



## Effect of Spraying Some Safe Substances on Yield and Fruits Quality of “Zaghloul” Date Palm

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### Abstract

The present study was conducted during 2012 and 2013 seasons on Zaghloul date palm fruits. Spathes were sprayed three times at growth start, after fruit setting and at one month later with four substances namely Amino acids enriched with micronutrients (Fe, Zn, Mn, B and Mo), Sugar alcohol enriched with micronutrients (B, Fe, Mn, Zn and N), Algae extract formulation containing (potassium oxide, phosphorus oxide, N, Zn, Fe and Mn) in concentration of 0.2% and Licorice root extraction (*Glycyrrhiza Glabra* L.) in concentration of 0.7%. Sprayed fruits were harvested at khalal stage in order to study the effect of all treatments on fruit quality of Zaghloul date palm. All treatments increasing (fruit weight, fruit dimensions, fruit volume, total soluble solids (°Brix), total sugars and total anthocyanin) as compared with control treatment. The best results with regard to fruit quality of Zaghloul date palms were obtained with spraying licorice root extract at three times.

**Keywords:** Zaghloul date palm, *Phoenix dactylifera* L., spraying, amino acids, sugar alcohol, algae extract, licorice root extract, *Glycyrrhiza Glabra* L., quality

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### Introduction

Date palm (*Phoenix dactylifera* L.) is one of the oldest fruit trees in the world. It is known as “tree of life” because of its resilience, its need for limited water inputs, its long term productivity and its multiple purpose qualities. In Egypt, dates are important traditional crops according to (FAO, 2009). The date palm is extensively cultivated for its edible fruit. It is used on both fresh and dry forms. Being rich in sugar it is a source of energy. Most of the carbohydrates in date in the form of fructose and glucose are easily absorbed by the human body (Al-Farsi *et al.*, 2005). Generally, whole dates are harvested and marketed at three stages of development: mature firm (Bisir or Khalal), full ripe (Rutab) and dry (Tamr). The decision for harvesting at one or other stage depends on cultivar characteristics, especially soluble tannins levels, climatic conditions and market demand (Glasner *et al.*, 1999). Amino acids with their ant-oxidative properties play an important role in plant defense against oxidative stress induced by unfavorable



conditions. They are responsible for enhancing the biosynthesis of proteins, plant pigments, vitamins and natural hormones such as IAA and ethylene and stimulating cell division (Sies, 1997). Amino acids as organic nitrogenous compounds are the building blocks in the synthesis of proteins, which are formed by a process in which ribosomes catalyze the polymerization of amino acids (Davies, 1982). Mixture of amino acids and micronutrients (15% amino acids, 2.9% F, 1.4% Zn and 0.7% Mn) in concentrations of 1.0 cm<sup>2</sup>/l improved quality of green bean (Abdel-Mawgoud *et al.*, 2011). Amino acid was very effective in improving yield and fruit quality of Balady mandarin trees (Faissal *et al.*, 2014). Sugars, alcohol sugars, organic acids and vitamins are very useful as indicators of metabolic activities in fruits and they indicate the changes in a qualitative structure of fruits. The variations in taste, firmness and appearance of fruits can be due to the alterations in contents and ratios of organic acids, sugars and alcohols (Doyon *et al.*, 1991). Sprayed with sugar alcohol formulation containing (0.2% B, 0.3% Iron, 3.2% Mn, 2% Zn and 5% N) improved yield and fruit quality (Abdel-Mawgoud *et al.*, 2011). Algae extract as a new bio fertilizer containing N, P, K, Ca, Mg and S as well as Zn, Fe, Mn, Cu, Mo, and Co, some growth regulators, polyamines and vitamins applied to improve nutritional status, vegetative growth, yield and fruit quality in different orchard as well as vineyards. In addition, bio-fertilization is very safe for human and environment to reduce pollution and decrease mineral usage fertilization as well as saving fertilization cost and using algal extract above 50% which increased TSS, and total sugars and decreasing total acidity rather than control (Eman and Abd-Allah, 2008). Licorice (*Glycyrrhiza glabra* L.), the root has been used medically for many years (Gibson, 1978). Licorice is a ligneous perennial shrub growing in mediterranean region and Asia widespread in Turkey, Italy, Spain, Russia, Syria, Iran and China (Asada and Yoshikawa, 2000). Licorice has been reported to have antioxidant, antibacterial, antiviral and expectorant activity (DerMarderosian, 2001). Microelements had also important role in fruit set, retention, development and cause efficient yield and quality improvement (Khan *et al.*, 1993). The objectives of this study were to evaluate the effectiveness of spraying fruits with amino acids, sugar alcohol, algae extract and licorice extract for increasing productivity and improving fruits quality of Zaghoul date palm.

