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Evaluation of the Effect of Nano-Fertilization and Disper Osmotic in Treating the Salinity of Irrigation Water on the Chemical and Mineral Properties of Date Palm (*Phoenix dactylifera* L.)

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Abstract This study was conducted during the two growing seasons (2018 and 2019) in Date Palm Trees Station-Al-Hussinya District-Horticulture and, Department of Forestry, Ministry of Agriculture, Karbala Governorate. Two cultivars of date palm trees Zahdi and Khistawi were studied. The 27 palm trees for each cultivars were randomly selected, homogeneous in vegetative growth and similar in size and shape. The results showed that the Zahdi cultivar recorded a significant increase in the content of chlorophyll and proline which reached 0.939 $mg.g^{-1}$ and 12.854. g^{-1}, respectively. The Khistawi cultivar recorded a significant difference in the carbohydrate content of leaf which reached 9.564 $\mu g.g^{-1}$ compared to Zahdi cultivar. The results were also showed that superiority of the concentration was 1 g. L^{-1}. palm $^{-1}$ in all studied characteristics. The study showed that in the concentration of 2 g. L^{-1}. $Palm^{-1}$ of disper osmotic had significant difference in the most of studied characteristics. Bilateral and triple inequalities have a significant moral effect in all studied characteristics.

Keywords: Date palm, Nano-fertilization, Disper osmotic, Chemical, Mineral properties.

Introduction

The date palm *Phoenix dactylifera* L. belong to family Arecaceae is one of the most important perennial fruit trees growing in tropical and subtropical regions between latitudes 10 - 39 ° north and south of the world (Ibrahim, 2014). The nanotechnology or nano science is, deals with the study and processing of materials are of the size of 10^{-9} in diameter. Where they show properties of materials that are differed from when they are traditional dimensions of more than 100 nanometres (Saleh, 2015). This technology has great potential in the crop marketing by improving the efficiency of fertilizer and increasing the crop production (Liu & Lai, 2015). The usage of nano materials in the fertilization programs is an efficient alternative to conventional fertilizers as it has showed several advantages such as economically beneficial compared to the conventional fertilizers overtime, where it was shown that applying small quantities of nano fertilizer were increased the crop productivity about 20-30% (Kah *et al*., 2018).

The disper osmotic fertilizer, which contains essential nutrition elements, calcium , potassium mainly in addition to some organic materials and free amino acids has a potential effect in reduce salt stress in the soil and plant (Parther *et al*., 1978). Fathi *et al.* (2017) reported the important roles of nano fertilizer in to reducing the saline stress, enhance of crop growth and productivity comparing with conventional fertilizer. These benefits may be due to the distinctive characteristics of nanoparticles. The 0.5 $g.L^{-1}$ of zinc fertilizer increased the size and weight of fruits of mongo and butter trees in addition to the yield and the percentage of dissolved solids (Zagzog & Mohamed, 2017).

Subramanian *et al*. (2008) indicated the important of nano fertilizers in improving the nutrient efficiency and prevents the loss or stabilization of nutrient ions to the environment. Moreover Davarpanah *et al*. (2016) found that the addition of Zn and B nanoparticles were elevated the level of content of mineral elements such as N, P, K, Ca, Zn and B in the pomegranate leaf comparing with conventional fertilizers.

The study was carried out to find out the following:

1-The effect of the type of fertilizer (nano ferture or disper osmotic) on increasing the resistance of date palm to salinity of irrigation water and improving the physical, chemical and anatomical properties of date fruits.

2- Determine the best concentration of nanostructures or biofertilizer to obtain the highest yield and quality of the fruits and content of leaves from mineral elements under conditions of salt tension.

Materials & Methods

The study was carried out during the two growing seasons (2018 and 2019) at Al-Husseiniya station of palm plant Orchards, Horticulture and Forestry Department ,Ministry of Agriculture, Karbala governorate (32.6037°N, and 44.0197^{0} E). A soil sample (sub-samples) were taken randomly and at a depth of 0-30 and 30-60 cm, to represent the orchard Soil samples were dried and pebbles impurities were removed and then grinded and sifted with a sieve capacity of its slots 2 mm size .They were preserved in plastic containers for the purpose of determining some physical and chemical properties of the orchard soil. Well irrigated soil were taken at the same time as soil samples were collected .These samples were kept in plastic containers after adding a few drops of coloring and calcon (5%) and kept in the refrigerator at 4°C until analysis time. Table (1) represents the results of physical and chemical analysis of soil and water.

A total of 54 date palms of Zahdi cultivar and 27 date palms of Khastawi. By using the drip irrigation method, the salinity of the well was adjusted to 20 $d.sm^{-1}$ the beginning of the experiment on 1/3/2018 by transferring the well water to a 3000 L basin and NaCl salt was added to the required concentration according to Sahuki & Khafaji (2014) each 625-640 ppm was equivalent to one Decisiemens. The drip irrigation system used and the drips were lent (20 litres/hour/dotted), by 3 large drips for each palm .The date palm trees were irrigated every (seven to 10 days).

