



## **Effect of the Bio-activator Milagro on Pollination Efficiency and Fruit quality of Zaghloul Date Palm Cultivar**

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**Abstract:** This work was carried out during two successive seasons (2011 and 2012) on Zaghloul date palm cultivar grown in Abo-Rawash region El-Giza Governorate, Egypt. Uniform date palms at 22 years old were pollinated at 1<sup>st</sup> week of April by dusting female florescence for three times using 5 g of (2g. pollen grains + 3g filler material), (2g Milagro + 3g filler material) and (1g pollen grains + 1g Milagro + 3g filler material). The first was applied in dust form as soon as female inflorescence opened. The second and third treatments were carried out after month and two months from initial applied using the same rates with of the Bio-activator Milagro only, to study the effect it on pollination efficiency and fruit quality respectively.

Results showed that different treatments markedly improved pollination process, yield and fruit quality of Zaghloul date palm. Data also indicated that combined treatment of pollen grains + Milagro revealed the highest effect in increasing fruit set, fruit retention %, yield/palm (Kg) and fruit quality resembled by its physical and chemical properties. On the other hand, all tested treatments dates showed no statistical difference in total acidity and tennis percentages values. These results of this study concluded that the bio-activator Milagro as non-chemical tool, low cost and had potential strategy for improving pollination, yield and fruit quality of Zaghloul date palm cultivar as well as considered to be environmentally safe.

**Key words:** Zaghloul date palm, pollination, bio activator, yield, fruit quality.

### **Introduction**

The date palm (*Phoenix dactylifera*) is the most common fruit tree grown in semi-arid and arid regions. <sup>1</sup>Egypt is considered the leading country among the top ten date producers (1,130,000 tones); it produces about 18% of the world production where Arab countries produce about 76% of the total international production. In this respect, Egypt ranked the first among Arab countries. Zaghloul dates is the best date varieties suitable for marketing in Egypt at the Bisir or Khalaal stage, which are the most economically important soft cultivars grown in Egypt.

In date palm orchards, pollination is a principal cultural practice where it classified as a dioeciously species with male and female flowers produced on separate trees<sup>2</sup>. Though dates are naturally wind pollinated, humans have assisted in this pollen transfer inside each female spathe just it opens, since great antiquity by using limited quantity of pollen grains as basis to justify the use of dusters and sprayers as mechanical pollinators.

Therefore, development of artificial hand pollination using new techniques becomes a necessary operation as a mean to ensure good yield<sup>3, 4</sup>. Applying natural biological activators like Milagro has made plant

nutrition a central element of farming practice. It improves plant growth in all parts as a tonic for physiological processes in particular to enhance hormonal photosynthesis that increases yield and improves fruit quality characteristics<sup>5, 6</sup>. Its bio-stimulant effect comes from that Milagro is a natural growth activator that extracted from pollen flowers of cabbage has a broad effects. This product is reflecting the effect of Auxins, Cytokinins, Gibberellins, Ethylene, Hydrogen Sinamed and Humic, where its impact depends on the time of trans-action<sup>7, 8</sup>.

Thus, the target of the present work was to assess the effects of a commercially available extract of the bio-activator namely Milagro with or without pollen grains as a safe way for enhancing pollination process, increase fruit set, fruit retentions, yield and improving fruit quality of Zaghoul date palm cultivar.

## Materials and Methods

### Date Palm Orchard

This study was carried out during two successive seasons (2011 & 2012) on 22 years old Zaghoul date palm Cv. (*Phoenix dactylifera* L.) grown in sandy soil at 8 x 8 meters a part under drip irrigation system. Tested palms were grown in a private orchard located at Abo-Rawash region, El-Giza Governorate, Egypt under conventionally accepted practices. The experiment was designed as randomized complete block design with 3 replicates (palm/replicate) and grouped under 3 treatments. Soil texture was sandy which characterized by 59.8% Sand, 22.4% Silt, 14.2% Clay, 3.6% organic matter, 8.4 pH, 1.5 dS/m EC, 5.2% CaCO<sub>3</sub>, 0.6 % P, 0.86% K, 4.2% Ca, 1.1% Mg, 7.8 ppm Fe, 3.2 ppm Mn and 3.4 ppm Zn. The biological activator Milagro in organic micro scale form was mixed with filler material and dust applied to female inflorescence.

