

# **A COMPARATIVE STUDY OF THE PERFORMANCE OF SOFT TYPE DATE GROWN IN ARID ENVIRONMENT**

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## **ABSTRACT**

The objective of this study was to evaluate the behaviour of Zaghloul cultivar (soft type date) at an area known for dry type (Aswan, south of Egypt). A comparative study was made for such cultivar in relation to different environments of northern and central Nile delta, Giza and central Egypt (Assiut). This evaluation included A) vegetative parameters such as height and girth of palm trunk, number of yearly produced leaves and leaf morphology (length of leaf leaflet), B) flowering and fruit set parameters such as date of spath bursing, spathe morphology (length and diameter) and initial and horticulture fruit set, C) fruit development and physical and chemical characteristics and D) yield parameters including harvesting date, bunch number per palm, bunch weight (kg) and estimated yield per palm. The data of the present study indicated that Zaghloul fruiting-when compared with earlier studies - was 20, 37, 39 and 71 days earlier than same cultivar when grows under Assiut, Giza, Qalyobia and Beheira Governroates, respectively. Yield components (average bunch weight at harvest) were lower in Aswan when compared with those of same cultivar at Northern Governorate. Most of vegetative characteristics of Zaghloul cv. were not influenced. Zaghloul at Northern areas had higher scores in fruit quality and yield meanwhile it lacks values in earliness and flesh weight % which were lower at Aswan. Therefore, for horticulturists to grow soft type dates in arid areas should expect low productivity or yield (by 50%) and some other poor quality (high seed weight and fibers content) but in return they can overcome such shortages as they would produce an extremely earlier crop.

## INTRODUCTION

In the ancient illustrations of the ancient Egyptian tombs walls, the date palm (*Phoenix dactylifera* L.) and its fruits are well recorded (Crues, 1940).

Recently date palm grows successfully throughout Egypt, from the Mediterranean coast (Lat. 31° 30' N) up to Aswan Governorate (Lat. 22° N) (Brown and Bahgat, 1938).

The number of fruitful female palms in Egypt is almost seven millions (6,951,000) planted on approximately (61,000) feddan. Aswan Governorate contributed with 902,997 fruitful female palms (12.99% nation wide total) while there is about 483,641 palms in juvenile stage. Although, Aswan Governorate only contributes by 5.02% of total area devoted to date palm, it produces about 9.47% of total dates production (FAO, 1996).

Due to the National Irrigation Projects (Aswan & High Dams) in Aswan area, the number of palms dropped from 2.5 millions in the beginning of this century to about 1,061,189 palms which represent about 12% of the total numbers of palms in Egypt (Hussein *et al.*, 1993).

Statistics of date palm cultivars in Aswan Governorate indicated that in addition to what is called Balady cultivar there are 4 major dates cultivars namely, Sakkoti (91,313 female palms; 1.7%), Bartamuda (9,755 female palms; 1.1%) and Malakaby (3,725 female palms; 0.41%). Baladi seedling palms represented about 77.28% (689,592 female palms). Other cultivars including soft and semidry ones (85,279) represented only (9.43%) of total female palms.

There are five stages of date fruit development (Hababouk, Kimri, Khalal, Rutab and Tamar) stages. The last stage disappears in soft date cultivars (Hussein *et al.*, 1979).

This investigation aimed to study the following objectives:

Evaluation of the behaviour of Zaghloul date cultivar (soft type) at an area known for dry type (Kom-Ombo, Aswan). This included

vegetative growth, flowering, fruit formation and characteristics and yield. A comparative study for such cultivar in relation to different environments.

## **MATERIALS AND METHODS**

This investigation was carried out in Horticultural Services Orchard, Ministry of Agricultural at Kom-Ombo Region, Aswan Governorate during two consecutive seasons of 1996 and 1997 to study Zaghoul date palm cultivar behaviour. Five palms were randomly selected among palms that tended to have leaf/bunch ratio of 8:1. In addition, Zaghoul palms were 12 years old (5 years of fruiting). All tested palms were subjected to the same horticultural practices. They were pollinated throughout the two seasons by known high activity pollen source. Generally, the following measurements were determined during the two seasons of study:

### **A) Yield Parameters:**

Yield parameters of the investigated palms were determined namely, harvesting date, number of bunches per palm, average bunch weight, yield per palm.

### **B) Vegetative Parameters:**

These included palm height and girth, leaves number per palm and leaf morphology.

### **C) Flowering and Fruit Set Parameters:**

These parameters were determined as follows: dates of Spathes bursting, spathe morphology and initial and horticultural fruit set %.

### **D) Fruit Development and Characteristics:**

Physical and chemical characteristics of fruits were determined 60 days from pollination until harvesting date at 15 days intervals, 30 fruits from each palm were taken to determine the following measurements:

## **1 - Physical characteristics:**

### **I: Fruit dimension:**

The fruit height (cm), fruit diameter (cm), were estimated using a varrier caliper, while the shape inded was calculated.

### **II: Other physical Characteristics:**

The fruit weight (g), flesh weight (g), flesh weight percentage, were determined.

## **2 - Fruit Chemical characteristics:**

The studied chemical chracteristics of fruits included:

**I - Total Soluble Solids % (TSS%):** by hand refractometer.

**II- Sugar content:**

The percentage of the total and reducing sugars were determined according to Lane and Eynon volumetric method that outlined in (A.O.A.C. 1985).

Non reducing sugars were then calcualted.

**III- Total Acidity):**

It were titrated against 0.1 N Sodium hydroxide using phonalphtalene as an indicator according tot he (A.O.A.C. 1985). Acidity was determined as citric acid (Hussein *et al.*, 1987).

**IV- Moisture and dry matter content:**

The flesh of fruit sampling was cut into small parts and dried at 60-65°C for 48 h. (Dawson and Aten, 1963).

## **V - Crude Fibers content:**

Determination of crude fibers content was achieved using acetic acid glacial and nitric acid 10:1 solution on 1 g sample according (A.O.A.C., 1985).

