.2       | 7.8       |
| Sweetness           | 2.7  | 3.5          | 8.2  | 11.0      | 13.7      |
| Solubility          | 1.4  | 2.8          | 4.2  | 5.6       | 7.0       |
| Pit size            | 1.1  | 2.2          | 3.4  | 4.5       | 5.6       |
| Total quality score | 20   | 40           | 60   | 80        | 100       |

**RESULTS**

**Palm Trunk Girth and Frond Length and Parts:**

Palm trunk girth and frond length and its different parts of Barhee cultivar and strains as recorded during both seasons was cleared in Table 2. The palm trunk girth of Barhee palm cultivar and the studied strains were similar statistically in the two seasons. In addition, strain number one produced the lowest frond length (4.72 m in the 1<sup>st</sup> and 4.76 m in the 2<sup>nd</sup> seasons) that differed significantly with fronds produced by Barhee cultivar (5.28 and 5.31 m in the 1<sup>st</sup> and 2<sup>nd</sup> seasons) and strain number two (5.30 and 5.26 m in the 1<sup>st</sup> and 2<sup>nd</sup> seasons).

Zone of frond base length of Barhee cultivar and strains did not differ significantly during the two seasons. In regard to pinnae zone length, it was differed significantly according to the studied palms during study. Whatever, strain number one developed the shortest pinnae zone length during the two seasons. While Barhee cultivar produced the tallest pinnae zone length comparing with other palm tree in the two seasons.

The length of spine zone of Barhee cultivar and different Barhee strains had differed significantly between them in both seasons. It was clearly noticed that Barhee strain number two had the highest length of spin zone followed by Barhee cultivar and strain number one in the two seasons, respectively.

**Length and Width of Leaflet and Spine Length and Number:**

Table 3 exhibit that length and width of leaflet had significantly affected by different sources of Barhee during both seasons. Whereas, length and numbers of spins did not differ significantly by Barhee source in the two seasons. It was clearly noticed that Barhee strain number two produced the longest leaflet length followed by Barhee cultivar and strain number one in the two seasons. Whereas, strain number one produced the widest leaflet comparing with that produced by Barhee cultivar and strain number two in the two seasons.

Regarding to spine length, leaves of strain number one developed the tallest spins comparing with cultivar and strain two in the two seasons. Whereas, leaves of strain number one contained the lowest number of spins comparing with leaves of Barhee cultivar and strain number two in both seasons.

**Strand Length and Number, Fruit Retained and Bunch Weight:**

Data presented in Table 4 clear that strand length, fruit retained and bunch weight were varied significantly affecting by different sources of Barhee in both seasons.

The results of strand length and number cleared that strain number two produced inflorescences that contained the highest values of them comparing with Barhee cultivar and strain number one in the two seasons.

Table 2: Palm trunk girth and frond length and its different parts of Barhee cultivar and strains (2007 and 2008 seasons)

|             | Trunk girth (m) |        | Frond length (m) |        | frond base length (cm) |        | Pinnae zone length (m) |        | Spine zone length (m) |        |
|-------------|-----------------|--------|------------------|--------|------------------------|--------|------------------------|--------|-----------------------|--------|
|             | Season          | Season | Season           | Season | Season                 | Season | Season                 | Season | Season                | Season |
| Barhee palm | 2007            | 2008   | 2007             | 2008   | 2007                   | 2008   | 2007                   | 2008   | 2007                  | 2008   |
| Cultivar    | 1.56            | 1.56   | 5.28             | 5.31   | 33.7                   | 33.8   | 3.66                   | 3.66   | 1.28                  | 1.31   |
| Strain 1    | 1.56            | 1.56   | 4.72             | 4.76   | 27.0                   | 27.0   | 3.29                   | 3.31   | 1.16                  | 1.18   |
| Strain 2    | 1.57            | 1.57   | 5.30             | 5.26   | 34.6                   | 34.5   | 3.48                   | 3.46   | 1.47                  | 1.45   |
| LSD at 5%   | NS              | NS     | 0.40             | 0.33   | NS                     | NS     | 0.19                   | 0.22   | 0.27                  | 0.15   |