### Selected Palm Dates were Equally Shared between the Following Treatments

Nine selected female uniform date palm trees were pollinated during 1<sup>st</sup> week of April as soon as it opened by dusting female inflorescence using 5 g of (2g pollen grains + 3g filler material) or (2g Milagro + 3g filler material) or (1g pollen grains + 1g Milagro + 3g filler material) as soon as it opened. These treatments (the 2<sup>nd</sup> and 3<sup>rd</sup>) were re-conducted (using the same rates “with Milagro” alone) after month and two months from initial treatment, in order to pollination efficiency, increase yield and improve fruit quality.

### The Studied Measurements

**1. Fruit set percentage:** The number of set fruits was recorded and fruit set % calculated<sup>9</sup>.

**2. Fruit retention percentage:** <sup>10</sup> Using the following equation:

|   |
|---|
| Total number of the retained fruits/bunch |
| Total number of nodes/bunch               |

**3. Total yield/palm:** Bunches were harvested and weighted during the 2<sup>nd</sup> week of September at the peak of color development. Number of bunches/palm was recorded and average of yield weight/palm was calculated (Kg).

**4. Fruit quality:** Twenty fruits were randomly selected from each bunch, for determination of physical and chemical fruit properties.

#### a) Physical Characteristics

Fruit length (cm), diameter (cm), shape (L/D), volume (cm<sup>3</sup>), weight (g) and flesh/fruit were assessed.

#### b) Chemical Characteristics

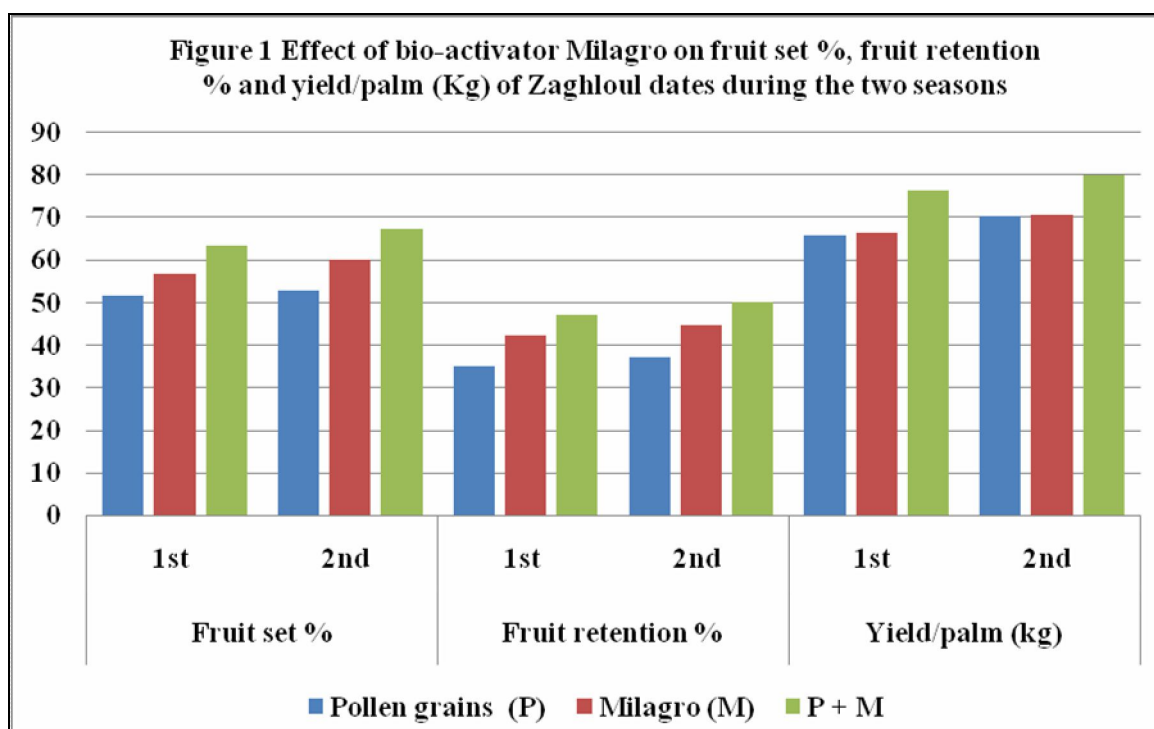
- **Total Sugars (g/100g fresh weight)**<sup>11</sup>
- **Reducing sugars:** <sup>12</sup>Using Methanolic extract.
- **Non-reducing sugars:** Was determined by differentiate between total and reducing sugars.