## **VI- Total Nitrogen, Phosphorus, Potassium and Crude protein:**

The total nitrogen was determined using the macro-kjeldahl method (Black, 1965). The total phosphorus was determined by spectrophotometer using the chlorostannous phosphomolybdic acid method in sulphuric acid system (Jackson, 1958). The total potassium was determined by the flame photometer method (Jackson 1958). Crude protein (%) was calculated by multiplying Nitrogen content by 6.25 ( $N \times 6.25$ ).

## **VII- Tannins Content:**

The tannins content was determined using the Indigo carmen indicator according to (Winton & Winton, 1958).

## **Comparative Study of Zaghloul Date Palm:**

Based on some features of Zaghloul date palm grown in Assiut, Giza Qalyobia and Beheira (Abdalla *et al.*, 1990), the performance of Zaghloul at Kom-Ombo, Aswan was then compared. To evaluate the performance of Zaghloul among different localities the following criteria were used:

1- Earliness, 2- Yield, 3- Fruit weight, 4- Flesh weight, 5- Flesh weight %, 6- Total sugars %, 7- Fibers content and 8- Tannins content.

Scoring: 1- Earliness and yield as major criteria for evaluation had 25 points each.

2 - Fruit Weight, flesh weight, flesh weight % and total sugars had 10 points each.

3 - Fruit content of fibers and tannins had 5 points each. Total points then is 100.

4 - For each character, the highest result when is desired takes the highest points (nil of not desired) while the least results takes Zero points (the

highest points of the least result is desired). Other results were weighed, accordingly; i.e. high yield is desired, therefore, the highest yield and value at any locality takes Zero points, and yield values at other localities were compared according to the difference between the highest and lowest values (El-Agamy, 1970).

### **Statistical Analysis:**

Data were statistically analyzed using the analysis of variance “F” test and the least significant differences L.S.D. at 5% (Gomez and Gomez, 1984).

## **RESULTS AND DISCUSSION**

The results obtained during the course of manuscript will be demonstrated as follow:

1- Yield parameter, 2- Vegetative parameters, 3- Flowering and fruit set parameters and 4- Fruit development and characteristics.

### **1- Yield Parameters:**

#### **1.1- Harvesting date:**

The obtained results on Zahgloul cultivar in Table (1) indicated that under Kom-Ombo conditions, harvesting date was at mid August (14-16); 150 days after pollination while the time of harvesting for the same cultivar was the 15<sup>th</sup> of Sept. (158 days) according to Mougheith *et al.* (1976) at Moshtohor, Qalyobia Governorate and during the first week of September in Assiut Governorate (Hussein *et al.*, 1987). Abdalla *et al.* (1990) indicated that such cultivar reached the harvesting in Assiut 20 days earlier than in Giza and Qalyobia and 55 days earlier than in Beheira Governorate. Therefore, when Zaghoul palms were grown in Kom-Ombo, they could be picked earlier, than all Egyptian Governorates by: 20 days than Assiut, 37 days than Giza, 39 days than Qalyobia and 71 days than Beheira Governorate.

#### **1.2- Bunches Number Per Palm:**

Table (1) showed that Zaghoul cv. produced significantly more number of bunches per palm in 1997 season than 1996 one. The average

number of bunches/palm were 4.60 and 6.20 during 1996 and 1997, respectively.

These results indicated less number of bunches per palm in Zaghloul cv. under Kom-Ombo environment compared to those obtained by Abdalla *et al.* (1990) where it was 7.66, 9.33 when such cultivar was grown in Beheira, (10.67, 8.17) in Qalyobia, (11.33, 8.83) in Giza and (9.33, 7.66) in Assiut. According to Mougheith *et al.* (1976) Zaghloul cv. produced an average of 12 bunches/palm in Moshtohor, Qalyobia.

**Table (1): Yield parameters of Zaghloul cv. during 1996 and 1997 seasons.**

Parameters	1996	1997	L.S.D. 0.05
Harvesting date	14/8	16/8	-
Bunches no./palm	4.60 B*	6.20 A	0.68
Average bunch weight (kg)	8.98 A	7.13 B	1.11
Estimated yield/palm (kg)	41.20 A	44.30 A	6.20

\* Means within row having same letter are not significant at L.S.D. 0.05.

### 1.3- Average Bunch Weight (kg) [ABW]

Bunch weight average of Zaghloul cv. was significantly higher in 1996 season than 1997 one as shown in table (1) probably due to favorable environment during the first season.

The results indicated that Zaghloul palms (12 years old and 5 fruiting years) under the present conditions gave higher bunch weight (8.5 kg as an average of two seasons) than bunch weight of Zaghloul palms grown at Moshtohor, Qalyobia Governorate (7.6 kg as an average) according to Mougheith *et al.* (1976).

Meanwhile, Zaghloul palms grown in Assiut Governroate gave higher average bunch weight (20.01 kg) according to Hussein *et al.* (1987) and (20.09 kg) according to El-Kassas *et al.* (1995) compared to average bunch weight of Zaghloul grown at Kom-Ombo.

Abdalla *et al.* (1990) revealed that the average bunch weights of Zaghloul, cv. grown under Beheira, Qalyobia, Giza and Assiut were (10.88, 11.55, 10.76 and 10.66 kg), respectively.

#### **1.4- Estimated yield per palm [EYP]**

Yield per palm presented in Table (1) was estimated as average bunch weight x number of bunches per palm. Data indicated that when Zaghloul palms were planted in Kom-Ombo produced fruit yield per palm of 41.2 to 44.3 kg in both seasons at palm age of 12 years (5 years of fruiting) with a significant difference between the two seasons.

Such estimated value indicated that Zaghloul in Kom-Ombo is 43.53% of Zaghloul grown in Moshtohor, Qalyobia according to Mougheith *et al.* (1976) and 49.25% of Zaghloul in Beheira, 42.88% of Zaghloul in Giza and 50.59% of Zaghloul in Assiut according to Abdalla *et al.* (1990).

Fruit yield together with fruit quality were a milestone of the evaluation of Zaghloul (the soft fruit date) in a region which characterized for dry fruit dates. Therefore, fruit yield of Zaghloul cultivar should be considered to recommend plantation of such cultivar deep to the south. Nevertheless, one should also put attention to the economic value of earliness of Zaghloul compared to other governorates of Egypt as mentioned before.

