Evaluation the efficacy of nano-fertilization and Disper osmotic in treating salinity of irrigation water in quality and productivity properties of date palm *Phoenix dactylifera* L.

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**Abstract.** The study was conducted during two growth seasons (2018 and 2019) at the Al Husseiniya date palm station/ Horticulture and Forestry Department/ Karbala Governorate. The experiment included 54 with two cultivars date palm trees (27 trees of Khastawi cultivar and 27 of Zahdi cultivar). Three concentrations of nano-fertilizer (IQ Combi) which included (0, 0.5 and 1 g. L⁻¹) were tested. In addition, three concentrations of bio-nutritious Disper Osmotic GS (0, 1 and 2 g. L⁻¹) were used. The results showed that there were significant differences between Khastawi and Zahdi cultivars in the percentage of fruits holding, with the highest percentage of hold fruits recorded in Zahdi cultivar (73.07%). In case of nano-fertilizer concentration of (1 g. L⁻¹) was superior in producing the highest percentage of hold fruits (77.46%), compared with other concentrations. Moreover, Disper Osmotic gave the highest percentage of fruit holding at 2 g. L⁻¹(76.09%). Zahdi cultivar was superior in the mean of fruit flesh weight, length and weight of fruits (6.346 g, 3.207 cm, 7.514 g). Application of nano-fertilizer showed a significant effect in increasing the mean of fruit flesh weight, length and weight of fruits with a concentration of 1 g. L⁻¹. Disper Osmotic was also increased the mean of fruit flesh weight, length and weight of fruits, where concentration of 2 g. L⁻¹ gave the highest rates (6.779 g, 3.167 cm, 7.786 g), respectively, compared with control treatment. The results were also showed that the percentage of fruit falling of Zahdi cultivar was 27.38% which significantly lower than Khastawi cultivar (35.28%). Treatment with nano-fertilizer at 1g L⁻¹ was significantly decreased the rate of fruit falling (28.09%). Also, Disper Osmotic at 2 g. L⁻¹ was decreased the rate of fruit falling (30.94%), compared with control treatment. The results showed that date palm cultivar was not significantly affected the maturity ratio. There was a significant difference in the fruit Bunch Weight, where Zahdi cultivar was superior in giving the highest mean of fruit Bunch Weight (11.664 kg, palm⁻¹). The results also showed superiority of nano-fertilizer by giving the highest fruit Bunch Weight (11.329 kg) at 1 g. L-1 palm⁻¹. While, Disper Osmotic has exceeded at concentration of 2 g. L⁻¹.palm⁻¹ significantly which gave giving the highest the highest fruit Bunch Weight (11.142 kg. palm⁻¹). Bilateral and trilateral interactions were also showed significant effects in all studied traits.
1. Introduction

The date palm *Phoenix dactylifera* L. belongs to the Arecaceae family, is one of the most valuable domesticated fruit trees growing in tropical and subtropical regions between latitudes (10 - 39º) north and south of the earth [1]. Salinity is one of the most serious issues in arid and semi-arid regions of the world, affecting the growth of fruit trees and their productivity including the quality of the fruits [2]. Although palm dates are one of the most tolerant fruit trees to salinity, their productivity decreases with increasing the salinity in the root area. Where, it is not recommended to cultivate date palm in areas that exceed salinity 7000 ppm [3]. In order to reduce the significant decline in growth and productivity of date palm trees and decrease the resulting damage from salt stress in agricultural lands irrigated with high salinity water, it is important to use some strategies to reduce the harmful effects of salinity, including the use of certain nutrients to promote absorption nutrients by trees and reduce salt stress [4]. Nanotechnology can be defined as the manipulation of matter with at least one dimension sized from 1 to 100 nanometers [5]. In the early 2000s, the nanotechnology methods garnered increased scientific and commercial attention, especially in agricultural fields that led to improve fertilizer efficiency and increase crop production dramatically [6]. Also, the Disper Osmotic fertilizer, which contains calcium, potassium, and some organic substances and free amino acids can be reduced the salt stress in both soil and plants. Thus, the main objectives of this study were to investigate the effect of type of fertilizer (nano manure and Disper osmotic) in increasing the resistance of date palms to salinity of irrigation water and to improve the physiological properties of date palm fruits of both Khastawi and Zahdi cultivars.

2. Materials and methods

The study was carried out during two seasons of growth (2018 and 2019) at the Al Husseiniya date palm station/ Horticulture and Forestry Department/ Karbala Governorate between latitudes (44-51 °) and longitudinal lines (32-37 °). 54 (14 years old) date palm trees (27 trees of Khastawi cultivar and 27 of Zahdi cultivar) with the similar vegetative growth and size. The date palms were irrigated with well water (electrical conductivity 6.64 dS.m⁻¹) using Drip irrigation. The salinity of the well water was adjusted to 20 dS.m⁻¹ when starting the experiment in 1/3/2018 by transferring the well water to a 3000-liter basin and NaCl was added to obtain the required concentration using the method described by [7] where each 625-640 ppm is equivalent to one desynm⁻¹. Drip irrigation system was then extended (20 L/h/dotted) with 3 large dotted per palm. Agricultural services including raking and removing the thorns and unifying the number of rows of palm fronds, with leaving 6 bunches. Rot disease palm pollen was controlled in the mid of February and both the lesser date moth and the dubas date tropiduchid were controlled using Malathion insecticide after 20 day. The spiders were also treated during May with the materxin plus according to the recommendations of the [8]. Palm trees both cultivars were fertilized with decomposed organic fertilizer (15 kg. Palm⁻¹) in January by making a trench around the palm and then fertilizer was added [9]. The palm trees of both cultivars were manually pollinated using pollen (Ghannami ahmar variety), which was cultivated in the same nursery on 18/3/2018 for Zahdi cultivar and 24/3/2018 for Khastawi cultivar, by placing 5 male spikes for each female spadix.