Table 3: Leaflets length and width (cm) and spines numbers and length (cm) of Barhee cultivar and strains (2007 and 2008 seasons)

|             | Leaflet length (cm) |             | Leaflet width (cm) |             | Spine length (cm) |             | Spines number |             |
|-------------|---------------------|-------------|--------------------|-------------|-------------------|-------------|---------------|-------------|
|             | 2007 season         | 2008 season | 2007 season        | 2008 season | 2007 season       | 2008 season | 2007 season   | 2008 season |
| Barhee palm | 2007 season         | 2008 season | 2007 season        | 2008 season | 2007 season       | 2008 season | 2007 season   | 2008 season |
| Cultivar    | 55.2                | 55.2        | 3.6                | 3.7         | 10.9              | 10.9        | 11.33         | 11.33       |
| Strain 1    | 52.7                | 52.7        | 4.0                | 4.0         | 11.1              | 11.1        | 10.67         | 10.67       |
| Strain 2    | 56.7                | 56.7        | 3.5                | 3.6         | 11.0              | 10.9        | 11.33         | 11.33       |
| LSD at 5%   | 1.2                 | 1.2         | 0.3                | 0.2         | NS                | NS          | NS            | NS          |

Table 4: Strands numbers and length (cm), fruit retained (%) and bunch weight (kg) of Barhee cultivar and strains (2007 and 2008 seasons)

|             | Strand number |             | Strand Length (cm) |             | Fruit retained (%) |             | Bunch weight (Kg) |             |
|-------------|---------------|-------------|--------------------|-------------|--------------------|-------------|-------------------|-------------|
|             | 2007 season   | 2008 season | 2007 season        | 2008 season | 2007 season        | 2008 season | 2007 season       | 2008 season |
| Barhee palm | 2007 season   | 2008 season | 2007 season        | 2008 season | 2007 season        | 2008 season | 2007 season       | 2008 season |
| Cultivar    | 86.00         | 86.67       | 42.6               | 42.9        | 25.33              | 25.67       | 8.375             | 9.603       |
| Strain 1    | 88.00         | 88.33       | 40.7               | 41.6        | 25.67              | 27.00       | 7.581             | 8.681       |
| Strain 2    | 88.33         | 89.67       | 44.9               | 45.8        | 26.67              | 27.67       | 8.590             | 9.986       |
| LSD at 5%   | NS            | NS          | 1.4                | 1.5         | 1.09               | 1.53        | 0.402             | 0.389       |

Table 5: Fruit, flesh and seed weights (g) and seed per fruit (%) of Barhee cultivar and strains (2007 and 2008 seasons)

|             | Fruit weight (g) |             | Flesh weight (g) |             | Seed weight (g) |             | Seed / fruit (%) |             |
|-------------|------------------|-------------|------------------|-------------|-----------------|-------------|------------------|-------------|
|             | 2007 season      | 2008 season | 2007 season      | 2008 season | 2007 season     | 2008 season | 2007 season      | 2008 season |
| Barhee palm |                  |             |                  |             |                 |             |                  |             |
| Cultivar    | 15.12            | 15.52       | 13.67            | 14.17       | 1.45            | 1.35        | 9.59             | 8.69        |
| Strain 1    | 15.84            | 16.27       | 14.26            | 14.68       | 1.58            | 1.59        | 10.04            | 9.77        |
| Strain 2    | 17.80            | 18.46       | 15.95            | 16.65       | 1.85            | 1.81        | 10.39            | 10.18       |
| LSD at 5%   | 0.71             | 0.31        | 0.84             | 0.28        | 0.32            | 0.31        | 0.73             | 0.85        |