## **2- Vegetative parameters:**

Parameters of vegetative growth will be focused on the status of each parameter and the changes occurred during 1996 and 1997 seasons, particularly in Zaghloul cultivar which is relatively younger:

### **2.1- Palm Height and Girth (m):**

Data of Table (2) described the vegetative characteristics of Zaghloul cultivar palms. Data showed that the palm height (m) increased significantly in that cultivar during 1997 compared to 1996. Zaghloul

palm reached 5.10 m at the age of 12 years increased to 5.5 m with 40 cm increase (7.84%) under Kom-Ombo environments.

Meanwhile, no changes occurred in palm girth during the two seasons of study and this was expected in palm growth. Palm girth of Zaghloul cv. was 1.53 m at the age of 12 years under the experiment condition.

## 2.2- Produced Leaves and Leaf Morphology:

### 2.2.1- Produced Leaves/palm/season:

Table (2) showed that Zaghloul cv. produced 11.6 leaves during 1996 and 10.8 during 1997, with no significant difference between the 2 seasons.

Table (2): Changes in Vegetative Parameters of Zaghloul cv. during 1996 and 1997 seasons.

Parameters	1996	1997	Change	L.S.D. 0.05
Plant height (m)	5.10 B*	5.50 A	0.4	0.13
Palm girth (m)	1.53 A	1.53 A	0.0	0.02
Produced leaves/palm/season	11.6 A	10.8 A	-0.8	2.22
Leaf length (m)	4.33 B	4.68 A	0.35	0.15
Leaflet length (cm)	50.75 A	53.32 A	2.43	3.64

\* Means within row having same letter are not significant at L.S.D. 0.05.

### 2.2.2- Leaf Length (m) and Leaflet Length (cm):

Table (2) indicated that leaf length increased for Zaghloul cultivar significantly in 1997 compared to 1996. Zaghloul leaf length increased from 4.33 to 4.68; 0.35 m. increase (12.37%).

In addition, Zaghloul leaflet insignificantly increased from 50.75 cm in 1996 to 53.32 cm in 1997 with increment 2.57 cm (5.06%).

Very little literature is available to discuss the vegetative growth of Zaghloul dates. Abdalla *et al.* (1990) made an intensive study on Zaghloul at 4 different governorates included vegetative characteristics.

Palm girth of Zaghoul in the present study was in same range of what was obtained by Abdalla *et al.* (1990); 1.53 vs. 1.45, 1.55, 1.57 and 1.62 m. in Beheira, Qalyobia, Giza and Assiut governorates, respectively; regardless of different ages. Leaf length in this study was 4.33 and 4.68 m average of 4.51 m and this could be similar to 3.98 m in Beheira, 4.38 m in Qalyobia; 4.58 m in Giza and 4.69 m in Assiut.

### 3- Flowering and Fruit Set Parameters:

#### 3.1- Date of spathes bursting:

From data of Table (3) it is clearly indicated that the spathes of Zaghoul cv. were the earliest in their bursting date. Date of bursting of Zaghoul cv. spathes started from 8<sup>th</sup> of Feb. and continued to the 15<sup>th</sup> of March during 1996 and from 10<sup>th</sup> of Feb. to 15<sup>th</sup> of March during 1997. The present study showed also that the spathes of Zaghoul grown at Kom-Ombo Region started in bursting (8<sup>th</sup> Feb.) by 52 days earlier than what was obtained by Mougheith *et al.* (1976) for Zaghoul cv. grown at Moshtohor.

#### 3.2. Spathe Morphology:

##### 3.2.1- Spathe length and girth (cm);

Table (3) showed that the spathe length of Zaghoul cv. was insignificantly less in 1996 (33.4 cm) compared to in 1997 (31.4 cm); 2 cm; less. In addition spathe girth of Zaghoul cv. was insignificantly less in 1996 (14.8 cm) compared to (13.8 cm) in 1997; (1 cm decrease).

Table (3): Flowering and fruit set parameters of Zaghoul cv. during 1996 and 1997 seasons.

Parameters	1996	1997	L.S.D. 0.05
Date of spathes bursting	8/2-15/3	10/2-15/3	-
Spathe length (cm)	33.40 A*	31.40 A	6.63
Spathe girth (cm)	14.80 A	13.80 A	2.90
Number of strands/bunch	52.90 A	55.60 A	3.60
Number of flowers/strand	35.08 A	35.10 A	1.75
Initial fruit set (%)	60.30 A	61.66 A	10.37
Ultimate fruit set (%)	12.70 B	10.58 A	2.04

\* Means within row having same letter are not significant at L.S.D. 0.05.

### **3.2.2- Number of strand/bunch:**

Zaghloul palms (12 years old) produced insignificantly higher number of strands/bunch in 1997 (55.6) than in 1996 (52.9).

On the other hand, according to Mougheith *et al.* (1976) Zaghloul palms grown at Moubasher, Qalyobia produced higher number of strands per bunch (64.8) than Zaghloul palms grown under the present study conditions which produced 54.25 strands/bunch, this number was also lower than Zaghloul grown at Beheira, Qalyobia, Giza and Assiut in Abdalla *et al.* (1990) study. The number of strands per bunch was 64.0, 70.3, 76.3 and 74.0 of the 4 Governorates, respectively. Low number of strands per bunch in the present study may be due to the younger age of Zaghloul palms (12 years) which grown at Kom-Ombo Region, Aswan Governorate in addition to environmental conditions and horticultural management.

### **3.2.3- Number of flowers/strand:**

The number of flowers per strand of Zaghloul as shown in Table (3) not significant in 1997 compared to 1996. The averages number of flowers per strand were 35.08, 32.24 in Zaghloul palms during two experimental seasons.

### **3.3. Initial fruit set (%):**

Table (3) indicated that the low percentage of initial fruit set was recorded on Zaghloul cv. Zaghloul initial fruit set % insignificantly increased during 1997 (61.66%), compared to 1996 (60.30).

### **3.4. Horticulture fruit set (%):**

Same Table (3) indicated also that horticultural fruit set % decreased, significantly from 12.7 in 1996 to 10.58% in Zaghloul cv.