- **Total soluble tannins (g/100g fresh weight):** Was determined in fruit tissue (including skin and flesh) using Folin-Ciocalteu and sodium carbonate reagent and measured for absorbance <sup>13</sup> using a UV-V Spectrophotometer at 750 nm.
- **Soluble Solid Contents (SSC):** Determined in fruit juice by hand refractometer.
- **Total Acidity Percentage (TA %):** <sup>12</sup>Estimated as malic acid /100 ml juice.

**Statistical Analysis:** Data subjected to analysis of variance to determine the significant differences and Duncan's multiple range test was used for means comparison when F test significant at P 0.05<sup>14</sup>.

## Results and Discussion

### 1- Fruit Set, Fruit Retention and Yield/Palm(kg)



#### Fruit set %

Data in Figure (1) cleared that the best value percentages were obtained in dates combined pollinated with Milagro + pollen grains reflecting (63.4% and 67.4%) in the first and second seasons, respectively followed by the sole pollinated treatment with Milagro (56.7% and 60.0%) as compared with pollen grains alone (51.5% and 52.8%) consecutively.

#### Fruit retention %

Obtained data also in Figure (1) revealed that best treatments gave the highest significant fruit retention % in both seasons were obtained in dates pollinated with Milagro + pollen grains (47% and 50%) followed by the sole pollinated treatment with Milagro (42.3% and 44.7%) as compared with pollen grains treatment (35% and 37%).

#### Yield/palm (kg)

Figure (1) demonstrates that the combined effect of (pollen grains + Milagro) gave the highest significant value of yield/palm (76.3 and 80.0 kg) as compared with sole pollinated using either Milagro (66.3 and 70.7 kg) or pollen grains (65.7 and 70.3 kg) for the first and second season, respectively. On the other hand, no significant differences were noticed between sole treatments used under study in this respect for both

seasons. Finally, combination treatment with P+M caused the highest effect in increasing fruit set%, fruit retention % and yield/palm followed by sole pollinated with Milagro, while the lowest increase was obtained from pollen grains treatment alone. These results are in harmony with those<sup>2, 15, 16</sup>.

The enhancement in fruit set, fruit retention and yield/date palm of Zaghoul cv. by pollination with either Milagro alone or combined with pollen grains may be attributed to its effects in the processes of photosynthesis, Auxin, Cytokinin, Gibberellins, Ethylene, Hydrogen Sinamed and Humic that progress the formation and movement of natural hormones which are vital to improvement of cell division, especially in the meristematic tissues. These findings are in accordance with<sup>10, 17, 18, 19, 20</sup>.

## 2- Physical Characteristics

**Table 1 Physical characteristics of Zaghoul date fruits as affected by the bio activator Milagro (2011 & 2012 seasons)**