Date palm trees were pollinated for both cultivars using pollen Red Ghanami cultivated in the same orchard at 18/3/2018.In the first season and 25/3/2019, while second season of the Zahdi cultivar and 24/3/2018 .In the first season and 28/3/2019 the second season of the Khastawi cultivar by placing five male strands for each female spathe.

Table (1): Results of Analysis of Some Physical and Chemical Properties of Orchard Soil.

Type of Analysis		Unit of measurement	analysis' results
Potential of hydrogen(pH)		1:1	7.84
Electrical conductivity E.C		$dS.m^{-1}$	10.54
CEC		$Cmol_c .Kg^{-1}$ Soil	14.30
Organic Carbon O.C		$g.Kg^{-1}$ Soil	8.21
Organic matter O.M		$g.Kg^{-1}$ Soil	14.12
Calcium carbonate		$g.Kg^{-1}$ Soil	37.26
Total nitrogen		$g.Kg^{-1}$ Soil	3.70
Ready phosphorus		$mg.Kg^{-1}$ Soil	7.90
Ready Potassium		$mg.Kg^{-1}$ Soil	208
Ca^{+2}	Cationic dissolved ions	$Mmol.L^{-1}$	21.32
Mg^{+2}		$Mmol.L^{-1}$	11.00
Na^{+}		$Mmol.L^{-1}$	9.29
K^{+}		$Mmol.L^{-1}$	1.47
CL^{-}	Soluble negative ions	$Mmol.L^{-1}$	32.50
$HCO3^{-}$		$Mmol.L^{-1}$	1.92
SO_4^{2-}		$Mmol.L^{-1}$	5.13
Clay	Soil texture	$gm.Kg^{-1}$	314
Greene		gm.Kg -1	376
Sand		gm.Kg -1	310
Soil texture			silt clay loam

Leaf content of total chlorophyll (mg. g^{-1} Fresh weight):

The total leaf content of total chlorophyll was calculated according to the method described by Al -Jawari (2004). The total chlorophyll concentration was estimated using to the following equation:

$$Total\ chlorophyll = [\ 20.2(\text{D645}) + 8.02(\text{D663})] \times \frac{V}{1000 \times W}$$

whereas:

V: Final volume of filtration after centrifugation separation.

D: Reading the optical density of the extracted chlorophyll.

W: Weight (g).

Leaf content of total carbohydrates (mg.g^{-1})

Carbohydrates were estimated in the leaf by taking 0.5 g of dried and grinded of leaf. 70 ml of distilled water was added and then the mixture was heated at 70°C for an hour. Then the mixture was cooled, filtered with filter paper and 1 ml phenol (5%) and 5 ml concentrated sulfuric acid were added (Dobius *et al*., 1956).

Proline content of leaf (dry weight): mg.g^{-1}.

Amino acid proline was estimated in the leaf according to the method described by Troll &

Lindsley (1955) and the amount of proline was calculated according to the following formula:

$$\text{Proline sample content } \mu g/g = \frac{\text{Reading from the curve} \times \text{dilution}}{\text{Weight of sample}}$$

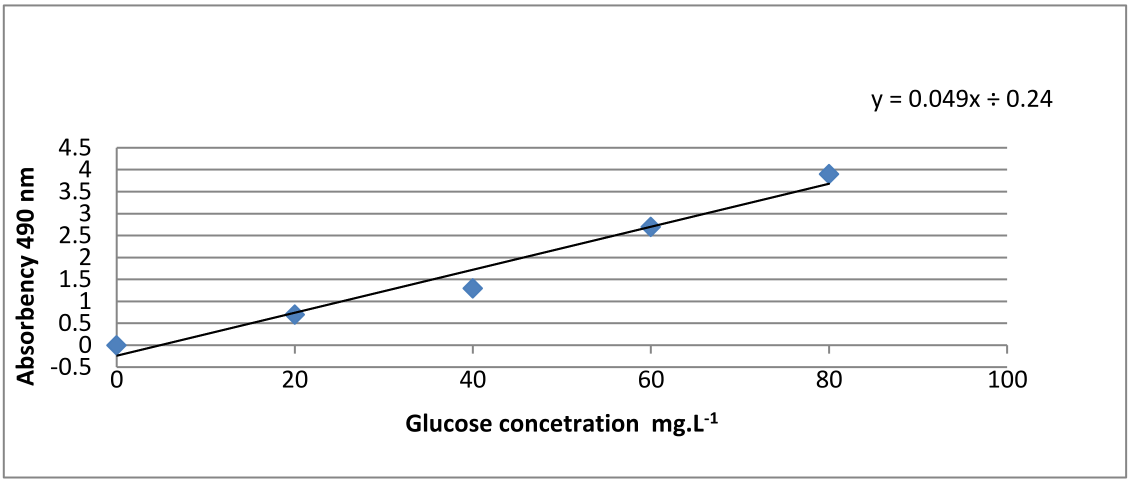

Fig. (1): Standard glucose curve.