2.1 Experiment treatments

First: cultivars is represented by two cultivars of date palm trees (Khastawi and Zahdi). Second: nano-fertilizer (0, 0.5 and 1 g. L⁻¹). Third: Disper Osmotic GS with three concentrates (0, 1 and 2 g. L⁻¹). All fertilizers were combined with irrigation water and added in three in the first three batches at the time of vaccination Palm trees and the second batch after four weeks of vaccination and the third batch after eight weeks of vaccination by 60 liters. Palm⁻¹.

2.2 Attributes and measurements studied during the experiment:
2.2.1 Physical Characteristics of Date Palm Fruits:
Percentage of holding fruits, Fruit weight, seed weight, flesh weight, Fruit length, fruit diameter and fruit size

2.2.2 Productivity Characteristics of Date Palm Fruits:
Percentage of fruit falling, Maturity Ratio, Fruit Bunch Weight and Total quantity.

2.3 Statistical analysis:
Randomized complete Block Design (R.C.B.D) was used with three replicates. The first factor was cultivar (Khastawi and Zahdi), the second factor was the compost was nano-fertilizer IQ Combi with three application levels, and the third factor was Disper Osmotic GS, with three concentrations using three date palms per concentration. The results were analyzed using Genestat software (version 2007). The statistical differences between the coefficients were tested using the least significant difference L.S.D at the probability level of 0.05 [10].

3. Result:

3.1 Physical Characteristics of Date Palm Fruits

3.1.1 Percentage of fruit holding:
The results of Table (1) indicated that there were significant differences between the two cultivars Khastawi and Zahdi in the percentage of fruit holding, where Zahdi cultivar was superior in giving the highest percentage of fruit holding (73.07%), compared to fruit holding of Khastawi cultivar which was 70.15%. In case of nano-fertilizer, the concentration of (1 g. L$^{-1}$) was superior in producing the highest percentage of hold fruits (77.46%), compared with other concentrations and control treatment which gave 64.6% as a percentage of fruit holding. Disper Osmotic gave the highest percentage of fruit holding at a concentration of 2 g. L$^{-1}$ (76.09%), compared to concentration of 1 g. L$^{-1}$ and control treatment which gave the lowest percentage of fruit holding (66.35%).

In case of the interaction between cultivar of date palm and concentration of nano-fertilizer (IQ Combi), the treatment of IQ Combi at concentration of 1 g. L$^{-1}$ and Zahdi cultivar gave the highest percentage of fruit (79.76%), compared with other concentrations of IQ Combi and control treatment in Khastawi cultivar (63.09%). While, the interaction Zahdi cultivar and Despir Osmotic fertilizer with a concentration of 2 g. L$^{-1}$ recorded the highest percentage of fruit holding (77.07%). In addition, the interaction between IQ Combi with a concentration of 1 g. L$^{-1}$. Palm$^{-1}$ and Despir Osmotic fertilizer with a concentration of 2 g. L$^{-1}$. Palm$^{-1}$ recorded the highest percentage of fruit holding (81.86%), compared to other treatments.

Results of Table (1) was also showed that there was a significant difference in the interaction between the cultivar of date palm, IQ Combi and Disper Osmotic, where the treatment of Zahdi cultivar with 1 g/L and the Disper Osmotic fertilizer at a concentration of 2 g. L$^{-1}$ gave the highest percentage of fruit holding (83.92%).
Table 1. The effect of the cultivar of date palm, nano-fertilizer (IQ Combi) and Disper Osmotic fertilizer and their interactions on the percentage of the fruit holding (%) of palm fruits, Zahdi and Khastawi cultivars.

| Cultivars      | Despir Osmotic g. L⁻¹ | IQ Combi g. L⁻¹ | L.S.D 0.05 |
|----------------|------------------------|-----------------|------------|
| AL-Zahdee      | 0                      | 66.35           | AL-Zahdee  |
|                | 1                      | 72.38           |            |
|                | 2                      | 76.09           |            |
| Alkhstawi      | 0.5                    | 2.122           |            |
|                | 1                      | 72.76           |            |
|                | 1                      | 77.46           |            |
| L.S.D 0.05     |                        | 73.07           |            |
|                |                        | 70.15           |            |
| 0.5            |                        | 1.744           |            |

| Cultivars      | Despir Osmotic g. L⁻¹ | IQ Combi g. L⁻¹ | L.S.D 0.05 |
|----------------|------------------------|-----------------|------------|
| AL-Zahdee      | 0                      | 70.07           | AL-Zahdee  |
|                | 1                      | 75.07           |            |
|                | 2                      | 67.07           |            |
| Alkhstawi      | 0.5                    | 77.46           |            |
|                | 1                      | 75.16           |            |
|                |                        | 72.19           |            |
|                |                        | 63.09           |            |
| L.S.D 0.05     |                        | 3.001           |            |

| Cultivars      | Despir Osmotic g. L⁻¹ | IQ Combi g. L⁻¹ | L.S.D 0.05 |
|----------------|------------------------|-----------------|------------|
| AL-Zahdee      | 0                      | 75.69           | AL-Zahdee  |
|                | 1                      | 74.41           |            |
|                | 2                      | 78.26           |            |
| Alkhstawi      | 0.5                    | 76.33           |            |
|                | 1                      | 77.33           |            |
|                |                        | 61.12           |            |
| L.S.D 0.05     |                        | 3.001           |            |

3.1.2 Weight of fruit flesh:

The results of Table (2) showed the superiority of the Zahdi cultivar in the weight of fruit flesh, which reached (6.346 g), compared to the fruit flesh of Khastawi cultivar which 5.848 g. The table was also showed that the use of nano-fertilization had a significant effect on the weight of fruit flesh, with a concentration exceedig 1 g L⁻¹ which was 6.769g, compared with other treatments includig control treatment that gave 5.290 g. Despir Osmotic was also increased the weight of fruit flesh and the concentration of 2 g.L⁻¹, givig the highest weight of fruit flesh (6.779 g), while control treatment recorded the lowest weight of fruit flesh (5.183 g).