Table 6: Fruit length, diameter (cm), fruit length/diameter (L/D) ratio and size (cm<sup>3</sup>) of Barhee cultivar and strains (2007 and 2008 seasons)

|             | Fruit length (cm) |             | Fruit diameter (cm) |             | Fruit L/D ratio |             | Fruit size (cm <sup>3</sup> ) |             |
|-------------|-------------------|-------------|---------------------|-------------|-----------------|-------------|-------------------------------|-------------|
|             | 2007 season       | 2008 season | 2007 season         | 2008 season | 2007 season     | 2008 season | 2007 season                   | 2008 season |
| Barhee palm |                   |             |                     |             |                 |             |                               |             |
| Cultivar    | 3.5               | 3.5         | 2.6                 | 2.7         | 1.35            | 1.30        | 15.92                         | 16.12       |
| Strain 1    | 3.5               | 3.6         | 2.7                 | 2.7         | 1.30            | 1.33        | 16.10                         | 16.22       |
| Strain 2    | 3.7               | 3.7         | 2.7                 | 2.8         | 1.37            | 1.32        | 16.40                         | 16.44       |
| LSD at 5%   | NS                | NS          | NS                  | NS          | NS              | NS          | NS                            | NS          |

On the other hand, strain number one developed inflorescences of the shortest strand length in the two seasons. Whatever, there is no significant differences were noticed between Barhee cultivar strands number comparing with that of strains one and two in the two seasons.

Concerning fruit retained percentage, Barhee strain number two produced the highest fruit retained percentage (26.67 and 27.67%) followed by strain number one (25.67 and 27.00%) and Barhee cultivar (25.33 and 25.67%) in the first and second seasons, respectively. In this concern, Barhee cultivar fruit retained percentage significantly differed with those obtained by either strain one or two in the two seasons.

Concerning bunch weight, strain two produced the weightiest bunches (8.590 and 9.986 kg) followed by Barhee cultivar (8.375 and 9.603 kg) and strain one (7.581 and 8.681 kg) in the first season and second seasons, respectively. Moreover, there is no significant differences were observed between bunches weights that produced from Barhee cultivar and strain two in the two seasons.

**Fruit, Flesh and Seed Weights and Seed/fruit Weight Percentage:** Table 5 clear that fruit and flesh weight were varied significantly during the two seasons affecting by different sources of Barhee palms. Strain number two produced the heaviest fruit and flesh weight (17.80 and 15.95 g) followed in descending order by that obtained from strain one (15.84 and 14.26 g) and Barhee cultivar (15.12 and 13.67 g) in the first season. The same trend was also noticed in the second season.

Referring to seed weight as shown in Table 5, Barhee seed was the lightest ones comparing with those recorded with the two strains under study. Whatever, there are no significant differences between Barhee cultivar and strain one in this respect in the two seasons. On the other hand, strain two increased significantly seed weight comparing with Barhee cultivar and strain one in the two seasons.

The percentage of seed/fruit weight (Table 5) had significantly affected by different sources of Barhee palms in the two seasons. Whoever, Barhee cultivar was the lowest one comparing with those produced of strains one and two in the two seasons. On the other hand, strain two produced the highest percentage of seed/fruit weight in both seasons.

**Fruit Length (L), Diameter (D), L/D Ratio and Size:** Fruit length (L), diameter (D), L/D ratio and fruit size were not significantly affected by different sources of Barhee palms during both seasons (Table 6). Whatever, fruits obtained from strain two had the highest values in all fruit dimensions and size followed by strain one and Barhee cultivar in the two seasons, respectively (Figure 1).

**Fruit Firmness and Fruit Contents of Moisture, Acidity and Tss%:** Data presented in Table 7 clear that fruit firmness was not significantly varied according to Barhee sources during study. All fruits of palms under study had the same statistically firmness values. The same results were also noticed regarding to fruit moisture and acidity content in the two seasons.

TSS percentages of fruit content were significantly similar concerning the studied palms during the study. Whatever, strain two produced the highest fruit content of TSS followed by fruits that produced from strain one and Barhee cultivar in the two seasons.