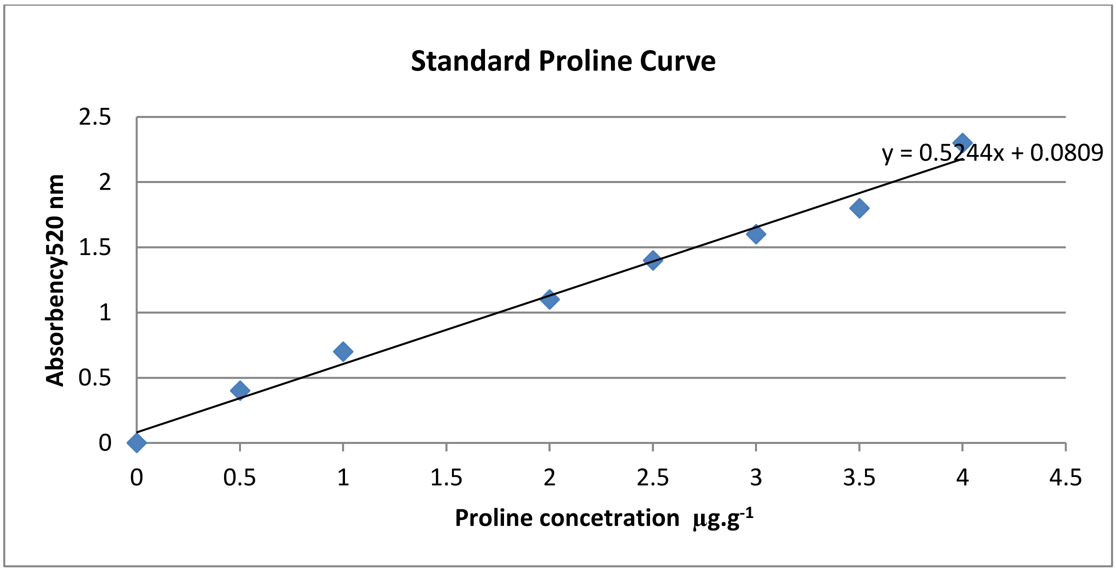

Fig. (2): Standard curve for amino acid (Proline).

Leaf content of mineral elements

Samples were placed in an electric oven at 70°C for three days to dry. Then 0.2 g of dry matter were ground for each treatment and digested in a mixture of concentrated sulfuric acid 96% and perchloric at a concentration of 4% with heating according to Cresser & Parsons (1979). The total nitrogen content in the plant samples was measured using a steam distillation by micro kjeldal method based on method described in Page *et al*. (1982).

Phosphorus was estimated after adjusting the acidity of the mixture using molybdate. Ammonium and ascorbic acid was measured by Spectrophotometer at the length 700 nanometer (Murphy & Riley, 1962). Potassium, sodium and calcium were determined by the Flame photometer (Cresser & Parsons, 1979).

Zinc and Iron Concentration

Zinc and iron concentrations in the leaf were estimated by Atomic Absorption (Black, 1965).

Chlorine concentration

Chlorine concentration was measured based on the following method (Cresser & Parsons, 1979). Samples were dried and grinded as described above 0.2 g of dried samples were digested by 50 ml of acetic acid at 4% concentration and, shake for half an hour, filtered by filter paper and adjusted. The acidity of the leachate to a diagonal neutral basin .

Experimental deign and statistical analysis

Factorial experiment (3×3×2) was used to randomized complete block design (RCBD) with three replicates for each treatment. The number of date palm trees (54 palm trees) for each cultivar. The results were analysed using ANOVA test. Mean comparisons between the treatments were performed using LSD test at 5%level of significance (Sahoki & Wahib, 1990). Statistical analysis were conducted using GenStat (Version 07).

Results & Discussion

Chlorophyll content in the leaf

Our results found that the best chlorophyll content in the leaf was in the Zahdi cultivar, which exceeded the highest content of chlorophyll by 0.939 mg.g $^{-1}$ (Table 2).

Disper osmotic fertilizer exceeded the concentration of 2 g.L^{-1} palm^{-1} with the highest content (1.041 mg.g $^{-1}$). Between the cultivar and the nanofertilizer, the cultivar and disper osmotic fertilizer, the nanofertilizer and the disper osmotic the bilateral interactions between the nanofertilizer and the disper osmotic fertilizer has exceeded the concentration (1 and 2 g . L^{-1} content was 1.250 mg.g $^{-1}$ while the control treatment recorded the lowest value (0.645 mg.g $^{-1}$). The results of the same table indicated that the triple interaction between the cultivar, the nano fertilizer and the disper osmotic fertilizer had a significant effect on the leaf content of total chlorophyll.