The interactions between the cultivar of date palm and IQ Combi; cultivar of date palm and Despir Osmotic; IQ Combi and Despir Osmotic showed a significant effect on the weight of fruit flesh. Zahdi date palm treated with IQ Combi at a concentration of 1 g. L⁻¹ gave the highest weight of fruit flesh (7.222 g), while the control treatment of Khastawi cultivar gave 5.257 g. In case of interaction between Despir Osmotic fertilizer and cultivar, Zahdi cultivar exposed to Despir Osmotic with a concentration of 2 g. L⁻¹ recorded the highest weight of fruit flesh (7.227 g), compared to the other treatments.

Despir Osmotic and IQ Combi interaction showed a significant effect with the highest weight of fruit flesh recorded in the treatment of exposure to IQ Combi at 1g L⁻¹ and Despir Osmotic at 1 g.
L$^{-1}$ for both cultivars. In case of the interaction between the cultivar of date palm, IQ Combi and Disper Osmotic, the treatment of Zahdi cultivar with 1 g.L$^{-1}$ of IQ Combi and the Disper Osmotic fertilizer at a concentration of 2 g.L$^{-1}$ gave the highest weight of fruit flesh (8.557 g), compared with other treatments includig control treatment for Khastawi cultivar which gave (3.950 g).

**Table 2.** The effect of the cultivar of date palm, nano-fertilizer (IQ Combi) and Disper Osmotic fertilizer and their interactions on the weight of fruit flesh (g) of palm fruits, Zahdi and Khastawi cultivars.

| Despir Osmotic g. L$^{-1}$ | IQ Combi g. L$^{-1}$ | cultivars | AL- Zahdee | L.S.D 0.05 |
|---------------------------|---------------------|-----------|-----------|-----------|
| 5.183                     | 0                   | 5.290     | 0         | 6.348     |
| 6.329                     | 1                   | 6.231     | 0.5       | 6.348     |
| 6.779                     | 2                   | 6.769     | 1         | 5.874     |
| 0.231                     | 0.231               | 0.189     |           |           |
| Despir Osmotic g. L$^{-1}$ | Cultivars           | IQ Combi g. L$^{-1}$ | cultivars | L.S.D 0.05 |
| 2                         | 1                   | 0         |           |           |
| 7                         | 6.610               | 5.201     | 1         | 5.32      |
| 0                         | 6.047               | 5.165     | 7         | 7.25      |
| 0.328                     | L.S.D 0.05          | 0.328     |           | L.S.D 0.05 |

3.1.3 Weight of seed:

The results in Table (3) showed that there was a significant difference between the two cultivars in the weight of the seed, where Zahdi cultivar gave the highest rate of seed weight (1.168 g), compared to Khastawi cultivar which gave the lowest rate of seed weight (0.765 g). It was also noted that IQ Combi and Disper Osmotic fertilizer had significant effect on the weight of seed with increasig the concentration. Where treatment of IQ Combi at a concentration 1 g. L$^{-1}$ gave the highest weight of seed (1.024 g), compared to control treatment which gave the lowest value (0.886 g). In addition, Disper Osmotic fertilizer was significantly increased the weight of seed at a concentration of 2 g.L$^{-1}$ (1.007 g), compared to control treatment which gave the lowest value (0.901 g).

The interactions between the cultivar of date palm and IQ Combi; cultivar of date palm and Disper Osmotic; IQ Combi and Disper Osmotic showed a significant effect on the weight of seed. Zahdi date palm treated with IQ Combi at a concentration of 1 g. L$^{-1}$ gave the highest weight of
In case of interaction between Despir Osmotic fertilizer and cultivar, Zahdi cultivar exposed to Despir Osmotic with a concentration of 2 g. L\(^{-1}\) recorded the highest weight of seed (1.206 g), compared to the other treatments.

Despir Osmotic and IQ Combi interaction showed a significant effect with the highest weight of seed recorded in the treatment of exposure to IQ Combi at 1 g. L\(^{-1}\) and Despir Osmotic at 1 g. L\(^{-1}\) for both cultivars (1.067 g) while the control treatment gave the lowest value (0.813 g).

In case of the interaction between the cultivar of date palm, IQ Combi and Desper Osmotic, the treatment of Zahdi cultivar with 1 g. L\(^{-1}\) of IQ Combi and the Disper Osmotic fertilizer at a concentration of 1 g. L\(^{-1}\) gave the highest weight of seed (1.263 g), while the control treatment for Khastawi cultivar gave the lowest value (0.610 g).

**Table 3.** The effect of the cultivar of date palm, nano-fertilizer (IQ Combi) and Disper Osmotic fertilizer and their interactions on the weight of seed (g) of Zahdi and Khastawi date palm cultivars

| Despir Osmotic | IQ Combi | Cultivars |
|----------------|----------|-----------|
| 0.901          | 0        | 0.886     | 1.168 |
| 0.992          | 1        | 0.990     | 0.5   |
| 1.007          | 2        | 1.024     | 1.076 |
| 0.023          | 1        | 0.023     | 0.019 |

| Despir Osmotic | Cultivar | IQ Combi |
|----------------|----------|----------|
| 1.206          | 1.191    | 1.106    | 1.222 |
| 0.807          | 0.793    | 0.695    | 0.826 |
| 0.032          | 0.032    | L.S.D 0.05 |

| Despir Osmotic | Cultivars |
|----------------|-----------|
| 2              | 1         | 0        |
| 0.950          | 0.895     | 0.813    | 0      |
| 1.023          | 1.015     | 0.931    | 0.5    |
| 1.048          | 1.067     | 0.958    | 1      |
| 0.040          | L.S.D 0.05 |

| Despir Osmotic | Cultivars |
|----------------|-----------|
| 2              | 1         | 0        |
| 1.156          | 1.130     | 1.016    | 0      |
| 1.223          | 1.180     | 1.140    | 0.5    |
| 1.240          | 1.263     | 1.163    | 1      |
| 0.743          | 0.660     | 0.610    | 0      |
| 0.823          | 0.850     | 0.723    | 0.5    |
| 0.856          | 0.870     | 0.753    | 1      |
| 0.057          | L.S.D 0.05 |

**3.1.4 Fruit length:**

The results in Table (4) showed that there was a significant difference between the two cultivars in the length of fruit, where Zahdi cultivar gave the highest fruit length (3.207 cm), compared to Khastawi cultivar which gave the lowest rate of seed weight (2.837 cm). Results were also showed that IQ Combi at a concentration 1 g. L\(^{-1}\) gave the highest fruit length (3.161 cm), compared to control treatment. In addition, Despir Osmotic fertilizer was significantly increased the fruit length at a concentration of 2 g. L\(^{-1}\) (3.167 cm).