**Fig. 1: Fruits and seeds of Barhee cultivar and strains photos**

**Table 7: Fruit firmness (kg/cm<sup>2</sup>) and fruit content of moisture, acidity and TSS (%) of Barhee cultivar and strains (2007 and 2008 seasons)**

|             | Firmness (kg/cm <sup>2</sup> ) |             | Moisture (%) |             | Acidity (%) |             | TSS (%)     |             |
|-------------|--------------------------------|-------------|--------------|-------------|-------------|-------------|-------------|-------------|
|             | 2007 season                    | 2008 season | 2007 season  | 2008 season | 2007 season | 2008 season | 2007 season | 2008 season |
| Barhee palm |                                |             |              |             |             |             |             |             |
| Cultivar    | 7.50                           | 7.43        | 64.97        | 64.29       | 0.029       | 0.028       | 33.26       | 33.30       |
| Strain 1    | 7.17                           | 7.07        | 64.90        | 64.14       | 0.032       | 0.029       | 33.73       | 33.57       |
| Strain 2    | 7.33                           | 7.40        | 64.40        | 64.03       | 0.027       | 0.026       | 33.90       | 33.67       |
| LSD at 5%   | NS                             | NS          | NS           | NS          | NS          | NS          | NS          | NS          |

**Table 8: Fruit total, reducing and non-reducing sugars content (%) of Barhee cultivar and strains (2007 and 2008 seasons)**

|             | Total sugars (%) |             | Reducing sugars (%) |             | Non-reducing sugars (%) |             |
|-------------|------------------|-------------|---------------------|-------------|-------------------------|-------------|
|             | 2007 season      | 2008 season | 2007 season         | 2008 season | 2007 season             | 2008 season |
| Barhee palm |                  |             |                     |             |                         |             |
| Cultivar    | 27.76            | 27.60       | 20.44               | 21.09       | 7.32                    | 6.51        |
| Strain 1    | 28.29            | 28.17       | 21.62               | 21.48       | 6.67                    | 6.69        |
| Strain 2    | 28.96            | 28.86       | 21.27               | 21.32       | 7.69                    | 7.54        |
| LSD at 5%   | 0.51             | 0.54        | 0.13                | 0.14        | 0.35                    | 0.32        |

**Table 9: Fruit content of chlorophyll A, B and carotene (%) of Barhee cultivar and strains (2007 and 2008 seasons)**

|             | Chlorophyll A (%) |             | Chlorophyll B (%) |             | Carotene (%) |             |
|-------------|-------------------|-------------|-------------------|-------------|--------------|-------------|
|             | 2007 season       | 2008 season | 2007 season       | 2008 season | 2007 season  | 2008 season |
| Barhee palm |                   |             |                   |             |              |             |
| Cultivar    | 0.247             | 0.277       | 0.457             | 0.497       | 4.990        | 4.813       |
| Strain 1    | 0.217             | 0.277       | 0.453             | 0.589       | 5.933        | 5.470       |
| Strain 2    | 0.280             | 0.268       | 0.447             | 0.572       | 5.183        | 5.293       |
| LSD at 5%   | NS                | NS          | NS                | NS          | NS           | NS          |

**Table 10: Sensory attributes of Barhee cultivar and strains fruits as recorded at harvest during 2007 and 2008 seasons**

| Attribute       | Season 2007 |          |          | LSD at 5% | Season 2008 |          |          | LSD at 5% |
|-----------------|-------------|----------|----------|-----------|-------------|----------|----------|-----------|
|                 | Barhee cv.  | Strain 1 | Strain 2 |           | Barhee cv.  | Strain 1 | Strain 2 |           |
| Color           | 16.44       | 16.21    | 17.00    | NS        | 16.50       | 16.65    | 16.91    | NS        |
| Appearance      | 15.33       | 15.31    | 15.29    | NS        | 15.43       | 15.44    | 15.63    | NS        |
| Fruit size      | 11.50       | 11.50    | 11.50    | NS        | 11.48       | 11.48    | 11.50    | NS        |
| Shear force     | 6.13        | 6.10     | 6.18     | NS        | 6.02        | 6.09     | 6.10     | NS        |
| Flesh thickness | 7.89        | 8.13     | 8.72     | 0.42      | 8.11        | 8.22     | 8.81     | 0.43      |
| Mouth feel      | 5.89        | 5.87     | 5.79     | NS        | 5.82        | 5.84     | 5.78     | NS        |
| Chewiness       | 7.62        | 7.63     | 6.18     | 0.53      | 7.53        | 7.60     | 6.05     | 0.55      |
| Sweetness       | 13.00       | 13.25    | 13.56    | 0.48      | 13.00       | 13.10    | 13.60    | 0.52      |
| Solubility      | 6.98        | 6.93     | 6.13     | 0.61      | 6.98        | 6.91     | 6.00     | 0.64      |
| Pit size        | 5.00        | 5.11     | 5.42     | 0.27      | 5.23        | 5.29     | 5.55     | 0.32      |
| Total score     | 95.78       | 96.04    | 95.77    | -         | 96.10       | 96.62    | 95.93    | -         |