Carbohydrates content in the leaf

Table (3) showed that the date palm cultivars had a significant effect on the leaf content of carbohydrates, where Khastawi were gave the highest content carbohydrates (9.564 mg.g^{-1}). Nano fertilizer at a concentration of 1 g.L^{-1}.Palm^{-1} gave the highest carbohydrate content in the leaf about 10.968 mg.g^{-1}. While the usage of disper osmotic fertilizer, was recorded the highest content of carbohydrate(10.808 mg.g $^{-1}$) concentration of 2 gm.l^{-1}.palm^{-1}.The results of this table indicated that the bilateral interaction between the cultivar and the type of fertilizer has a significant effect on the leaf content of carbohydrates. The interaction between the Khastawi cultivar and the concentration of 2 mg.L^{-1} disper Osmotic fertilizer has exceeded. (11.327 mg. g $^{-1}$) compared to other treatments. On the other hand bilateral interaction between nano fertilizer and disper osmotic had a significant effect on the leaf content of carbohydrates as the concentration exceeded (1 and 2 g^{-1} palm^{-1}), respectively, with the highest content (12.860 mg.g^{-1}). The triple interaction between the cultivar,

Table (2): Effect of cultivar, nano fertilizer (IQ Combi), disper osmotic fertilizer and their interactions on total chlorophyll content (mg.g $^{-1}$) in date palm leaf, Zahdi and Khastawi cultivars.

	despir osmotic			Nano fertilizer		Cultivar	
Zahdi	0.806		0	0.742	Zahdi	0.939	
	0.931		1	0.935			
Khastawi	1.041		2	1.101	Khastawi	0.913	
L.S.D		0.0247			L.S.D	0.0201	
Cultivar	despir osmotic			Cultivar	Nano fertilizer		
	2	1	0		1		0
Zahdi	1.046	0.948	0.823	Zahdi	1.113	Zahdi	0.760
Khastawi	1.035	0.914	0.788	Khastawi	1.088	Khastawi	0.724
L.S.D		0.034		L.S.D		0.034	
Nano fertilizer				despir osmotic			
		2				0	
0		0.828			0	0.645	
0.5		1.045			0.5	0.840	
1		1.250			1	0.933	
L.S.D	0.042						
Cultivar				Cultivar		Nano fertilizer	
Zahdi		2		1	Zahdi	0	
		0.820		0.790			
		1.070		0.920		0.5	
		1.350		1.136		1	
Khastawi		0.836		0.716	Khastawi	0	
		1.020		0.923		0.5	
		1.250		1.103		1	
L.S.D				0.060			

The nano fertilizer and the disper osmotic showed a significant effect on the leaf content of carbohydrates.

Proline content in the leaf

The results presented in table (4) showed that the cultivars had a significant effect on the leaf content of proline where the Zahdi cultivar exceeded the highest significant increase in leaf content of proline (12.854 mg.g $^{-1}$). The highest proline content of leaf (13.628 mg.g $^{-1}$) was recorder in nano fertilizer treatment at a concentration of 1 g.L $^{-1}$. Palm $^{-1}$ .In case of fertilizer disper osmotic treatment, the highest proline content of leaf (13.468 mg.g $^{-1}$) was recorded at a concentration of 2 g.L $^{-1}$. palm $^{-1}$. The same table indicated that he bilateral interaction between the cultivar and the type of fertilizer had a significant effect on the leaf content of proline. Bilateral interaction between the two types of fertilizer nanoparticles and disper osmotic has exceeded the treatment with a concentration (1 and 2 g.L $^{-1}$ Palm $^{-1}$) respectively, recording the highest content (16.246 µg.g $^{-1}$) compared to other treatments.

Table (3): Effect of cultivar, nanofertilizer(IQ Combi), disper osmotic fertilizer and their interactions in carbohydrate content (mg.g $^{-1}$) in date palm leaf Zahdi and Khastawi cultivars.

Cultivar		Nano fertilizer		Despir osmotic			
Zahdi	8.77	7.426	0	7.32	0		
		9.108	0.5	9.373	1		
Khastawi	9.564	10.968	1	10.808	2		
L.S.D	0.118		0.145		0.145		
Cultivar	Nano fertilizer			cultivars	Despir osmotic		
	1	0.5	0		2	1	0
Zahdi	10.356	8.616	7.34	Zahdi	10.289	8.768	7.254
Khastawi	11.58	9.600	7.511	Khastawi	11.327	9.979	7.386
L.S.D	0.205				L.S.D		0.205
Nano fertilizer		Despir osmotic					
		0		1	2		
0		6.408		7.105	8.763		
0.5		7.415		9.108	10.8		
1		8.137		11.907	12.86		
L.S.D		0.251					
cultivar		Nano fertilizer	Despir osmotic				
Zahdi		0	1	0	2		
			7.3	6.327	8.393		
		0.5	8.54	7.333	9.973		
		1	10.463	8.103	12.5		
Khastawi		0	6.91	6.49	9.133		
		0.5	9.677	7.497	11.627		
		1	13.35	8.17	13.22		
L.S.D		0.356					

The table also indicates significant differences in the triple interaction between the cultivar, the nano fertilizer and the disper osmotic, where the treatment of the Zahdi cultivar and nano fertilizer exceeded the concentration of 1 gm. L $^{-1}$ palm-1 and disper osmotic at 2 gm. 1 The highest protein content in the leaf was (17.291 µg.g $^{-1}$) compared to the other transactions.