The interactions between the cultivar of date palm and IQ Combi; cultivar of date palm and Despir Osmotic; IQ Combi and Despir Osmotic showed a significant effect on the fruit length.
Zahdi date palm treated with IQ Combi at a concentration of 1 g L\(^{-1}\) gave the highest fruit length (3.344 cm). In case of interaction between Despir Osmotic fertilizer and cultivar, Zahdi cultivar exposed to Despir Osmotic with a concentration of 2 g L\(^{-1}\) recorded the highest fruit length (3.300 cm), compared to control treatment which gave the lowest value (2.633 cm).

In case of the interaction between the cultivar of date palm, IQ Combi and Disper Osmotic, the treatment of Zahdi cultivar with 1 g L\(^{-1}\) of IQ Combi and the Disper Osmotic fertilizer at a concentration of 2 g L\(^{-1}\) gave the highest fruit legth (3.467 cm), while the control treatment for Khastawi cultivar gave the lowest value (2.467 cm).

Table 4. The effect of the cultivar of date palm, nano-fertilizer (IQ Combi) and Disper Osmotic fertilizer and their interactions on the fruit length(cm) of Zahdi and Khastawi date palm cultivars.

| Despir Osmotic g.L\(^{-1}\) | IQ Combi g.L\(^{-1}\) | Cultivars |
|---------------------------|---------------------|----------|
| 2.861                     | 0                   | 3.207    |
| 3.039                     | 1                   | 3.050    |
| 3.167                     | 2                   | 3.161    |
| 0.100                     | 0.100               | 0.082    |

| Despir Osmotic g.L\(^{-1}\) | Cultivar | IQ Combi g.L\(^{-1}\) | Cultivars |
|---------------------------|---------|---------------------|----------|
| 2.861                     | 0.5     | 3.207               |
| 3.133                     | 3.100   | 3.344               |
| 2.944                     | 2.622   | 2.978               |
| 0.142                     | 0.142   | 2.856               |

| Despir Osmotic g.L\(^{-1}\) | Cultivar | IQ Combi g.L\(^{-1}\) | Cultivars |
|---------------------------|---------|---------------------|----------|
| 2                         | 0.5     | 3.303               |
| 3.100                     | 3.100   | 2.950               |
| 3.300                     | 3.183   | 3.000               |
| 0.174                     | 0.174   | 2.833               |

| Despir Osmotic g.L\(^{-1}\) | IQ Combi g.L\(^{-1}\) | Cultivars |
|---------------------------|---------------------|----------|
| 2                         | 0.5     | 3.303               |
| 3.267                     | 3.233   | 3.233               |
| 3.467                     | 3.300   | 3.267               |
| 2.800                     | 2.767   | 2.467               |
| 3.133                     | 2.933   | 2.667               |
| 3.433                     | 3.067   | 2.733               |
| 0.246                     | 0.246   | 2.800               |

3.1.5 Fruit diameter:
The results in Table (5) showed that there was a significant difference between the two cultivars in the fruit diameter, where the fruit diameter of Zahdi cultivar was significantly higher (1.978 cm) than fruit diameter Khastawi cultivar (1.730 cm). Results were also showed that IQ Combi at a concentration 1 g. L\(^{-1}\) gave the highest fruit diameter (1.939 cm), compared to control treatment. In addition, Despir Osmotic fertilizer was significantly increased the fruit diameter at a concentration of 2 g L\(^{-1}\) (1.911 cm).

The binary interactions between the cultivar of date palm and IQ Combi; cultivar of date palm and Despir Osmotic; IQ Combi and Despir Osmotic showed a significant effects on the fruit diameter. Zahdi date palm treated with IQ Combi at a concentration of 1 g. L\(^{-1}\) gave the highest fruit diameter (2.044 cm). In case of interaction between Despir Osmotic fertilizer and cultivar,
Zahdi cultivar exposed to Despir Osmotic with a concentration of 2 g. L\(^{-1}\) recorded the highest fruit diameter (2.033 cm), compared to control treatment which gave the lowest value (1.644 cm).

In case of the interaction between the cultivar of date palm, IQ Combi and Disper Osmotic, the treatment of Zahdi cultivar with 1 g.L\(^{-1}\) of IQ Combi and the Disper Osmotic fertilizer at a concentration of 2 g.L\(^{-1}\) gave the highest fruit diameter, while the control treatment for Khastawi cultivar gave the lowest value (1.567 cm).