**Total, Reducing and Non-reducing Sugars Fruit Content:**

Fruit total, reducing and non-reducing sugars content were affected significantly by different Barhee sources in the two seasons (Table 8). It was clearly noticed that highest fruit total soluble sugars content was recorded with strain two followed by strain one and Barhee cultivar in the two seasons, respectively. Whereas, strain one produced the highest fruit content of reducing sugars followed by strain two and Barhee cultivar in the two seasons. Moreover, the highest fruit non-reducing sugars percentage was obtained from strain number two comparing with other fruits of Barhee cultivar and strain one in the two seasons.

**Fruit Chlorophyll A, B and Carotene Content:** Results of fruit chlorophyll A, B and carotene content, as exhibited in Table 9, cleared that no significant differences were noticed within the studied palm sources in the two seasons. Whatever, strains one and two raised fruit carotene content higher than that detected in Barhee cultivar fruits in the two seasons.

**Sensory Evaluation:** Taste panel scores (Table 10) for each sensory attribute had differed significantly in flesh thickness, chewiness, sweetness, solubility and pit size between fruits of Barhee cultivar and strains in the two seasons. Whereas, color, appearance, fruit size shear force and mouth feel did not differ between fruits of Barhee cultivar and strains in both seasons.

However, all fruits of palms under study recorded the highest score (excellent) in all attributes except in chewiness character which was very good with strain number two in both seasons of study. In addition, fruits from obtained strain one achieved the highest total score during sensory analysis followed by fruits of Barhee cultivar and strain two during the two seasons.

**DISCUSSION**

From the aforementioned results it was clearly noticed that palm morphological characteristics of Barhee cultivar and the two strains under study was varied slightly without significant differences concerning palm trunk girth, length of frond base zone and spines number and length. These results are agree with Mehanna [12] and Mohamed *et al.* [13]. They reported that palm trunk girth was ranged between 1.35 to 1.56 m and spines number per leaf (10 to 16 spines).

Whereas, strain number 2 recorded the highest values of spine zone length and leaflet length. On the other hand, Barhee cultivar and strain number 2 produced similar statistically results of frond length and leaflet length. On the other hand the highest leaflet zone of frond was obtained by Barhee cultivar leaves. These results are in agreement with those obtained by [9, 10, 13, 25, 26]. They reported the great variation was existed between different Iraqi date palm cultivars on bunch weight. Also, Results showed that leaflets length may depend on growing conditions.

In addition, there is no significant differences were obtained in strand numbers per inflorescence between Barhee cultivar and the other two palm strains under study. Strain two produced the longest strand followed by Barhee cultivar and strain one. Concerning fruit retained percentage and bunch weight, strain 2 produced the highest values in this regard while Barhee cultivar produced the lowest values in this concern. Also, strain 2 produced the highest fruit, flesh and seed weights as well as the percentage of seed/fruit weight; whereas, Barhee cultivar produced the lowest values in this regard. Moreover, fruit length, fruit diameter, L/D ratio, fruit size and fruit firmness were statistically similar

between Barhee cultivar and the other strains under study. These findings are in harmony with those obtained by [2, 9, 10, 13, 14, 15, 25, 27].

Regarding to fruit chemical properties, there is no significant differences were detected between Barhee cultivar and other strains under study in their fruit contents of moisture, acidity, chlorophyll A and B and carotene. Also, there is no significant differences were found between different sources of Barhee in their fruit content of TSS. On the other hand, strain two produced the highest fruit total and non-reducing sugars content comparing with strain one and Barhee cultivar. Whereas, strain one produced the highest reducing sugars fruit content comparing with Barhee cultivar and strain two. These results are in agreement with those found by [3, 9, 13, 25-29], who supported the variation in percentages of TSS and total sugars between different date palm cultivars.