Horticultural fruit set (%) of Zaghloul grown under Assiut conditions was 39.58% an average of 3 seasons from the data obtained by El-Kassas *et al.* (1995), which is higher than the percentage of horticultural fruit set of Zaghloul grown under the present study (11.64%,

av. of two seasons). The high temperature in Kom-Ombo may affect the horticultural fruit set % for such a soft type date.

### 3.5. Changes in fruit retention and fruit drop (%):

Data in Table (4) showed that the fruit drop (%) of Zaghloul cv. increased significantly until the fruit reached the age of 105 days after pollination, then increases in fruit drop were not significant in the following ages. The highest increase in fruit drop (%) occurred in the period between 75 to 90 days after pollination (15.10% increase) as an average of both seasons. Fruit drop (%) reached its maximum value (88.36% as an average) when the fruit reached the harvesting date (150 days after pollination). Fruit drop percentage consider as an indicator of fruit retention (%) meaning that, if fruit drop % decreased fruit retention increased and vice versa.

Table (4): Changes in some flowering parameters (fruit retention and fruit drop) of Zaghloul cultivar during 1996 & 97 seasons.

Fruit age (days after pollination)	Fruit retention (%)			Fruit drop (%)		
	1996	1997	Av.	1996	1997	Av.
60	55.84	51.93	53.89	44.16	48.07	46.12
75	40.79	39.73	40.26	59.21	60.27	59.74
90	23.96	24.56	24.26	76.04	75.37	75.71
105	18.74	18.58	18.66	81.26	81.42	81.34
120	16.68	16.80	16.74	83.32	83.20	83.26
135	15.89	15.29	15.59	84.11	84.71	84.41
150	12.70	10.58	11.64	87.30	89.42	88.36
L.S.D. 0.05	5.23	5.23	-	5.10	5.12	-

## 4- Fruit Development and Characteristics:

### 4.1- Fruit physical characteristics:

#### 4.1.1- Fruit height (cm):

Data of Tables (5) revealed that Zaghloul fruit height significantly increased in the period from the age of 60 to 105 days, then gradually increased to the age of 135 days. When the fruit age reached 135 days, fruit height insignificantly increased until the harvesting date (150 days after pollination).

**Table (5): Changes in some fruit physical characteristics (fruit height, fruit diameter, and shape index) of Zaghloul cultivar during 1996 & 97 seasons.**

Fruit age (days) after pollination	Fruit height (cm)			Fruit diameter (cm)			Shape index (H/D)		
	1996	1997	Av.	1996	1997	Av.	1996	1997	Av.
60	2.36	2.31	2.33	1.51	1.53	1.52	1.56	1.53	1.55
75	3.92	3.90	3.91	2.12	2.10	2.11	1.84	1.86	1.85
90	5.00	4.98	4.99	2.34	2.33	2.34	2.14	2.14	2.14
105	5.37	5.26	5.32	2.51	2.48	2.50	2.14	2.12	2.13
120	5.52	5.53	5.53	2.59	2.58	2.59	2.13	2.15	2.14
135	5.70	5.71	5.71	2.68	2.64	2.66	2.13	2.16	2.15
150	5.81	5.82	5.82	2.70	2.67	2.69	2.15	2.19	2.17
L.S.D. 0.05	0.13	0.15	-	0.08	0.07	-	0.11	0.08	-

Zaghloul fruit height at harvesting in the present study (5.82 cm; as an average of two seasons) was higher than fruit height of Zaghloul grown in Assiut (5.62 cm) and (4.34 cm) according to Hussein *et al.* (1987) and El-Kassas *et al.* (1995).

According to Abdallah *et al.* (1990), fruit heights of Zaghloul grown in Beheira, Qalyobia, Giza and Assiut (5.9, 5.7, 5.44 and 5.53 cm). According to Kassem *et al.* (1994), fruit height of Zaghloul grown under Beheira conditions, (5.8 cm) was almost similar to Zaghloul fruit height obtained by the present study. Mougheith *et al.* (1976) showed that Zaghloul fruit height produced in Moshtohor, Qalyobia was (5.97 cm).

#### **4.1.2. Fruit diameter (cm):**

Table (5) clearly indicated that fruit diameter of Zaghloul cv. attained a similar behaviour as fruit height during fruit age progress.

The results obtained by the present study explained that Zaghloul fruit diameter at harvesting (2.69 cm) was higher compared to the fruit diameter of Zaghloul grown in Assiut (2.15 cm) according to El-Kassas *et al.* (1995), however, it was lower than fruit diameter of Zaghloul grown in Assiut (3.12 cm) according to Hussein *et al.* (1987). The results under

the present study showed also that fruit diameter was close to what found by Hussein *et al.* (1984) and Kassem *et al.* (1994) and it was similar also to the studied fruits by Mougheith *et al.* (1976) and Abdalla *et al.* (1990).

#### 4.1.4. Fruit weight (g):

Data from Table (6) showed that Zaghoul fruit weight increased sharply with high significant differences from the age of 60 days after pollination to the age of 75 days and continued in increasing gradually to the maximum at harvesting date. The average of Zaghoul fruit weight of both seasons at harvesting was 24.63 g.

Table (6): Changes in some fruit physical characteristics (fruit weight, flesh weight and flesh weight %) of Zaghoul cultivar during 1996 & 97 seasons.

Fruit age (days) after pollination	Fruit weight (g)			Flesh weight (g)			Flesh weight (%)		
	1996	1997	Av.	1996	1997	Av.	1996	1997	Av.
60	3.60	4.33	3.97	3.44	3.61	3.53	95.5 5	96.7 2	96.1 4
75	10.7 8	11.2 6	11.0 2	9.84	10.3 5	10.1 0	91.2 7	91.8 8	91.5 7
90	17.4 2	17.7 5	17.5 9	15.6 8	16.0 3	15.8 6	89.9 9	90.3 1	90.1 5
105	18.5 6	19.0 1	18.7 9	16.3 7	16.8 6	16.6 3	88.2 0	88.6 7	88.4 3
120	20.5 8	21.0 0	20.7 9	18.2 9	18.7 6	18.5 2	88.8 7	89.3 1	89.0 9
135	23.1 5	22.6 2	22.8 8	20.7 7	20.2 3	20.5 0	89.6 8	89.3 5	89.5 1
150	24.9 0	24.3 5	24.6 3	22.6 9	22.1 2	22.4 0	91.0 8	90.8 5	90.9 6
L.S.D. 0.05	1.39	1.54	-	1.33	1.33	-	1.31	1.20	-