Table 5. The effect of the cultivar of date palm, nano-fertilizer (IQ Combi) and Disper Osmotic fertilizer and their interactions on the fruit diameter(cm) of Zahdi and Khastawi date palm cultivars.

| Despir Osmotic g.L\(^{-1}\) | IQ Combi g.L\(^{-1}\) | cultivars |
|---------------------------|---------------------|-----------|
| 1.778                     | 0                   | 1.978     | AL-Zahdee |
| 1.872                     | 1                   | 1.861     | 0.5       | Al khstawi |
| 1.911                     | 2                   | 1.939     | 1         | 1.730     | L.S.D 0.05 |
| 0.057                     | 0.057               | 0.046     |           |

| Despir Osmotic g.L\(^{-1}\) | Cultivars | IQ Combi g.L\(^{-1}\) | cultivars |
|---------------------------|-----------|---------------------|-----------|
| 2                         | 1.989     | 1.911               | AL-Zahdee |
| 1.789                     | 1.756     | 1.644               | Al khstawi |
| 0.081                     | L.S.D 0.05| 0.081               | L.S.D 0.05|

| Despir Osmotic g.L\(^{-1}\) | IQ Combi g.L\(^{-1}\) | cultivars |
|---------------------------|---------------------|-----------|
| 2                         | 1.767               | 1.700     | 0         |
| 1.817                     | 1.867               | 1.800     | 0.5       |
| 2.000                     | 1.983               | 1.833     | 1         |
| 0.099                     | L.S.D 0.05          |           |

3.1.6 Fruit weight:

The results in Table (6) showed that there was a significant difference between the two cultivars in the fruit weight, where the fruit weight of Zahdi cultivar was significantly higher (7.514 g) than fruit weight of Khastawi cultivar (6.613 g). Results were also showed that IQ Combi at a concentration 1 g.L\(^{-1}\) gave the highest fruit weight. In addition, Despir Osmotic fertilizer was significantly increased the fruit weight at a concentration of 2 g.L\(^{-1}\) (7.786 g), compared to control treatment (6.084 g).

The binary interactions between the cultivar of date palm and IQ Combi; cultivar of date palm and Despir Osmotic; IQ Combi and Despir Osmotic showed a significant effects on the fruit weight. Zahdi date palm treated with IQ Combi at a concentration of 1 g L\(^{-1}\) gave the highest fruit weight. In case of interaction between Despir Osmotic fertilizer and cultivar, Zahdi cultivar exposed to Despir Osmotic with a concentration of 2 g.L\(^{-1}\) recorded the highest fruit weight (8.433 g), compared to control treatment which gave the lowest value (5.861 g).
In case of the interaction between the cultivar of date palm, IQ Combi and Disper Osmotic, the treatment of Zahdi cultivar with 1 g.L\(^{-1}\) of IQ Combi and the Disper Osmotic fertilizer at a concentration of 2 g.L\(^{-1}\) gave the highest fruit weight (9.797 g), while the control treatment for Khastawi cultivar gave the lowest value (4.560 g).

Table 6. The effect of the cultivar of date palm, nano-fertilizer (IQ Combi) and Disper Osmotic fertilizer and their interactions on the fruit weight(g) of Zahdi and Khastawi date palm cultivars

| Desper Osmotic g.L\(^{-1}\) | IQ Combi g.L\(^{-1}\) | Cultivars |
|-----------------------------|----------------------|-----------|
| 6.084                       | 0                    | 6.176     | 7.514 |
| 7.321                       | 1                    | 7.221     | 0.5   |
| 7.786                       | 2                    | 7.793     | 1      | 6.613 |
| 0.240                       | 0.240                | 0.196     | L.S.D 0.05 |

| Desper Osmotic g.L\(^{-1}\) | Cultivars | IQ Combi g.L\(^{-1}\) |
|-----------------------------|-----------|----------------------|
| 8.433                       | 7.801     | 6.608                |
| 7.038                       | 6.840     | 5.961                |
| 0.340                       |           | L.S.D 0.05           |

| Desper Osmotic g.L\(^{-1}\) | IQ Combi g.L\(^{-1}\) |
|-----------------------------|----------------------|
| 6.792                       | 6.685                |
| 7.803                       | 7.408                |
| 8.762                       | 7.868                |
| 0.417                       | L.S.D 0.05           |

3.1.7 Fruit Size:

The results in Table (7) showed that there was a significant difference between the two cultivars in the fruit size, where the fruit size of Zahdi cultivar was significantly higher (8.759 cm\(^3\)), compared to fruit size of Khastawi cultivar. Results were also showed that IQ Combi at a concentration 1 g. L\(^{-1}\) gave the highest fruit size. In addition, Desper Osmotic fertilizer was significantly increased the fruit size at a concentration of 2 g.L\(^{-1}\).

The binary interactions between the cultivar of date palm and IQ Combi; cultivar of date palm and Desper Osmotic; IQ Combi and Desper Osmotic showed a significant effects on the fruit size. Zahdi date palm treated with IQ Combi at a concentration of 1 g. L\(^{-1}\) gave the highest fruit size (10.056 cm\(^3\)). In case of interaction between Desper Osmotic fertilizer and cultivar, Zahdi cultivar exposed to Desper Osmotic with a concentration of 2 g.L\(^{-1}\) recorded the highest fruit size (9.833 cm\(^3\)).

In case of the interaction between the cultivar of date palm, IQ Combi and Disper Osmotic, the treatment of Zahdi cultivar with 1 g.L\(^{-1}\) of IQ Combi and the Disper Osmotic fertilizer at a
concentration of 2 g.L\(^{-1}\) gave the highest fruit size (11.333 cm\(^3\)), while the control treatment for Khastawi cultivar gave the lowest value (6.367 cm\(^3\)).