In field evaluation experiments in Malaysia, fruiting and yield variation among oil palm plantlets derived from a single clone were found less than from palm of seedling population [7].

Al-Doss *et al.* [6] suggested that variation between the same cultivar of date palm trees may be due to more-genotypes that produced from seeds. Also, the differences between cultivars or strains of date palm may be due to cytological differences between them [5].

In addition, Mohamed *et al.* [13] concluded that the physical and chemical characteristics of date palm fruits depending upon cultivars and environmental conditions.

Sensory analysis revealed that the two strains of seedling Barhee palm that compared during this study with Barhee cultivar were similar in all studied attributes. Despite of presenting significant differences in some sensory attributes (flesh thickness, Chewiness, sweetness, solubility and pit size) studied, nevertheless, the accumulation scoring for all ten attributes studied was excellent except fruit chewiness for strain number two that take very good score [2, 3, 4].

## REFERENCES

1. Mustafa, A.I., A.M. Hamad and M.S. Al-Kahtani, 1983. Date varieties for jam production. In Proc. Of The First Symp. On The Date palm, in Saudi Arabia, King Faisal Univ. Al-Hassa, 496-501.
2. Ismail, B., I. Haffar, Y. Mechref, R. Baalbaki and J. Henry, 2006. Physico-chemical characteristics and total quality of five date varieties grown in the United Arab Emirates. *International J. Food Sci. and Technol.*, 41: 919-926.
3. Ismail, B., I. Haffar, R. Baalbaki and J. Henry, 2008. Physico-chemical characteristics and sensory quality of two date varieties under commercial and industrial storage conditions. *Science Direct*, 41: 896-904.
4. Aziz, H.M. and A.A. Al-Hassani, 1998. Morphological characteristics and their role in date palm cultivar and strains identification. *Proceeding Scientific Symposium On Date Palm Research, Morocco, Feb.*, 16-18: 147-156.
5. Al-Salih, A.A. and L.A.W. Al-Sheikh Hassain, 1980. Correlation of some leaflet morphological aspects in deferent date palm cultivars. *First Arab Conference on Biological Sci.*, 21-24 April, Baghdad, pp: 109.
6. Al-Doss, A.A., M.A. Aly and M.A. Basha, 2001. Morphological and Agronomical variations among some date palm cultivars grown in Saudi Arabia using principal component and cluster analysis. *EIMalik Saudi J. Agric. Sci.*, 13: 3-18.
7. Corley, R.H.V., C.Y. Wong, K.C. Wooi and L.H. Jones, 1981. Early results from the first oil palm trials. *Malaysian International Agriculture Oil Palm Conference, Kuala Lumpur, Report*, 14(A): 1-27.
8. Shaheen, M.A., M.A. Bacha and T.A. Nasr, 1986. A comparative study of the morphological characteristics of the leaves of some seedling date palm males. *Proceeding of The Second Symposium On Date Palm, King Faisal Univ. Saudi Arabia*, 1: 261-273.
9. Ahmed, F.F., E.A. El-Malt, M.A. Ragab and A.A. Ahmed, 1996. Comparative study of productivity, some physical, chemical and nutritional chrematistics of thirteen Saudi and Iraqi date palm cultivars. *Annals of Agric Sci. Moshtohor*, 34: 1809-1833.
10. Marzougi, M., M. Salih, A.M.A. Osman and A. Al-Harthy, 1998. Morphological characteristics of some Omani date palm cultivars. *Proceeding Scientific Symposium On Date Palm Research, Morocco, Feb.*, 16-18: pp: 170-180.
11. Al-Wasel, A.S.A., 1999. Phenotypic comparison of tissue culture-derived and conventionally propagated (by offshoots) date palm (*Phoenix dactylifera* L.) cv. Barhee trees. 1-Vegetative characteristics. *The International Conference On Date Palm.*, 9-11 Nov., pp: 96-106.
12. Mehana, S.A., 1999. Comparative studies on six date palm cultivars from tissue culture under United Arab Emirates conditions. *Zagazig J. Agric. Res.*, 26: 119-131.