| Treatments          | Non reducing sugar (%) | Reducing sugar (%) | Total sugar (%) | Tannins (%)  | SSC (%)      | Total Acidity (%) |
|---------------------|------------------------|--------------------|-----------------|--------------|--------------|-------------------|
| First season        |                        |                    |                 |              |              |                   |
| Pollen grains       | 5.07                   | 61.0               | 66.0            | 0.45         | 19.9         | 0.33              |
| Milagro (M)         | 5.40                   | 59.9               | 65.3            | 0.44         | 19.9         | 0.33              |
| P + M               | 5.50                   | 62.0               | 67.5            | 0.44         | 21.0         | 0.33              |
| LSD <sub>0.05</sub> | 0.203                  | 0.334              | 0.287           | 0.027        | 0.124        | 0.023             |
| Second season       |                        |                    |                 |              |              |                   |
| Pollen grains       | 5.07                   | 62.0               | 67.1            | 0.51         | 22.1         | 0.32              |
| Milagro (M)         | 5.50                   | 63.0               | 68.6            | 0.50         | 22.5         | 0.30              |
| P + M               | 5.60                   | 65.0               | 70.6            | 0.50         | 23.0         | 0.30              |
| LSD <sub>0.05</sub> | <b>0.304</b>           | <b>0.204</b>       | <b>0.128</b>    | <b>0.022</b> | <b>0.653</b> | <b>0.023</b>      |

Means followed by the same letter within each column of each category are not significantly differ from each other at 5% level.

### Fruit length (cm)

Date in Table (1) illustrated that the highest significant fruit weight was obtained as pollen grains combined with Milagro followed by the sole treatment of Milagro as compared with the pollen grain treatment alone. This hold was true for both seasons.

### Fruit diameter (cm)

Obtained results indicated that Table (1) date palms pollinated with Pollen grains + Milagro recorded the highest increment in fruit diameter (2.80 and 2.90 cm) followed by sole treatments of either pollen grain (2.70 and 2.70 cm) or sole treatment with Milagro in the second season (2.70cm) .

### Fruit shape index (L/D)

Data in Table (1) revealed that Zaghoul cv. treated with Pollen grains or Milagro or combination of them, were similar in shape with non significant differences between its L/D ratios, this hold true for both seasons.

### Fruit weight (g)

Data indicated that Table (1) date palms treated with (pollen grains + Milagro) showed highest statistical values (22.8 and 23.7g). Also, dusting with bio-Milagro induced equally higher significant increment in fruit weight (22.5 and 24.0g) as compared with pollen grain one (19.5 and 22.3g).

### Fruit volume (cm<sup>3</sup>)

Table (1) clear that Fruit volume was significantly higher as a result of applying pollen grains + Milagro (22.4 and 24.0 cm<sup>3</sup>), for both seasons followed by Milagro treatment (22.0 and 23.0 cm<sup>3</sup>), where pollen grains treatment revealed equal values with Milagro one in the second season.

### Flesh/fruit %

Data in Table (1) indicated that the best results were significantly obtained as dates were combined pollinated with pollen grains + Milagro (83.3 and 82.8 %) followed in descending order by sole application of pollen grains (82.3 & 82.1 %), in the 1<sup>st</sup> and 2<sup>nd</sup> seasons, respectively. Regarding pollination with sole Milagro treatment, results recorded the third in this respect.

### Bunch weight (kg)

In the first season, obtained data show that Table (1) dusting with (P+M) gave the highest significant weight bunch weight (27.7kg) followed by the sole treatment of Milagro (26.2kg) as compared with pollen grains treatment (22.9kg). Mean while in the second season, date palms treated with either (pollen grains + Milagro) or Milagro alone showed the highest significant bunch weight with statistically equal values (29.0 and 28.0kg) as compared with pollen grains treatment (25.0kg).

The improvement in mentioned aspects of physical characteristics for pollinated date Cv. Zaghoul by the bio- activator Milagro as combined with pollen grains may be attributed to its effects in stimulating biosynthesis of organic materials especially carbohydrates and proteins, and enhancement the formation and movement of natural hormones which are vital to improvement of cell division and cell enlargement, especially in the meristematic tissues<sup>18</sup>. These results are also in harmony with<sup>21, 22, 23, 15, 16</sup>.