Table 7. The effect of the cultivar of date palm, nano-fertilizer (IQ Combi) and Disper Osmotic fertilizer and their interactions on the fruit size (cm\(^3\)) of Zahdi and Khastawi date palm cultivars.

| Despir Osmotic g.L\(^{-1}\) | IQ Combi g.L\(^{-1}\) | Cultivars |
|-----------------------------|---------------------|----------|
| 6.978                        | 0                   | 8.759    |
| 7.778                        | 1                   | 0.5      |
| 8.568                        | 2                   | 8.706    |
| 0.273                        | 2                   | 8.223    |
| 0.273                        | 0                   | 0        |
| 2                            | 1                   | 10.05    |
| 9.8                          | 33                  | 7.778    |
| 7.3                          | 02                  | 6.889    |
| 0.386                        | L.S.D 0.05          | 0.386    |

| Despir Osmotic g.L\(^{-1}\) | Cultivars | IQ Combi g.L\(^{-1}\) |
|-----------------------------|----------|---------------------|
| 9.8                         | 33       | 8.667               |
| 7.3                         | 02       | 6.178               |
| 0.386                       | L.S.D 0.05| 0.386               |

| Despir Osmotic g.L\(^{-1}\) | IQ Combi g.L\(^{-1}\) |
|-----------------------------|---------------------|
| 2                           | 1                   |
| 7.267                       | 6.333               |
| 8.437                       | 8.233               |
| 10.000                      | 8.767               |
| 0.473                       | L.S.D 0.05          |

3.2 Productivity Characteristics of Date Palm Fruits:

3.2.1 Fruit fallig:

The results in Table (8) showed that there was a significant difference between the two cultivars in the fruit size, where the percentage of fruit fallig of Zahdi cultivar was significantly lower (27.83%), compared to percentage of fruit fallig of Khastawi cultivar which was 35.28%. Results were also showed that IQ Combi at a concentration 1 g.L\(^{-1}\) gave the lowest percentage of fruit fallig (28.09%), compared with control treatment which was 38.26%. In addition, Despir Osmotic fertilizer was significantly decreased the percentage of fruit fallig at a concentration of 2 g.L\(^{-1}\) (30.94%), compared with control treatment (33.56%).

The binary interactions between the cultivar of date palm and IQ Combi; cultivar of date palm and Despir Osmotic; IQ Combi and Despir Osmotic showed a significant effects on the percentage of fruit fallig. Zahdi date palm treated with IQ Combi at a concentration of 1 g.L\(^{-1}\) gave the lowest percentage of fruit fallig (22.83%). In case of interaction between Despir Osmotic
fertilizer and cultivar, Zahdi cultivar exposed to Despir Osmotic with a concentration of 2 g. L\(^{-1}\) recorded the lowest percentage of fruit fallig (26.99%).

In case of the interaction between the cultivar of date palm, IQ Combi and Disper Osmotic, the treatment of Zahdi cultivar with 1 g.L\(^{-1}\) of IQ Combi and the Disper Osmotic fertilizer at a concentration of 2 g.L\(^{-1}\) gave the lowest percentage of fruit fallig (21.80%), while the control treatment for Khastawi cultivar gave the lowest value (39.55%).

Table 8. The effect of the cultivar of date palm, nano-fertilizer (IQ Combi) and Disper Osmotic fertilizer and their interactions on the percentage of fruit fallig (%) of Zahdi and Khastawi date palm cultivars

|               | Despir Osmotic g.L\(^{-1}\) | IQ Combi g.L\(^{-1}\) | Cultivars       |
|---------------|-----------------------------|-----------------------|-----------------|
| 33.56         | 0                           | 38.26                 | 0               |
| 30.94         | 1                           | 28.32                 | 0.5             |
| 30.16         | 2                           | 28.09                 | 1               |
| 1.820         |                               |                       |                 |

|               | Despir Osmotic g.L\(^{-1}\) | Cultivars | IQ Combi g.L\(^{-1}\) |           |
|---------------|-----------------------------|-----------|-----------------------|-----------|
| 26.99         | 26.99                       | 27.39     | 29.12                 | AL-Zahdee |
| 33.32         | 34.50                       | 38.01     | 0.5                   |           |
| 2.575         |                               |           | L.S.D 0.05            |           |

|               | Despir Osmotic g.L\(^{-1}\) | IQ Combi g.L\(^{-1}\) | Cultivars       |
|---------------|-----------------------------|-----------------------|-----------------|
| 36.09         | 37.69                       | 41.00                 | 0               |
| 27.43         | 27.39                       | 30.14                 | 0.5             |
| 26.99         | 27.72                       | 29.56                 | 1               |
| 3.153         |                               |                       | L.S.D 0.05      |

|               | Despir Osmotic g.L\(^{-1}\) | IQ Combi g.L\(^{-1}\) | Cultivars       |
|---------------|-----------------------------|-----------------------|-----------------|
| 35.29         | 36.78                       | 39.55                 | 0               |
| 23.88         | 22.45                       | 24.06                 | 0.5             |
| 21.80         | 22.95                       | 23.74                 | 1               |
| 36.89         | 38.60                       | 42.45                 | 0               |
| 30.90         | 32.41                       | 36.21                 | 0.5             |
| 32.17         | 32.49                       | 35.37                 | 1               |
| 4.459         |                               |                       | L.S.D 0.05      |

3.2.2 Maturity Ratio:
The results in Table (9) showed that there was no significant difference between the two cultivars in the maturity ratio, where the percentage of the maturity ratio of Khastawi cultivar was 39.83% and 39.20% for Zahdi cultivar. Results were also showed that IQ Combi at a concentration 1 g. L\(^{-1}\) gave the highest maturity ratio (35.64%), compared with other treatments and control treatment which was 38.26%. In addition, the maturity ratio of date palm exposed to Despir Osmotic fertilizer at a concentration of 2 g.L\(^{-1}\) (41.93%), which was not significantly different than concentration of 1 g. L\(^{-1}\).

The binary interactions between the cultivar of date palm and IQ Combi; cultivar of date palm and Despir Osmotic; IQ Combi and Despir Osmotic showed a significant effects on the maturity ratio. Khastawi date palm treated with IQ Combi at a concentration of 1 g L\(^{-1}\) gave the highest maturity ratio (42.55%). In case of interaction between Despir Osmotic fertilizer and cultivar, Khastawi cultivar exposed to Despir Osmotic with a concentration of 2 g. L\(^{-1}\) recorded the highest maturity ratio (43.06%). The interaction between IQ Combi and Despir Osmotic fertilizer showed
a significant effects on the maturity ratio, where the treatment of IQ Combi at 1 g.L$^{-1}$ and Despir Osmotic fertilizer at a concentration of 2 g.L$^{-1}$ gave the highest maturity ratio (45.61%).