Zaghoul fruit weight at harvesting date under the present study conditions; 24.06 g. was lower than fruit of Zaghoul grown under Moshtohor, Qalyobia conditions (26.6 g) according to Mougheith *et al.* (1976) but it was higher than fruit weight of Zaghoul grown in Assiut (16.26 g) revealed by El-Kassas *et al.* (1995). On the other hand, fruit weight of Zaghoul in Kom-Ombo was very similar to Zaghoul fruit weight in Assiut (24.38 g) according to Hussein *et al.* (1987). The

present study showed also that Zaghoul fruit weight in Kom-Ombo was higher than Zaghoul fruit weight in south Sinai (20.04 g) according to Hussein *et al.* (1984) and than Zaghoul in Beheira (22.68 g) revealed by Kassem *et al.* (1994).

#### **4.1.5. Flesh weight (g) and flesh weight percentage (%):**

Data from Tables (6) revealed that the flesh weight (g) increased sharply from the age of 60 days after pollination to 90 days, then increased but not significantly to the age of 105 days and significantly increased to the harvesting date (180 days after pollination), reached to 22.4 g. On other hand, the flesh weight (%) decreased gradually from the age of 60 to 105 days.

The results obtained by the present study showed that the fruit flesh weight (g) of Zaghoul grown in Kom-Ombo was higher than fruit flesh (g) of Zaghoul grown in Assiut (19.64 g) according to Hussein *et al.* and than such cultivar in Assiut (13.19 g) according to El-Kassas *et al.* (1995).

The current results showed also that fruit flesh weight (%) of Zaghoul grown in Kom-Ombo (90.96%) was very close to Zaghoul flesh weight at Moshtohor, Qalyobia (91.10%) according to Mougheith *et al.* (1976).

The results obtained by Abdallah *et al.* (1990) indicated that flesh weight percentage of Zaghoul planted in Beheira, Qalyobia, Giza and Assiut were 91.25, 90.77, 91.72 and 92.56%, respectively.

## **4.2. Chemical characteristics:**

### **4.2.1- Total soluble solids (T.S.S.):**

Table (7) showed that the total soluble solids percentage of Zaghoul fruit increased gradually from the age of 60 days after pollination to the age of 105 days, then significantly increased to the age of 120 days. When fruit age reached the age of 120 days, total soluble solids percentage sharply increased (significantly) to its maximum value (31.52%) at the harvesting date.

The results obtained by the present study indicated that total soluble solids of Zaghloul fruit under Kom-Ombo conditions was higher than total soluble solids of Zaghloul fruit under different conditions according to Kassem *et al.* (1994), in Beheira (28.3%), Mougheith *et al.* (1976) in Moshtohor (29.7%), Hussein *et al.* (1987) in Assiut (28.29%), El-Kassas *et al.* (1995) in Assiut (27.89%) and Abdalla *et al.* (1990) in Beheira (24.96%), in Qalyobia (24.50), in Giza (25.07) and Assiut (28.65%).

Table (7): Changes in some fruit chemical characteristics (total soluble solids, total acidity, and total soluble solids/acidity) of Zaghloul cultivar during 1996 & 97 seasons.

Fruit age (days) after pollination	Total soluble solids* (%)			Total acidity* (%)			Total soluble solids/acidity		
	1996	1997	Av.	1996	1997	Av.	1996	1997	Av.
60	6.67	6.85	6.76	0.330	0.346	0.338	20.21	19.79	20.00
75	7.19	7.39	7.29	0.164	0.166	0.165	43.80	44.52	44.16
90	8.00	8.03	8.01	0.128	0.122	0.125	62.50	65.82	64.16
105	8.56	8.68	8.60	0.094	0.097	0.096	91.06	89.48	90.27
120	9.95	10.03	10.00	0.085	0.089	0.087	117.06	115.29	116.17
135	15.65	15.80	15.72	0.074	0.074	0.074	211.49	213.50	212.49
150	31.32	31.71	31.52	0.060	0.060	0.060	522.00	528.50	525.25
L.S.D. 0.05	1.02	1.00	-	0.023	0.022	-	35.33	63.10	-

\* On fresh weight basis.

#### 4.2.2. Total acidity (%):

Data of Table (7) clearly indicated that total acidity content of Zaghloul fruit greatly decreased from the age of 60 to the age of 75 days, then significantly decreased to the age of 105 days. When the age of fruit reached 105 days, total acidity gradual decreased until the harvesting date. Average total acidity percentage of Zaghloul fruits at harvest was 0.06%.

The results obtained by the present study showed that total acidity of Zaghloul fruit in Kom-Ombo was lower than total acidity of Zaghloul fruit in beheira (0.85%) according to Kassem *et al.* (1994), in Assiut (0.56%) according to Hussein *et al.* (1987).

Abdalla *et al.* (1990) found that total acidity percentage of Zaghoul fruit in Beheira, Qalyobia Giza and Assiut were 0.044, 0.05, 0.59 and 0.127%, respectively. Hence, total acidity of Zaghoul fruit in Kom-Ombo was higher than Beheira and Qalyobia; similar to Giza and lower than Assiut.

#### **4.2.3. Total soluble solids/acidity:**

From data of Table (7) it appeared that the total soluble solids/acidity of Zaghoul fruit increased gradually from the age of 60 to 120. When the age of fruit reached to 120 days, total soluble solids/acidity sharply increased (significantly) to the harvesting date.

The results of the present study showed that total soluble solids/acidity of Zaghoul in Kom-Ombo was higher than total soluble solids/acidity of Zaghoul fruit in Beheira (48.79) according to Kassem *et al.* (1994) in Assiut (51.62) revealed by Hussein *et al.* (1987) and in Qalyobia, Giza and Assiut according to Abdalla *et al.* (1990).

#### **4.2.4. Total sugars content:**

Data obtained from Table (8) showed that total sugars content of Zaghoul fruit gradually increased from the age of 60 to 105 days, then significantly increased until the harvesting date.