## Materials and methods

### 1. Plant materials:

This investigation was carried out during two successive seasons in 2012 and 2013 on Zaghoul date palms (soft cultivar). It is grown on the experimental farm at the Central laboratory for Research and Development of Date palm, Agriculture Research Center (ARC), Giza, Egypt. The experiment was designed as a completely randomized block design each treatment was replicated three times, one palm per each. Therefore, fifteen

uniform in vigor Zaghoul date palms of 20 years old received normal cultural practices were selected for achieving of this study.

## 2. Pre-harvest treatments:

1. Spraying of amino acid enriched with micronutrients (Fe, Zn, B, Mo and Mn) at (2.0 cm/l)
2. Spraying of sugar alcohol enriched with micronutrients (B, Fe, Mn, Zn and N) at (2.0 cm/l)
3. Spraying of green algae enriched with (potassium oxide, phosphorus oxide, N, Zn, Fe and Mn) at (2.0 cm/l)
4. Spraying of licorice root extraction (*Glycyrrhiza Glabra* L.) at (7.0 g/l)
5. Control (untreated fruits).

### 2.1. Purchase and preparations of pre-harvest substances:

**2.1.1. Amino acids:** Amino acid solution (Amino Tec (Mix), as commercial name) obtained from Techno green for industrial production) company having the following composition: Free amino acid (7.4%), soluble iron (1.2%), soluble zinc (0.8%), soluble manganese (1%), soluble boron (0.1%) and soluble molybdenum (0.1%) W/ V. The amino acids solution (2 cm) was mixed with 1000 mL distilled water.

**2.1.2. Sugar alcohol:** sugar alcohols solution (Manni-Plex, as commercial name) obtained from Techno green for industrial production) company having the following composition: (Mannitol, Sorbitol, Glycerol) and minerals (zinc 2.4%, manganese 3%, iron 1.2% and boron 0.3%). The sugar alcohol solution (2 cm) was mixed with 1000 mL distilled water.

**2.1.3. Algae extract formulation:** Algae extract (oligo-x, as commercial name) obtained from Agas (Arabian group for agricultural service) company having the following composition: Oligo-x a mixture of green algae and minerals (potassium oxide 12%, phosphorus oxide 0.5%, N 1%, Zn 0.3%, Fe 0.2% and Mn 0.1%). The alga extract solution (2 cm) was mixed with 1000 mL distilled water.

**2.1.4. Licorice root extract:** The licorice powder (7g) was mixed with 1000 mL distilled water. Mixtures were heated to 60°C under stirring for 4 hour and after cooling down, the solution was filtered with a fluted filter and the licorice extract stored in the refrigerator at 4°C until the absorptive bubble separation then next day spraying fruits (Short *et al.*, 2005).

All treatments were sprayed three times at growth start (1st week of Mar.), after fruit setting (last week of April) and at one month later (last week of May) in both seasons and

were harvested randomly at khalal stage in first September during 2012 and 2013 seasons. The fruits were harvested when attained full color (bright red). Fruits were transported to the laboratory of Agriculture Development Systems (ADS) project in the Faculty of Agriculture, Cairo University without signs of mechanical damage and deterioration were selected and standardized showing homogeneous size, color and form. The selected fruits from each treatment, washed, air dried and placed into plastic baskets then randomly distributed into 5 groups.