Nitrogen content in the leaf

It is clear from table (5) that the cultivar had a significant effect on the nitrogen content of the leaf, with the highest level recorder at Khastawi cultivar (0.816%). It was also observed that adding of the single nano fertilizer caused a significant increase in the leaf content of nitrogen, where the oncentration exceeded 1 g.L $^{-1}$ palm $^{-1}$ recorded the highest percentage (0.891%). Disper osmotic fertilizer at a concentration 1 g.L $^{-1}$. Palm $^{-1}$ gave the highest percentage. While the control treatment recorded the lowest percentage (0.553%).

The same table shows that there was a significant effect of the bilateral interaction between the cultivar and the fertilizer. The

Table (4): Effect of cultivar, nanofertilizer (IQ Combi), disper osmotic fertilizer and their interactions in Proline content (μg.g^{-1}) in date palm leaf Zahdi and Khastawi cultivars.

Cultivar		Nano fertilizer		Despir osmotic	
Zahdi	12.854	0	10.445	0	10.463
		0.5	11.974	1	12.116
Khastawi	11.178	1	13.628	2	13.468
L.S.D	0.26	0.319		0.319	

Cultivar	Nano fertilizer			cultivars	despir osmotic		
	0	0.5	1		0	1	2
Zahdi	11.095	12.858	14.608	Zahdi	10.952	13.224	14.386
Khastawi	9.795	11.089	12.649	Khastawi	9.974	11.008	12.55
L.S.D	0.451			L.S.D	0.451		

Nano fertilizer	despir osmotic		
0	0	1	2
0	9.305	10.468	11.563
0.5	11.14	12.186	12.595
1	10.945	13.694	16.246
L.S.D	0.552		

Cultivar	Nano fertilizer	despir osmotic		
	0	0	1	2
Zahdi	0.5	9.776	11.218	12.290
	1	11.705	13.294	13.576
	0	11.375	15.159	17.291
Khastawi	0.5	8.833	9.717	10.835
	1	10.574	11.078	11.615
	1	10.515	12.229	15.201
L.S.D	0.781			

highest yield of nitrogen in the leaf was 1.086%. Disper osmotic fertilizer, the treatment was higher than Khastawi and fertilizer with a concentration of 2 g.L^{-1}. Palm $^{-1}$ with the highest percentage (0.954%). The same table also showed that the bilateral interaction between the two types of fertilizer significantly affected the leaf content of nitrogen. The treatment of nano fertilizer at a concentration of 1 g $^{-1}$ palm^{-1} and disper osmotic fertilizer with a concentration of 2 g $^{-1}$.palm^{-1} was recorded the highest percentage (1.100%). The results of table (6) indicated significant effects of triple interaction between the cultivar, the nano fertilizer and the disper osmotic fertilizer. The treatment was superior to the cultivar, nano fertilizer and disper osmotic at concentrations (1 and 2

Table (5): Effect of cultivar, nanofertilizer (IQ Combi), disper Osmotic fertilizer and their interactions in leaf content of nitrogen(%) date palm Zahdi and Khastawi cultivars.

Cultivar		Nano fertilizer		Despir osmotic	
Zahdi	0.559	0	0.497	0	0.553
		0.5	0.674	1	0.725
Khastawi	0.816	1	0.891	2	0.785
L.S.D	0.0319	0.016		0.016	

cultivar	Nano fertilizer 0	0.5	1	cultivars	despir osmotic 0	1	2
Zahdi	0.448	0.533	0.696	Zahdi	0.495	0.567	0.615
Khastawi	0.546	0.815	1.086	Khastawi	0.611	0.883	0.954
L.S.D	0.023			L.S.D	0.023		

Nano fertilizer	despir osmotic		
0	0	1	2
0	0.438	0.503	0.551
0.5	0.581	0.738	0.703
1	0.640	0.935	1.100
L.S.D	0.029		

cultivar	Nano fertilizer	despir osmotic		
	0	0	1	2
Zahdi	0.5	0.430	0.446	0.470
	1	0.520	0.533	0.546
	0	0.536	0.723	0.830
Khastawi	0.5	0.446	0.560	0.633
	1	0.643	0.943	0.860
	1	0.743	1.146	1.370
L.S.D	0.041			

g). The highest percentage was 1.370% compared with other treatments.

Phosphorus content in the leaf

The contents of phosphorus was quantified table (6) and the results suggested that there was no significant differences between the two cultivars in phosphorus contents. Also, the treatment of disper osmotic fertilizer at a concentration of 2 g. L^{-1}. Palm $^{-1}$ gave the highest percentage of phosphorus contents (0.742%). The treatment of Zahdi cultivar and disper osmotic fertilizer at the highest concentration of 2 gm^{-1} $palm^{-1}$gave about (0.767%). The same table showed that the bilateral interactions between the cultivar and type of fertilizer resulted in a significant increase in the leaf content phosphorus ratio (0.816%). Moreover for the triple interaction between the cultivar, the nano fertilizer and the disper osmotic fertilizer, was investigated and the results revealed that, it was superior to the Zahdi cultivar and concentrate (1 and 2 gm $.L^{-1}.palm^{-1}$) respectively, with the highest phosphorus content in the leaf (0.853%).