The results of the present study clearly indicated that total sugar content of Zaghoul fruit in Kom-Ombo (29.13%) was higher than total sugar of same cultivar grown in Assiut (22.99%) according to Hussein *et al.* (1987) and El-Kassas *et al.* (1995) in Assiut was (22.89%).

According to Abdalla *et al.* (1990) total sugar percentages of Zaghoul fruit in Beheira, Qalyobia Giza and Assiut Governorates were 25.98, 25.04, 24.25 and 26.84%, respectively.

Table (8): Changes in some fruit chemical characteristics (total sugar, reducing sugar, and non reducing sugar) of Zaghloul cultivar during 1996 & 97 seasons.

Fruit age (days) after pollination	Total sugar* (%)			Reducing sugar* (%)			Non reducing sugar (%)		
	1996	1997	Av.	1996	1997	Av.	1996	1997	Av.
60	5.17	5.31	5.24	4.98	5.14	5.06	0.19	0.17	0.18
75	6.00	6.07	6.02	5.65	5.73	5.69	0.35	0.34	0.34
90	7.60	7.63	7.60	6.86	7.00	6.90	0.74	0.67	0.70
105	8.20	8.40	8.30	7.37	7.58	7.47	0.83	0.82	0.82
120	9.18	9.43	9.31	7.85	8.00	7.90	1.33	1.43	1.38
135	13.95	14.45	14.20	9.85	10.22	10.03	4.10	4.23	4.16
150	28.73	29.53	29.13	22.74	24.08	23.41	5.99	5.45	5.72
L.S.D. 0.05	1.31	1.21	-	1.02	1.22	-	0.90	0.90	

\* On fresh weight basis.

#### 4.2.5. Reducing sugar percentgaes:

Data from Table (8) showed that reducing sugar in Zaghloul fruit insignificantly increased from the age of 60 to 75 days, then significantly increased to the age of 90 days. When fruit age reached 90 days gradual increases in reducing sugar occurred to the age of 135 days, then increased with high significant rates to the age of 150 days (the harvesting date).

The results obtained by the present study showed that Zaghloul fruit in Kom-Ombo contained a higher percentage of reducing sugar (23.415) than Zaghloul fruit in Assiut (15.05% and 16.70%) according to Hussein *et al.* (1987) and El-Kassas *et al.* (1995), respectively.

Abdalla *et al.* (1990) mentioned that reducing sugar percentage of Zaghloul fruit in Beheira, Qalyobia, Giza and Assiut were 14.82, 12.18, 10.58 and 9.63, respectively.

#### 4.2.6. Non reducing sugar (%):

Table (8) showed that non-reducing sugar of Zaghloul fruit increased gradually from the age of 60 to 120 days, then significantly increased to the harvesting date.

The results obtained by the present study showed that non-reducing sugar of Zaghloul fruit in Kom-Ombo was similar to non-reducing sugar of Zaghloul fruit in Assiut (6.19%) according to El-Kassas *et al.* (1995) and was lower than what obtained by Hussein *et al.* (1987) (7.9%).

Comparing to Abdalla *et al.* (1990), non-reducing sugar of Zaghloul fruit in Kom-Ombo, Aswan was clearly lower than non-reducing sugar of such cultivar grown in Beheira (11.16%), in Qalyobia (12.86%), in Giza (13.67%) and Assiut (17.21%), respectively.

#### 4.2.7. Crude fibers percentage:

Table (9) showed that crude fibers of Zaghloul fruit insignificantly increased from the age of 60 to 75 days then insignificantly or significantly decreased until it reached the minimum content (7.90%) at harvesting date.

The results obtained by the present study showed that crude fibers of Zaghloul fruit in Kom-Ombo, Aswan was higher than crude fibers of Zaghloul grown in south Sinai (3.9%) according to Hussein *et al.* (1984).

According to Abdalla *et al.* (1990) crude fibers of Zaghloul fruit in Beheira (1.57), in Qalyobia (1.80), in Giza (1.93) and in Assiut (3.09%); was clearly lower compared to crude fibers of Zaghloul fruit in Kom-Ombo, Aswan revealed by the present study.

Table (9): Changes in some fruit chemical characteristics (crude fibers, nitrogen and total protein) of Zaghloul cultivar during 1996 & 97 seasons.

Fruit age (days) after pollination	Crude fibers* (%)			Nitrogen* (%)			Total prtoein (%)		
	1996	1997	Av.	1996	1997	Av.	1996	1997	Av.
60	14.60	14.60	14.60	0.440	0.442	0.441	2.754	2.758	2.756
75	15.00	15.00	15.00	0.396	0.400	0.398	2.475	2.490	2.482
90	14.40	13.80	14.10	0.366	0.364	0.365	2.292	2.270	2.281
105	11.00	11.00	11.00	0.276	0.288	0.282	1.728	1.802	1.765
120	11.00	10.60	10.83	0.242	0.252	0.247	1.514	1.582	1.548
135	8.40	8.00	8.20	0.214	0.230	0.222	1.338	1.430	1.384
150	8.40	7.40	7.90	0.160	0.156	0.157	0.990	0.968	0.979
L.S.D. 0.05	2.24	1.94	-	0.054	0.050	-	0.337	0.309	-

\* On dry weight basis.

#### 4.2.8. Total nitrogen and total protein (%):

From data of Table (9) showed that total nitrogen and total protein (%) in Zaghloul fruit decreased gradually from the age of 60 to 90 days, then significant decreases occurred to the age of 105 days. When fruit age reached 105 days, both of total nitrogen and total protein decreased gradually to the age of 135 days then significantly decreased to the harvesting date.

The results from the present study showed that total nitrogen and total protein (0.157 and 0.979%) of Zaghloul fruit in Kom-Ombo were clearly lower compared to total nitrogen and total protein of such cultivar in south Sinai (0.544 and 3.400%) according to Hussein *et al.* (1984).

#### 4.2.9. Total phosphorus (%):

Data from Table (10) showed that total phosphorus of Zaghloul fruit insignificantly increased from the age of 60 to 90 days, then significantly decreased to the age of 120 days. When the age of fruit reached 120 days, total phosphorus insignificantly decreased to its minimum percentage (0.401%) at the harvesting date.