### 3. Quality assessments:

#### 3.1. Physical properties:

- 3.1.1. Yield and bunches weight:** Each bunch was weighed independently using a weighing balance to calculate the total yield at harvest, which was expressed in kilograms (kg).
- 3.1.2. Fruit weight (g):** A digital balance was used to determine the weight of the fruits with an accuracy of  $\pm 0.01$  g.
- 3.1.3. Fruit dimensions (length & diameter):** Fruit length was measured from the end of the fruit to the top of the shoulder which was expressed in (cm). While, fruit diameter was measured at the broadest point of the fruit shoulder and stated in (cm).
- 3.1.4. Fruit volume (cm<sup>3</sup>):** Because the volume of 1 g pure water is equivalent to 1 cm<sup>3</sup>, this study used pure water to determine the real volume of the date fruits.

#### 3.2. Chemical properties:

- 3.2.1. Total soluble solids (°Brix):** At room temperature, soluble solids were measured with a digital refractometer (Atago, Japan) and expressed in (Brix°).
- 3.2.2. Total sugars content:** The phenol sulfuric acid method was used to determine the total sugar content in the methanol extract, and the concentration was determined as g/100 g fresh weight using the method described by (Smith *et al.*, 1956).
- 3.2.3. Anthocyanin content (mg/ 100g FW):** Fruit peel tissue was determined according to (Husia *et al.*, 1965).

### 4. Statistical analysis:

The current study followed a complete randomized block design with factorial analysis, with three replicates for each treatment. The obtained data were subjected to analysis of variance (ANOVA) according to Snedecor and Cochran (1980) using SAS software (2006) and significant between means were differentiated and tested by multiple range test of Duncan (1955) at significance level of 5%.

## Results and discussion

### 5. Quality assessments:

#### 5.1. Physical properties:

##### 5.1.1. Palm yield, bunches weight and fruit weight:

Data in (Table 1) show that, the use of pre-harvest application played a significant influence on increasing total yield (Kg) per palm, bunch weight, fruit weight of “Zaghloul” date palm cultivar during two growing seasons (2012 and 2013). Moreover, the highest significant values of yield, bunch weight, and fruit weight were recorded of licorice root extract treatments followed by sugar alcohol followed by algae extract followed by amino acids. Licorice root extract recorded the highest total yield (207.66 and 238.66 kg/ palm) and bunch weight (20.96 and 23.86 kg) fruit weight (28.32 and 29.52g) while the lowest total yield was in the control treatment (109.66 and 111.00 kg/ palm), bunch weight (10.96 and 11.10 kg/ palm and fruit weight (18.00 and 18.95 g) in the two seasons, respectively. The previous finding on Balady mandarin proved using amino acids was very effective in improving yield (Ahmed *et al.*, 2014). In this concern, Abdel-Mawgoud *et al.* (2011) reported that sprayed with a sugar alcohol formulation containing (0.2% B, 0.3% Iron, 3.2% Mn, 2% Zn and 5% N) improved growth parameters and fruit quality. In addition, algae extract has a positive effect on fruit setting, yield and fruit quality (Jaswant *et al.*, 1994). The present results proved that spraying licorice root extract gave the highest yield per palm, bunch weight and fruit weight of Zaghloul date palm.

**Table (1):** Effect of safe pre-harvest treatments on total yield, bunch weight and fruit weight of “Zaghloul” date palm during 2012 and 2013 seasons

Pre-harvest treatments	Yield (kg/palm)		Bunch wt.(kg)		Fruit weight (g)	
	2012	2013	2012	2013	2012	2013
Amino acids (0.2%)	148.33 <sup>c</sup>	161.00 <sup>c</sup>	14.8 <sup>c</sup>	16.10 <sup>c</sup>	25.17 <sup>d</sup>	26.27 <sup>c</sup>
Sugar alcohol (0.2%)	182.00 <sup>b</sup>	200.00 <sup>b</sup>	18.20 <sup>b</sup>	20.00 <sup>b</sup>	25.80 <sup>b</sup>	26.93 <sup>b</sup>
Algae extract (0.2%)	164.3 <sup>c</sup>	190.00 <sup>b</sup>	16.43 <sup>c</sup>	19.00 <sup>b</sup>	25.46 <sup>c</sup>	26.69 <sup>b</sup>
Licorice root extract (0.7%)	207.66 <sup>a</sup>	238.66 <sup>a</sup>	20.96 <sup>a</sup>	23.86 <sup>a</sup>	28.32 <sup>a</sup>	29.51 <sup>a</sup>
Control	109.66 <sup>d</sup>	111.00 <sup>d</sup>	10.96 <sup>d</sup>	11.10 <sup>d</sup>	18.00 <sup>e</sup>	18.95 <sup>d</sup>

Means having the same letter (s) within a column are insignificantly different at 5% level.