## 3- Chemical Characteristics

### Non reducing sugar (%)

**Table 2 Effect of the bio activator Milagro on the chemical properties of Zaghoul date fruits (2011& 2012 seasons)**

| Treatments          | Fruit length (L/cm) | Fruit diameter (D/cm) | Fruit shape (L/D) | Fruit weight (g) | Fruit volume (cm <sup>3</sup> ) | Flesh/ Fruit W/w (%) | Bunch weight (Kg) |
|---------------------|---------------------|-----------------------|-------------------|------------------|---------------------------------|----------------------|-------------------|
| First season        |                     |                       |                   |                  |                                 |                      |                   |
| Pollen grains       | 5.63                | 2.70                  | 2.09              | 19.5             | 21.3                            | 82.3                 | 22.9              |
| Milagro             | 5.80                | 2.60                  | 2.23              | 22.5             | 22.0                            | 81.0                 | 26.2              |
| P + M               | 6.40                | 2.80                  | 2.29              | 22.8             | 22.4                            | 83.3                 | 27.7              |
| LSD <sub>0.05</sub> | 0.124               | 0.023                 | N.S               | 0.424            | 0.178                           | 0.492                | 0.578             |
| Second season       |                     |                       |                   |                  |                                 |                      |                   |
| Pollen grains       | 5.80                | 2.70                  | 2.15              | 22.3             | 23.0                            | 82.1                 | 25.0              |
| Milagro             | 6.00                | 2.70                  | 2.22              | 24.0             | 23.0                            | 81.5                 | 28.0              |
| P + M               | 6.50                | 2.90                  | 2.24              | 23.7             | 24.0                            | 82.8                 | 29.0              |
| LSD <sub>0.05</sub> | 0.124               | 0.124                 | N.S               | 0.34             | 0.167                           | 0.445                | 2.267             |

Means followed by the same letter within each column of each category are not significantly differ from each other at 5% level.

Obtained data indicated that Table (2) fruits from palms treated with Pollen grains contained less non reducing sugar values than those treated with either Milagro ( 5.40 and 5.50%) or pollen grains + Milagro (5.50 and 5.60%). The lowest values were obtained as dates pollinated with pollen grains only (5.07 %).

### Reducing sugars (%)

It could be noticed that Table (2) best results were statistically obtained as tested cv. pollinated with pollen grains + Milagro (62.0 and 65.0 %) during both seasons, consecutively. followed by pollen grains alone

(61.0 %) as compared with sole treatment of Milagro (59.9%). On the other hand, pollen grains arranged the second during the first season (62.0%) and replaced with Milagro one in the second season (63.0).

#### **Total sugars (%)**

From obtained data, it is noticed that Table (2) trend of total sugars was similar to those of reducing and none reducing one.

#### **Tannins (%)**

It could be noticed from Table 2 that total soluble tannins values were statistically similar for different tested treatments in both seasons.

#### **Soluble Solid Content (SSC %)**

The data in Table (3) indicate that (Pollen grains + Milagro) treatment gave fruits with significant higher SSC values followed by either Milagro or Pollen grains. This hold was true for both seasons.

#### **Total Acidity (TA %)**

It is quite evident from Table (2) that all pollinated dates showed no statistical differences in TA values for both seasons.

Generally, the above results disclosed that Pollen grains enhanced the highest improvement of most chemical properties under study as combined with the bio- activator Milagro. Similar results were reported by<sup>17, 2</sup>.

The progress in contents of reducing, total sugars and total soluble solids as well as reduction in total acidity, tannins and non reducing sugars in juice of Zaghloul date palm cultivar as pollinated with the growth activator Milagro alone or combined with pollen grains, may be attributed to the effect of its natural hormones. It improves growth in all parts of the plant as a tonic for physiological processes in particular to enhance the process of photosynthesis and increases the yield moreover improves the quality characteristics. Similar results were reported by many authors<sup>24, 25, 20, 15, 16</sup>.

### **Conclusion**

It can be concluded that the natural bio-activator Milagro has potential strategy for improving pollination process, yield and fruit quality of Zaghloul date palm *cv.* as dusting female inflorescence with pollen grains at rate (1g. pollen grains + 1g Milagro + 3g filler material). Besides, its safe effect as non-chemical tool environmentally and low cost.

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