No available literature about phosphorus content in Zaghloul fruits to compare with.

Table (10): Changes in some fruit chemical characteristics (phosphorus, potassium and total tannins) of Zaghloul cultivar during 1996 & 97 seasons.

Fruit age (days) after pollination	Phosphorus** (%)			Potassium** (%)			Total tannins* (%)		
	1996	1997	Av.	1996	1997	Av.	1996	1997	Av.
60	0.55 6	0.57 2	0.56 4	1.74 8	1.72 0	1.73 4	0.44 0	0.46 2	0.45 1
75	0.55 8	0.58 8	0.57 3	1.80 8	1.79 6	1.80 2	0.37 5	0.35 6	0.36 6
90	0.61 4	0.62 4	0.61 9	1.68 4	1.70 0	1.69 2	0.28 0	0.29 6	0.28 8
105	0.52 2	0.49 4	0.50 8	1.86 8	1.80 4	1.83 6	0.25 1	0.26 8	0.26 0
120	0.44 0	0.43 6	0.43 8	1.60 0	1.60 0	1.60 0	0.23 2	0.24 9	0.24 1
135	0.41	0.41	0.41	1.59	1.64	1.61	0.22	0.20	0.21

	4	4	4	2	0	6	4	5	5
150	0.40 8	0.39 4	0.40 1	1.49 6	1.49 0	1.49 3	0.15 1	0.16 2	0.15 7
L.S.D. 0.05	0.05 5	0.05 0	-	0.18 7	0.14 1	-	0.05 3	0.05 1	-

\* On fresh weight basis.

\*\* On dry weight basis.

#### 4.2.10. Potassium percentage (%):

Data of Table (10) showed that potassium percentage of Zaghloul fruit insignificantly increased from the age of 60 to 75 days, then insignificantly decreased to the age of 90 days. When fruit age reached 90 days. Potassium percentage insignificantly increased to the age of 105 days, then gradual decreases occurred until the harvesting date.

Potassium percentage on Zaghloul fruits under the present study was the highest as compared with nitrogen and phosphorus percentages. This agreement with the findings of Haas and Bills, 1934, Sawaya *et al.*, 1982, Booij *et al.*, 1992 and Ahmed *et al.*, 1996. They mentioned that potassium is abundant element in date palm fruits.

#### 4.2.11. Total tannins content:

From data of Table (10) total tannins of Zaghloul fruit significantly decreased from the age of 60 to 90 days, then insignificantly decreases occurred to the age of 120 days. When fruit reached 120 days, total tannins of Zaghloul fruit decreased gradually to its minimum value (1.157%) at the harvesting date.

The data obtained by the present study showed that total tannins of Zaghloul fruit in Kom-Ombo was lower compared to total tannins of Zaghloul fruit grown in Moshtohor, Qalyobia (0.632%) according to Mougheith *et al.* (1976) as well as in Qalyobia (0.178), in Giza (0.198) and in Assiut (0.287%) according by Abdalla *et al.* (1990).

#### 4.2.12. Moisture and dry matter content (%):

Table (11) showed that moisture content of Zaghloul fruit significantly increased from the age of 60 to 75 days, then insignificantly increased to the age of 90 days. When fruit age reached 90 days, moisture content decreased gradually to the age of 135 days, then sharply

decreases (significantly) occurred to the minimum value (56.61%) at harvest.

The results obtained by the present study indicated that dry matter content of Zaghoul fruit in Kom-Ombo (43.49%) was clearly higher compared to dry matter in Zaghoul fruit at Moshtohor, Qalyobia, according to Mougheith *et al.* (1976) and it was also higher than those found by Abdalla *et al.* (1990) in Beheira, Qalyobia, Giza and Assiut Governorate which were 25.92, 27.56, 30.47 and 35.91%, respectively.

Table (11): Changes in some fruit chemical characteristics (moisture and dry matter) of Zaghoul cultivar during 1996 & 97 seasons.

Fruit age (days after pollinatin)	Moisture (%)			Dry matter (%)		
	1996	1997	Av.	1996	1997	Av.
60	83.48	84.43	83.96	16.52	15.54	16.05
75	86.33	86.74	86.56	13.85	13.27	13.56
90	87.27	87.44	87.36	12.73	12.57	12.64
105	86.25	86.51	86.38	13.55	13.50	13.53
120	84.38	84.90	84.64	15.62	15.12	15.37
135	78.24	79.80	79.02	20.58	22.40	21.49
150	56.03	57.19	56.61	43.97	43.01	43.49
L.S.D. 0.05	2.69	1.19	-	2.97	2.64	-

### Evaluation Study:

Data presented in Table (14) and Fig. (1) illustrated a comparative study of the performance of Zaghoul date palms in Kom-Ombo, Aswan (present study) and 4 other localities; Assiut, Giza, Qalyobia and Beheira (based on Abdalla *et al.*, 1990). Data indicated that the highest evaluation score 60.67% was obtained when Zaghoul date palm was grown in Kom-Ombo, Aswan followed by Giza (58.01%) and Qalyobia (55.61%) Governorates while the least evaluation score occurred when Zaghoul was grown in Beheira Governorate (46.00%). Assiut Governorate was just little higher than Beheira (53.6%).

It is known that best area for fresh fruit type of date palms in Egypt is at Nile Delta. In addition, Beheira Governorate is the leading state in Egypt for Zaghoul cultivar, though evaluation score was contradicted with such concepts. Meanwhile, Assiut and Aswan or southern

Governorate are characterized for semi- and dry-cultivars but had higher scores (particularly Kom-Ombo, Aswan than know areas for Zaghloul.

When one is to analyze the evaluation scores, it can be concluded the following:

- 1 - Zaghloul at Kom-Ombo, Aswan had higher values (scores) in earliness (71, 39, 37, 20 days earlier than Beheira, Qalyobia, Giza and Assiut, respectively), total sugars and tannins content meanwhile, Zaghloul at Kom-Ombo, Aswan scored the least values and fibers content.
- 2 - Zaghloul at Beheira had higher scores in fruit quality and yield meanwhile it lacks values in earliness, flesh thickness and seed weight %.
- 3 - Zaghloul at Assiut had high scores in earliness, yield while it lacks values in fruit weight, fibers and tannins content.
- 4 - Zaghloul at Giza had advantages in yield, fruit weight and content of fibers and tannins (lack value of total sugar).
- 5 - In Qalyobia, Zaghloul was high in yield, fruit weight, fibers and tannins but lacked in flesh thickness and seed weight %.