Table (6): Effect of cultivar, nanofertilizer (IQ Combi), disper osmotic fertilizer and their interactions in leaf content of phosphorurs (%) date palm Zahdi and Khastawi cultivars.

Cultivar		Nano fertilizer		Despir osmotic	
Zahdi	0.635	0	0.507	0	0.463
		0.5	0.660	1	0.677
Khastawi	0.620	1	0.715	2	0.742
L.S.D	N.S	0.025		0.025	

cultivar	Nano fertilizer			cultivars	despir osmotic		
	0	0.5	1		0	1	2
Zahdi	0.527	0.654	0.724	Zahdi	0.463	0.675	0.767
Khastawi	0.487	0.666	0.705	Khastawi	0.463	0.680	0.716
L.S.D	0.036			L.S.D	0.036		

Nano fertilizer	despir osmotic		
0	0	1	2
0	0.321	0.581	0.620
0.5	0.493	0.698	0.790
1	0.575	0.753	0.816
L.S.D	0.044		

cultivar	Nano fertilizer	despir osmotic		
	0	0	1	2
Zahdi	0.5	0.340	0.613	0.630
	1	0.496	0.646	0.820
	0	0.553	0.766	0.853
Khastawi	0.5	0.303	0.550	0.610
	1	0.490	0.750	0.760
	1	0.596	0.740	0.780
L.S.D	0.062			

Potassium content in the leaf

The potassium content of the leaf was investigated and the results in table (7) showed that the cultivar had a significant effect on leaf content of potassium. The highest level of potassium content in the leaf was (1.718%), while the control treatment showed the lowest content (1.438%). As for the disper osmotic fertilizer, the treatment was recorded

Table (7): Effect of cultivar, nanofertilizer (IQ Combi), disper osmotic fertilizer and their interactions in leaf content of potassium(%) date palm Zahdi and Khastawi cultivars.

Cultivar		Nano fertilizer		Despir osmotic	
Zahdi	1.597	0	1.438	0	1.343
		0.5	1.601	1	1.663
Khastawi	1.574	1	1.718	2	1.751
L.S.D	0.014	0.018		0.018	

cultivar	Nano fertilizer			cultivars	despir osmotic		
	0	0.5	1		0	1	2
Zahdi	1.464	1.634	1.693	Zahdi	1.350	1.698	1.743
Khastawi	1.412	1.568	1.743	Khastawi	1.336	1.628	1.758
L.S.D	0.025			L.S.D	0.025		

Nano fertilizer	despir osmotic		
0	0	1	2
0	1.225	1.521	1.568
0.5	1.360	1.651	1.793
1	1.445	1.818	1.891
L.S.D	0.031		

cultivar	Nano fertilizer	despir osmotic		
	0	0	1	2
Zahdi	0.5	1.203	1.566	1.623
	1	1.406	1.733	1.763
	0	1.440	1.796	1.843
Khastawi	0.5	1.246	1.476	1.513
	1	1.313	1.570	1.823
	1	1.450	1.840	1.940
L.S.D	0.044			

the highest content of potassium increased (1.751%) at a concentration of 2 $g.L^{-1}.palm^{-1}$. The same table indicates that the bilateral interaction between the cultivar and the type of fertilizer had a significant effect on the leaf content of potassium as the treatment of the Khastawi cultivar and the nano fertilizer at a concentration of 1 $g.l^{-1}$ $palm^{-1}$ with the highest content (1.743%). The results also showed that the treatment of the Khastawi cultivar and disper osmotic fertilizer at a concentration of 2 g. L^{-1}. Palm $^{-1}$ was significantly superior to give the highest percentage (1.758%). Bilateral interaction between the two types of fertilizer nanoparticles and disper osmotic has exceeded the treatment with a concentration (1 and 2 g^{-1}-palm $^{-1}$), respectively, with the highest percentage (1.891%) compared to the other treatments. The table also indicates significant differences in the triple interaction between the cultivar, nano fertilizer and disper osmotic (Table 8).

Calcium content in the leaf

The calcium content of the leaf in the cultivar was increased significantly as shown in the table (8). Also, treatment of nanofertilizer with a concentration of 1 $g.L^{-1}$ .palm $^{-1}$ increased to the highest percentage about where the variety exceeded my ascetics by giving the highest percentage (1.301%). Nano-fertilization treatment was recorded at a concentration of 1 $g.L^{-1}.palm^{-1}$ the highest percentage about 1.392%. The treatment with disper osmotic fertilizer at a concentration of 2 $g.L^{-1}$-$palm^{-1}$ gave the highest percentage about 1.423%. Similarity the bilateral interaction between the cultivar and fertilizer was significantly affect the leaf content of calcium, where the treatment of the Khastawi cultivar and nano fertilization was exceeded the concentration of 1$g.L^{-1}$ $palm^{-1}$. As for the disper osmotic fertilizer, the treatment of Khastawi and the concentration exceeded 2 $g.L^{-1}.Palm^{-1}$ with the highest percentage (1.447%) compared to other treatments. On other hand, the bilateral interaction between the fertilizer nanoparticles and disper osmotic had a significant effect on the calcium content in the leaf where the concentration exceeded (1 g and 2 g. L^{-1}. palm $^{-1}$) respectively with the highest percentage (1.476%). While the results suggested a significant effect of the triple interaction between the cultivar, the nano fertilizer and the disper osmotic in the leaf content of calcium.