In case of the interaction between the cultivar of date palm, IQ Combi and Disper Osmotic, the treatment of Khastawi cultivar with 1 g.L$^{-1}$ of IQ Combi and the Disper Osmotic fertilizer at a concentration of 2 g.L$^{-1}$ gave the highest maturity ratio (46.97%).

### Table 9. The effect of the cultivar of date palm, nano-fertilizer (IQ Combi) and Disper Osmotic fertilizer and their interactions on the maturity ratio (%) of Zahdi and Khastawi date palm cultivars

| g.L$^{-1}$ Despir Osmotic | IQ Combi g.L$^{-1}$ | Cultivars       |
|---------------------------|-------------------|-----------------|
| 35.55                     | 0                 | AL-Zahdee       |
| 41.06                     | 1                 | 39.20           |
| 41.93                     | 2                 | 40.47           |
| 1.602                     | 1.602             | 42.42           |

| g.L$^{-1}$ Despir Osmotic | Cultivars | IQ Combi g.L$^{-1}$ | AL-Zahdee |
|---------------------------|-----------|---------------------|-----------|
| 0                         | 1         | 1                   | 34.46     |
| 36.29                     | 1         | 36.18               | 34.27     |
| 43.89                     | 1         | 42.61               | 34.92     |
| 45.61                     | 1         | 44.39               | 37.27     |

| g.L$^{-1}$ Despir Osmotic | Cultivars | IQ Combi g.L$^{-1}$ | AL-Zahdee |
|---------------------------|-----------|---------------------|-----------|
| 0                         | 1         | 39.19               | 36.67     |
| 39.44                     | 1         | 42.97               | 35.57     |

3.2.3 *Fruit Bunch Weight:*  
The results in Table (10) showed that there was a significant difference between the two cultivars in the fruit Bunch Weight, where the Fruit Bunch Weight of Zahdi cultivar was significantly higher (11.664 kg. Palm$^{-1}$), compared to Fruit Bunch Weight of Khastawi cultivar which was 8.522 kg. Palm$^{-1}$. Results were also showed that IQ Combi at a concentration 1 g. L$^{-1}$ gave the highest Fruit Bunch Weight (11.329 kg. Palm$^{-1}$), compared with control treatment which was 8.521 kg. Palm$^{-1}$. In addition, Despir Osmotic fertilizer was significantly increased the Fruit Bunch Weight at a concentration of 2 g.L$^{-1}$ (11.142 kg. Palm$^{-1}$), compared with control treatment (8.774 kg. Palm$^{-1}$). The binary interactions between the cultivar of date palm and IQ Combi; cultivar of date palm and Despir Osmotic; IQ Combi and Despir Osmotic showed a significant effects on the Fruit Bunch Weight. Zahdi date palm treated with IQ Combi at a concentration of 1 g L$^{-1}$ gave the highest Fruit Bunch Weight (13.206 kg. Palm$^{-1}$). In case of interaction between Despir Osmotic fertilizer and cultivar, Zahdi cultivar exposed to Despir Osmotic with a concentration of 2 g. L$^{-1}$ recorded the highest Fruit Bunch Weight (13.00 kg. Palm$^{-1}$). The interaction between IQ Combi and Despir Osmotic fertilizer showed a significant effects on the
Fruit Bunch Weight, where the treatment of IQ Combi at 1 g.L\(^{-1}\) and Despir Osmotic fertilizer at a concentration of 2 g.L\(^{-1}\) gave the highest Fruit Bunch Weight (12.548 kg. Palm\(^{-1}\)). In case of the interaction between the cultivar of date palm, IQ Combi and Disper Osmotic, the treatment of Zahdi cultivar with 1 g.L\(^{-1}\) of IQ Combi and the Disper Osmotic fertilizer at a concentration of 2 g. L\(^{-1}\) gave the highest Fruit Bunch Weight.

Table 10. The effect of the cultivar of date palm, nano-fertilizer (IQ Combi) and Disper Osmotic fertilizer and their interactions on the fruit Bunch Weight (kg. Palm\(^{-1}\)) of Zahdi and Khastawi date palm cultivars.

| Cultivars  | IQ Combi g.L\(^{-1}\) | Despir Osmotic g.L\(^{-1}\) | AL-Zahdee |
|------------|------------------------|-----------------------------|-----------|
| 8.774      | 0                      | 8.521                       | 11.664    |
| 10.363     | 1                      | 10.429                      | 11.852    |
| 11.142     | 2                      | 11.329                      | 11.363    |
| 0.447      | 0.447                  | 0.365                       | L.S.D 0.05|

| Cultivars  | IQ Combi g.L\(^{-1}\) | Despir Osmotic g.L\(^{-1}\) | AL-Zahdee |
|------------|------------------------|-----------------------------|-----------|
| 13.000     | 11.919                 | 10.074                      | 13.206    |
| 9.283      | 8.808                  | 7.474                       | 8.972     |
| 0.633      | L.S.D 0.05             | L.S.D 0.05                  |           |

Table 2.4 Total yield:
The results in Table (11) showed that there was a significant difference between the two cultivars in the overall yield rate, where the yield of Zahdi cultivar was significantly higher (69.99 kg. Palm\(^{-1}\)), compared to overall yield of Khastawi cultivar which was 51.13 kg. Palm\(^{-1}\). Results were also showed that IQ Combi at a concentration 1 g. L\(^{-1}\) gave the highest yield (67.98 kg. Palm\(^{-1}\)), compared with control treatment which was 51.12 kg. Palm\(^{-1}\). In addition, Despir Osmotic fertilizer was significantly increased the fruit Bunch Weight at a concentration of 2 g. L\(^{-1}\) (66.85 kg. Palm\(^{-1}\)), compared with control treatment (52.65 kg. Palm\(^{-1}\)).