### 5.1.2. Fruit dimensions (length & diameter) and fruit volume:

All pre-harvest treatments increased significantly fruit dimensions and volume as compared with control in the two studied seasons (Table 2). The best results concerning fruit length were obtained by spraying licorice root extract treatments followed by sugar alcohol followed by algae extract followed by amino acids. Licorice root extract gave the highest fruit diameter (3.22 & 3.54cm); fruit length (6.67 and 6.85 cm) and fruit volume (23.15 and 23.30 cm<sup>3</sup>) and the lowest fruit diameter (2.06 and 2.18 cm); fruit length (4.46 and 4.52 cm) and fruit volume (11.66 and 11.77 cm<sup>3</sup>) were recorded in control fruits in both seasons, respectively. From the obtained results, mixture of amino acids and micronutrients such as iron, zinc, manganese, boron and affect the elongation of the cell division and cell enlargement as well as the biosynthesis of carbohydrates and proteins, thus increasing weight, dimensions and volume of fruits. Many previous studies demonstrated that Mixture of amino acids and micronutrients (15% amino acids, 2.9% F, 1.4% Zn and 0.7% Mn) improved growth parameters (Abdel-Mawgoud *et al.*, 2011).

**Table (2):** Effect of safe pre-harvest treatments on diameter, length and fruit volume of “Zaghloul” date palm during 2012 and 2013 seasons

Pre-harvest treatments	Fruit diameter (cm)		Fruit length (cm)		Fruit volume (cm <sup>3</sup> )	
	2012	2013	2012	2013	2012	2013
Amino acids (0.2%)	2.52 <sup>d</sup>	2.70 <sup>bc</sup>	5.08 <sup>d</sup>	5.22 <sup>d</sup>	22.20 <sup>d</sup>	22.30 <sup>d</sup>
Sugar alcohol (0.2%)	2.88 <sup>b</sup>	2.93 <sup>b</sup>	5.67 <sup>b</sup>	5.78 <sup>b</sup>	22.82 <sup>b</sup>	22.92 <sup>b</sup>
Algae extract (0.2%)	2.68 <sup>c</sup>	2.62 <sup>c</sup>	5.28 <sup>c</sup>	5.34 <sup>c</sup>	22.40 <sup>c</sup>	22.51 <sup>c</sup>
Licorice root extract (0.7%)	3.22 <sup>a</sup>	3.54 <sup>a</sup>	6.67 <sup>a</sup>	6.85 <sup>a</sup>	23.15 <sup>a</sup>	23.30 <sup>a</sup>
Control	2.06 <sup>e</sup>	2.18 <sup>d</sup>	4.46 <sup>e</sup>	4.52 <sup>e</sup>	11.66 <sup>e</sup>	11.77 <sup>e</sup>

Means having the same letter (s) within a column are insignificantly different at 5% level.

### 5.2. Chemical properties:

The present results (Table 3) indicated that, all safe pre-harvest treatments more effective statistically in increasing total soluble solids in (°Brix) and total sugars content and total anthocyanin content as compared with untreated fruits. Dates sprayed with licorice root extract gave the highest significant total soluble solids content (37.89 and 39.01 °Brix), total sugar content (30.53 and 31.84 g/100g FW) and total anthocyanin content (22.25 and 23.39 mg/100g FW) in the first and second seasons, respectively). In contrast, the lowest total soluble solids in (°Brix) were observed at control fruit which recorded (17.42 and 19.14 °Brix), total sugar content (17.06 and 18.04 g/ 100g FW) and total anthocyanin content (14.13 and 15.28 mg/100g FW) in the first and second seasons, respectively.