Sodium content in the leaf

The results of table (9) indicated that there were significant differences between Zahdi and Khistawi cultivar in leaf sodium content, with the lowest sodium percentage (0.620%). As for the effect of nano fertilizer, the concentration of 1$g.L^{-1}$. Palm $^{-1}$ gave the lowest percentage of sodium in the leaves (0.563%). The treatment of plant with the disper osmotic fertilizer recorded the lowest percentage (0.550%) at a concentration 2 g. The interaction between the two factors significantly affected the percentage of sodium in the leaf, where the Zahdi cultivar and nano fertilizer with concentration and 1 $gm.L^{-1}.Palm^{-1}$ with the lowest percentage (0.524%). In comparison to the interaction of the cultivar and the disper osmotic fertilizer was superior to the treatment of Khastawi and disper osmotic fertilizer with a concentration of 2 $g.L^{-1}$. $Palm^{-1}$ with the lowest percentage (0.514%). While triplicate interaction between the study factors affected significantly.

Table (8): Effect of cultivar, nanofertilizer (IQ Combi), disper osmotic fertilizer and their interactions in leaf content of calcium (%) date palm Zahdi and Khastawi cultivars.

Cultivar		Nano fertilizer		Despir osmotic	
Zahdi	1.285	0	1.133	0	1.057
		0.5	1.354	1	1.399
Khastawi	1.301	1	1.392	2	1.423
L.S.D	0.020	0.024		0.024	

cultivar	Nano fertilizer			cultivars	despir osmotic		
	0	0.5	1		0	1	2
Zahdi	1.140	1.340	1.376	Zahdi	1.086	1.370	1.400
Khastawi	1.127	1.368	1.407	Khastawi	1.027	1.428	1.447
L.S.D	0.034			L.S.D	0.034		

Nano fertilizer	despir osmotic		
0	0	1	2
0	0.686	1.345	1.370
0.5	1.225	1.413	1.425
1	1.260	1.440	1.476
L.S.D	0.042		

cultivar	Nano fertilizer	despir osmotic		
	0	0	1	2
Zahdi	0.5	0.730	1.330	1.360
	1	1.250	1.380	1.390
	0	1.280	1.400	1.450
Khastawi	0.5	0.643	1.360	1.380
	1	1.200	1.446	1.460
	1	1.240	1.480	1.503
L.S.D	0.060			

Table (9): Effect of cultivar, nanofertilizer (IQ Combi), disper osmotic fertilizer and their interactions in leaf content of sodium (%) date palm Zahdi and Khastawi cultivars.

Cultivar		Nano fertilizer		Despir osmotic	
Zahdi	0.620	0	0.742	0	0.839
		0.5	0.652	1	0.568
Khastawi	0.685	1	0.563	2	0.550
L.S.D	0.020	0.025		0.025	

cultivar	Nano fertilizer			cultivars	despir osmotic		
	0	0.5	1		0	1	2
Zahdi	0.692	0.643	0.524	Zahdi	0.810	0.535	0.514
Khastawi	0.792	0.662	0.603	Khastawi	0.868	0.602	0.586
L.S.D	0.035			L.S.D	0.035		

Nano fertilizer	despir osmotic		
0	0	1	2
0	0.978	0.628	0.620
0.5	0.790	0.593	0.575
1	0.750	0.485	0.456
L.S.D	0.043		

cultivar	Nano fertilizer	despir osmotic		
	0	0	1	2
Zahdi	0.5	0.620	0.606	0.580
	1	0.575	0.580	0.560
	0	0.456	0.420	0.403
Khastawi	0.5	0.620	0.650	0.660
	1	0.575	0.606	0.590
	1	0.750	0.550	0.510
L.S.D	0.061			

Chloride content in the leaf

The results of table (10) showed that there were significant differences between the individual treatments, as the Zahdi cultivar recorded the lowest percentage of chloride in the leaf (0.620%). Nano fertilizer was recorded at a concentration of 1 g.l^{-1}. Palm^{-1}the lowest percentage (0.617%).while the best values for the bilateral interaction between the cultivar and the fertilizer, As for the fertilizer despir osmotic, it exceeded the concentration of 2 g.L^{-1}.palm^{-1} by giving the lowest percentage (0.647%). The comparison transaction recorded the largest percentage (0.868%). As for the best values of bilateral interference between the cultivar and the fertilizer, which led to a decrease in the leaf content of chloride, it was obtained when treating the ascetical cultivar and the nano fertilizer at a concentration of 1g.L^{-1}-palm^{-1}, which recorded the lowest percentage (0.520%). Also, the bilateral interaction between the fertilizer despir osmotic was recorded at a concentration of 2 g.L^{-1}. Palm $^{-1}$ and the Zahdi cultivar was the lowest percentage of chloride in the leaves (0.530%). The results of the same table indicate that the interaction between nano fertilizer at a concentration of 1 g.l^{-1}-palm tree^{-1} and despir osmotic at a concentration of 2 g.l^{-1}-palm^{-1} is the best effect in giving the lowest percentage of palm leaf content from chloride. In the same table and statistically analysis at the level of 5% and there are significant differences between the interaction of the three factors studied.