The binary interactions between the cultivar of date palm and IQ Combi; cultivar of date palm and Despir Osmotic; IQ Combi and Despir Osmotic showed a significant effects on the overall yield. Zahdi date palm treated with IQ Combi at a concentration of 1 g L\(^{-1}\) gave the highest overall yield (79.23 kg. Palm\(^{-1}\)). In case of interaction between Despir Osmotic fertilizer and cultivar, Zahdi cultivar exposed to Despir Osmotic with a concentration of 2 g. L\(^{-1}\) recorded the
highest overall yield (78.00 kg. Palm\(^{-1}\)). The interaction between IQ Combi and Despir Osmotic fertilizer showed a significant effects on the overall yield, where the treatment of IQ Combi at 1 g.L\(^{-1}\) and Despir Osmotic fertilizer at a concentration of 2 g.L\(^{-1}\) gave the highest overall yield (75.29 kg. Palm\(^{-1}\)). In case of the interaction between the cultivar of date palm, IQ Combi and Disper Osmotic, the treatment of Zahdi cultivar with 1 g.L\(^{-1}\) of IQ Combi and the Disper Osmotic fertilizer at a concentration of 2 g.L\(^{-1}\) gave the highest overall yield (88.76 kg. Palm\(^{-1}\)).

Table 11. The effect of the cultivar of date palm, nano-fertilizer (IQ Combi) and Disper Osmotic fertilizer and their interactions on the Total yield(kg. Palm\(^{-1}\)) of Zahdi and Khastawi date palm cultivars

| g.L\(^{-1}\) | Despir Osmotic | IQ Combi g.L\(^{-1}\) | Cultivars |
|------------|----------------|-----------------------|-----------|
| 52.65      | 0              | 51.12                 | 69.99     | AL-Zahdee |
| 62.18      | 1              | 62.58                 | 0.5       | AL-Zahdee |
| 66.85      | 2              | 67.98                 | 1         | Al khstawi|
| 2.688      | 2.688          | 2.194                 | L.S.D 0.05|

| g.L\(^{-1}\) | Despir Osmotic | Cultivars | IQ Combi g.L\(^{-1}\) | cultivars |
|------------|----------------|-----------|-----------------------|-----------|
| 2          | 1              | 0         | 78.00                 | 71.51     | AL-Zahdee |
| 55.70      | 0.5            | 44.44     | 53.83                 | 42.84     | Al khstawi|
| 3.801      | L.S.D 0.05     | 3.801     | L.S.D 0.05            |           |

| g.L\(^{-1}\) | Despir Osmotic | IQ Combi g.L\(^{-1}\) | cultivars |
|------------|----------------|-----------------------|-----------|
| 2          | 1              | 0                     | 57.18     | 44.75     |
| 68.08      | 0.5            | 65.24                 | 54.41     | 0         |
| 75.29      | 58.86          | 69.86                 | 58.78     | 1         |
| 4.655      | L.S.D 0.05     |                       |           |

| g.L\(^{-1}\) | Despir Osmotic | IQ Combi g.L\(^{-1}\) | cultivars |
|------------|----------------|-----------------------|-----------|
| 2          | 1              | 0                     | 67.22     | 59.02     | 51.98     |
| 78.02      | 0.5            | 74.48                 | 61.16     | 0         |
| 88.76      | 1              | 80.74                 | 68.20     | 1         |
| 47.14      | 0.5            | 43.86                 | 37.52     | 0         |
| 58.14      | 0.5            | 55.70                 | 47.66     | 0.5       |
| 61.82      | 1              | 58.98                 | 49.36     | 1         |
| 6.583      | L.S.D 0.05     |                       |           |

4. Discussion:
The results and exhibits indicated that the cultivar of date palm and the concentration of nano-fertilizer and the compost of Despir Osmotic significantly affected the physical, production and physiological characteristics of date palm. Zahdi cultivar was superior on Khastawi cultivar in most of physical, production and physiological studied characteristics (Percentage of fruit holding, Weight of fruit flesh, Weight of seed, fruit length, percentage of fruit falling, fruit Bunch Weight, Total yield). While the maturity of fruits did not reach the significant level between the cultivars. The significant differences between two cultivars in most of physical, production and physiological studied characteristics may be due to the nature of the genotype. The results showed that fertilization by different concentrations of manure and discus Osmotic alone or in combination has improved the physical, physiological and production characteristics under salt stress conditions. The mineral elements (Fe, Zn, Cu, B, Mn and Mo) Nano stasis contains an important role in the resistance of salinity conditions and increase growth and production by filling the plant's need of essential mineral elements in sufficient quantities[11]. The increase in meat weight, seed weight, length and fruit diameter when using different concentrations of
manure, may be due to the role of micro elements contained in manure (zinc, iron, copper and manganese) in increasing the activity of photosynthesis enzymes and increase the concentration of chlorophyll and thus increase [12]. This activity leads to a greater accumulation of food such as sugars, proteins, acids and water in the expanding cells, thus increasing the weight and size of the fruit, which was positively reflected in increasing the weight and size of the fruit. Twisting For both Zuhdi and Kastawi varieties when treated without adding to the manure. The high salinity may lead to an imbalance in the hormonal balance within the plant. There is a decline in the levels of encouraging plant hormones such Auxins, gibberellins and cytokinins, while an increase in growth-inhibiting hormones such as acid ABA [13]. The significant decrease in the rate of fruit loss with the use of manure is probably due to the role of the mineral elements in the small increase in the output of photosynthesis and the production of hormones, especially the Auxins and gibberellins and raise levels within the fruit in the early stages of growth, reducing the proportion of Abscisic acid [14]. The increase in maturity may be due to the role of micro-elements in manure, in stimulating the process of photosynthesis and starch metabolism to sugars and the movement of carbohydrates from the locations of composition in the leaves to fruits and increase the proportion of solids soluble and rapid breathing and thus increase the maturity [15]. The increase in the rate of weight of the burdens and the total amount of using manure is probably due to the increase in length, diameter, size and total weight fruit in the tits.

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