Many of the previous finding studied that application of amino acids was very effective in improving fruit quality in terms of increasing total sugars % in relative to the control treatment (Faissal *et al.*, 2014). Meanwhile, algae extract has a positive effect on fruit quality (Jaswant *et al.*, 1994). From the obtained results, spraying licorice root extract gave the highest value of total sugars and fruit quality.

**Table (3):** Effect of safe pre-harvest treatments on total sugars, tannins and anthocyanin of “Zaghloul” date palm during 2012 and 2013 seasons

Pre-harvest treatments	Total soluble solids (°Brix)		Total sugars (mg/100g FW)		Total anthocyanin (mg/100g FW)	
	2012	2013	2012	2013	2012	2013
Amino acids (0.2%)	31.28 <sup>d</sup>	32.92 <sup>d</sup>	25.94 <sup>d</sup>	26.94 <sup>d</sup>	17.37 <sup>d</sup>	18.29 <sup>d</sup>
Sugar alcohol (0.2%)	36.03 <sup>b</sup>	37.57 <sup>b</sup>	29.17 <sup>b</sup>	30.36 <sup>b</sup>	20.79 <sup>b</sup>	21.87 <sup>b</sup>
Algae extract (0.2%)	32.85 <sup>c</sup>	34.76 <sup>c</sup>	26.81 <sup>c</sup>	27.89 <sup>c</sup>	18.17 <sup>c</sup>	19.18 <sup>c</sup>
Licorice root extract (0.7%)	37.89 <sup>a</sup>	39.01 <sup>a</sup>	30.53 <sup>a</sup>	31.84 <sup>a</sup>	22.25 <sup>a</sup>	23.39 <sup>a</sup>
Control	17.42 <sup>e</sup>	19.14 <sup>e</sup>	17.06 <sup>e</sup>	18.04 <sup>e</sup>	14.13 <sup>e</sup>	15.28 <sup>e</sup>

Means having the same letter (s) within a column are insignificantly different at 5% level.

### Conclusion

All pre-harvest treatments were very effective for increasing yield and bunch weight; and improving fruit quality in terms of increasing (fruit weight, fruit dimensions, fruit volume, total soluble solids (°Brix) and total anthocyanin) as compared with control treatment. All treatments increasing are safe and simple which could be increased productivity and improving fruits quality of Zaghloul date palm.

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## تأثير رش بعض المواد الآمنة على المحصول وجودة ثمار نخيل البلح الزغلول

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### الملخص العربي

أجريت هذه الدراسة خلال موسمي ٢٠١٢، ٢٠١٣ على ثمار نخيل الببح صنف الزغلول. تم رش الثمار في ثلاث مواعيد، بداية النمو وبعد عقد الثمار ثم بعد شهر بأربعة مواد مختلفة وهي، أحماض أمينية غنية بالعناصر الصغرى (الحديد، المنجنيز، الزنك، البورون، المولبدنيوم والمنجنيز) - سكريات كحولية غنية بالعناصر الصغرى (البورون، الحديد، المنجنيز، الزنك والنيتروجين) - مستخلص طحالب بحرية يحتوى على (أكسيد بوتاسيوم، أكسيد فوسفور، نيتروجين، زنك، حديد و منجنيز) وذلك بتركيز ٠.٢% ومستخلص جذور العرقسوس وذلك بتركيز ٠.٧%. تم حصاد الثمار المرشوشة في مرحلة الخلال لدراسة تأثير تأثير هذه المعاملات على تحسين جودة ثمار نخيل البلح الزغلول، وظهر لكل المعاملات تأثير فعال جدا في تحسين جودة الثمار حيث زادت من (وزن الثمرة، أبعاد الثمرة، حجم الثمرة، المواد الصلبة الذائبة الكلية، السكريات الكلية و نسبة الأنثوسيانين) وذلك مقارنة بالثمار الغير معاملة. وقد تم الحصول على أفضل النتائج فيما يتعلق بجودة ثمار نخيل البلح الزغلول عند رش الثمار بمستخلص جذور العرقسوس ثلاث مرات بتركيز ٠.٧%.

**الكلمات الدالة:** نخيل البلح الزغلول - الرش - الأحماض الأمينية - السكريات الكحولية - مستخلص الطحالب البحرية - مستخلص جذور العرقسوس - الجودة