In conclusion, for horticulturists to grow Zaghloul in Kom-Ombo, Aswan, they should except low productivity of yield (by 50%) and some other poor quality (low flesh weight % and fibers content) but in return they can overcome such shortages as they would produce an extremely earlier crop when Zaghloul fruits appeared 71 days earlier than Beheira in addition to some fruit characteristics such as total sugars and low tannins content.

## REFERENCES

- Abdalla, M.Y., G.A. Said and H.M. El-Masry (1990). Effect of planting zone on major characteristics of Zaghloul date cultivar. *Zagazig J. Agric., Res.*, 17 (5A): 1621-1630.
- Association of Official Agricultural Chemists (1985). *Official Methods of Analysis*, A.O.A.C. 14<sup>th</sup>. Ed. pp. 496-500. Benjamin Franklin, Station Washington D.C., U.S.A.

- Black, C.A. (1965). *Methods of Soil Analysis*. Amer. Soci of Agron., Madison, Wisconsin, U.S.A.
- Brown, W. and M. Bahgat (1938). *Date Palm in Egypt*. Ministry of Agriculture, Hort. Section, Egypt. Booklet No. 24, 117 pp.
- Cruess, W.V. (1940). Dates and date products in Egypt and California. *J. Date Grower's*, Inst. 13: 20-21.
- Dawson, V.H.W. and A. Aten (1963). "Dates" handling, processing and packing. Rome F.A.O. of U.N. Development paper. 72, 156. In Hussein *et al.* 1979.
- El-Agamy, S.Z. (1970). *Studies on some varieties of guava*. M.Sc. Thesis, Fac. of Agric., Cairo University, 110 p.
- El-Kassas, Sh.E., T.K. El-Mahdi, A.A. El-Khowaga and Zynab Hamdy (1995). Response of Zaghloul date palms to certain treatment of pollination, flower thinning and bagging. *Assiut J. of Agric. Sci.* 26 (4): 167-178.
- Food and Agriculture Organization (1996). *Year Book of Agricultural Statistics*.
- Gomez, K.A. and A.A. Gomez (1984). *Statistical Procedures for Agriculture Research*. 2nd Ed. Wily, New York.
- Hussein, A.A., N.M. Gamal, G.M. Nour and S.S. Habib (1984). Evaluation of some date palm varieties grown in south Sinai Governorate. *Agric. Res. Review* 62 (3A): 289-303.
- Hussein, F., M.H. El-Kholy and T.A. Abo Said Ahmed (1993). Organic-Chemical constituents of some Egyptian dry date cultivars grown at Aswan. *Zagazig J. Agric. Res.* 20 (4): 1313-1321.
- Hussein, F., M.S. El-Katany and Y.A. Wally (1979). *Date Palm Growing and Date Production in the Arab and Islamic World*. Ain Shams press (In Arabic), Egypt.
- Hussein, M.A., H.M. Mahmoud and K.I. Ahmed Amen (1987). Effect of certain pollen storage treatments on bunch weight and fruit quality of Zaghloul dates. *Assiut J. of Agric. Sci.* 18 (2): 275-283.
- Jackson, M.L. (1958). *Soil Chemical Analysis*. Prentice Hall, Inc. U.S.A.

Kassem, A.A., M.R.M. Rabeh and H.A. Kassem (1994). The effect of bagging the spathes after pollination on yield and quality of Zaghloul and Samany dates. Zagazig J. Agric. Res. 21 (3B): 935-944.

Mougheith, M.G., I.A. Hassaballa and A.A. El-Ashrum (1976). Comparative studies on fruit development, quality and bunch characteristics at harvest of some Egyptian date cultivars. Annal of Agric. Sci. Moshtohor (5): 179-193.

Winton, A.L. and K.B. Winton (1958). The Analysis of Foods. John Wiley and Sons I.N.C., London, pp. 853-867.

### الملخص العربي

#### دراسة مقارنة لسلوك أحد الأصناف الرطبة من البلح عند زراعته في بيئة جافة

سمير زكى العجمى ، طلعت كامل المهدي ، عمر عبد الحارس خليل  
قسم البساتين ( فاكهة ) - كلية الزراعة - جامعة أسيوط

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كان الغرض من هذه الدراسة هو تقييم لسلوك صنف البلح الزغلول ( صنف رطب ) عند نموه في منطقة جافة في جنوب مصر وهي أسوان . ولقد عملت مقارنة لسلوك هذا الصنف تحت الدراسة مع مثيله المنزرع في الدلتا والجيزة ووسط الصعيد وشملت :

( أ ) الصفات الخضرية مثل طول وسمك ساق النخلة ، عدد الأوراق المتكونة على النخلة سنوياً وبعض صفاتها المورفولوجية .

( ب ) صفات الازهار وعقد الثمار مثل موعد انبثاق الأغاريض وعددها ونسبة العقد الأولى والنهائي .

( ج ) صفات المحصول مثل المحصول الكلى للنخلة ووزن السوباطة .

( د ) بعض الصفات الطبيعية والكيميائية للثمار أثناء نموها مثل وزن الثمرة وطولها وقطرها ونسبة المواد الصلبة الذائبة الكلية والحموضة والسكريات وغيرها .

وكانت أهم النتائج أن ثمار البلح الزغلول في منطقة كوم امبو بأسوان قد نضج مبكراً بفترات 20 ، 37 ، 39 و 71 يوم عن ثمار نفس الصنف المنزرعة في أسيوط والجيزة والقليوبية والبحيرة على الترتيب . كما أن وزن السوباطة والمحصول الكلى كان أقل في أسوان عنه في المناطق الشمالية . بالإضافة الى نقص بعض صفات الجودة في الثمار مثل زيادة وزن البذرة ونسبة الألياف . ولكن تبكير النضج في هذه المنطقة يعوض ذلك كثيراً من الناحية الاقتصادية .