13. Mohamed, S.G., B.M. Abd-Allah and F.M.A. Mostafa, 2004. Comparative study on some Iraqi date palm cultivars grown under middle and Upper Egypt climatic conditions. *Egypt. J. Appl. Sci.*, 19: 339-354.
14. El-Houmaizi, M.A., R. Lecoustre and J. Dauzat, 2007. Using architectural traits for characterizing and identifying date cultivars. The fourth Symposium on Date Palm in King Faisal Univ. Al Hassa, Saudi Arabia, 5-8 May, pp: 226.
15. Rizk, R.M., S.F. El-Sharabasy and Kh. A. Soliman, 2007. Characterization and evaluation of six males date palm (*Phoenix dactylifera* L.) genotypes in Egypt. The fourth Symposium on Date Palm in King Faisal Univ. AlHassa, Saudi Arabia, 5-8 May, pp: 238.
16. El-Salhy, A.M., 2001. The relation between leaf/bunch ratio and Zaghloul date productivity. *Egypt J. Hort.*, 28: 149-158.
17. Snedecor, G.W. and W.G. Cochran, 1989. *Statistical Methods*. 7<sup>th</sup>Ed., Iowa State Univ. Press. Ames. Iowa, U.S.A, pp: 593.
18. Steel, R.G.D. and J.H. Torrie, 1980. Reproduced from principles and procedures of statistics. Printed with the permission of C. I. Bliss, pp: 448-449.
19. Fageria, M.S., R.S. Dhaka and M. Agrawal, 2000. Maturity standards for date palm (*Phoenix dactylifera* L.). *J. Appl. Hort.*, 2: 119-120.
20. Association of Official Agricultural chemists, 1995. *Official Methods of Analysis A. O. A. C.* 15<sup>th</sup> Ed. Published by A. O. A. C. Washington, D. C. (U. S. A.).
21. Smith, F., M.A. Gilles, J.K. Hamilton and P.A. Godess, 1956. Colorimetric method for determination of sugars related substances. *Anal. Chem.*, 28: 350-356.
22. Nelson, N. and I. Somogy, 1944. Colourimetric method for determination of reducing sugars related substances. *J. Bio. Chem.* 153: 375 - 379. (Manual of analysis of fruit and vegetable products. 1978, 9-17).
23. Wettstein, D., 1957. Chlorophyll lethal faktoren under sub-microscopic for mvechsel der plastide. *Explt. Gell. Res.*, 12: 427-433.
24. Ismail, B., I. Haffar, R. Baalbaki and J. Henry, 2001. Development of a total scoring system based on consumer preferences weightings and sensory profiles: application of fruit dates (tamr). *Food Quality and Preferences*, 12: 499-506.
25. Salem, M.S. and Z.M. Hamdy, 1993. Evaluation of some Iraqi date cultivars under conditions of Upper Egypt. *Egypt J. Appl. Sci.*, 8: 520-269.
26. AbouObeidi, A., 1998. Morphological characteristics of the leading Tunisian date palm cultivars. *Proceeding Scientific Symposium on Date Palm Research, Morocco, Feb. 16-18*, pp: 163-169.
27. Meligi, M.A., G.F. Sourial, A.M. Mohsen, A. Khalifa and M.Y. Abdalla, 1983. Fruit quality and general evaluation of some Iraqi date palm cultivars grown under conditions of Barrage region, Egypt *Proc. The First Syamposium in Date Palm Saudi Arabia*, 23-25 March, pp: 212-221.
28. Al-Hooti, S., S.S. Jiwa and Q. Hussein, 1997. Phsicochemical characteristics of five date fruit cultivars grown in the Uinted Arab Emirates. *Plant Foods for Human Nutrition*, 50: 101-113.
29. Ahmed, I.A., A.K. Ahmed and R.K. Robinson, 1995. Chemical composition of date varieties as influenced by the stage of ripening. *Food Chemistry*, 54: 305-309.