Table (10): Effect of cultivar, nanofertilizer (IQ Combi), disper osmotic fertilizer and their interactions in leaf content of chloride (%) date palm Zahdi and Khastawi cultivars.

Cultivar		Nano fertilizer		Despir osmotic	
Zahdi	0.620	0	0.882	0	0.868
		0.5	0.693	1	0.677
Khastawi	0.841	1	0.617	2	0.647
L.S.D	0.033	0.040		0.040	

cultivar	Nano fertilizer			cultivars	despir osmotic		
	0	0.5	1		0	1	2
Zahdi	0.727	0.613	0.520	Zahdi	0.761	0.570	0.530
Khastawi	1.036	0.7744	0.714	Khastawi	0.975	0.785	0.764
L.S.D	0.057			L.S.D	0.057		

Nano fertilizer	despir osmotic		
0	0	1	2
0	1.105	0.785	0.756
0.5	0.775	0.688	0.618
1	0.725	0.560	0.566
L.S.D	0.070		

cultivar	Nano fertilizer	despir osmotic		
Zahdi	0	0	1	2
	0.5	0.933	0.630	0.620
	1	0.700	0.610	0.530
	0	0.650	0.470	0.440
Khastawi	0.5	1.276	0.940	0.893
	1	0.850	0.766	0.706
	1	0.800	0.650	0.693
L.S.D	0.099			

Zinc content in the leaf

It was noticed from the results of table (11) that the cultivars showed significant differences in the leaf content of zinc where Zahdi cultivar exceeded by giving the highest content reached 39.00 mg.g $^{-1}$. As for the use of disper osmotic fertilizer, it was noticed that there was a significant increase at a concentration 2 g.L^{-1} palm^{-1} with the highest content 42.89 mg. g^{-1} The results of this table indicated that the bilateral interaction between the cultivar and the type of fertilizer had a significant effect on the leaf content of zinc 45.00 mg. g^{-1} The same table also showed that the bilateral interaction between the nano fertilizer and disper osmotic caused a significant increase in the leaf content of zinc

Table (11): Effect of cultivar, nano fertilizer (IQ Combi), disper osmotic fertilizer and their interactions in leaf content of Zinc mg. g $^{-1}$ date palm Zahdi and Khastawi cultivars.

Cultivar		Nano fertilizer		Despir osmotic	
Zahdi	39.00	0	26.59	0	31.20
		0.5	41.61	1	39.33
Khastawi	36.61	1	45.22	2	42.89
L.S.D	1.366	1.672		1.672	

cultivar	Nano fertilizer			cultivars	despir osmotic		
	0	0.5	1		0	1	2
Zahdi	27.33	41.33	48.33	Zahdi	31.33	40.67	45.00
Khastawi	25.84	41.89	42.11	Khastawi	31.07	38.00	40.78
L.S.D	2.365			L.S.D	2.365		

Nano fertilizer	despir osmotic		
0	0	1	2
0	22.60	26.50	30.67
0.5	36.50	42.33	46.00
1	34.50	49.17	52.00
L.S.D	2.897		

cultivar	Nano fertilizer	despir osmotic		
	0	0	1	2
Zahdi	0.5	23.00	27.00	32.00
	1	35.00	42.00	47.00
	0	36.00	53.00	56.00
Khastawi	0.5	22.20	26.00	29.33
	1	38.00	42.67	45.00
	1	33.00	45.33	48.00
L.S.D	4.097			

as the concentration exceeded (1 and 2 $g.L^{-1}palm^{-1}$) respectively with the highest content 52.00 mg. g^{-1}. The triple interaction between the cultivar, the manure, and the disper osmotic showed a significant effect on the leaf content of zinc, as it was superior to the treatment of the Zahdi cultivar and the fertilizer concentration (1 and 2 g. L^{-1}. $palm^{-1}$) respectively by giving the highest content 56.00 $mg.g^{-1}$.

Iron content in the leaf

The results in table (12) showed the superiority of the Zahdi cultivar in leaf content of iron (111.33 $mg.g^{-1}$) compared to Khistawi cultivar (105.02 $mg.g^{-1}$). As for the use of disper osmotic fertilizer, it was observed that there was a significant increase at a, concentration of 2 g.

Table (12): Effect of cultivar, nano fertilizer(IQ Combi), disper osmotic fertilizer and their interactions in leaf content of Iron (%) date palm Zahdi and Khastawi cultivars.

Cultivar		Nano fertilizer		Despir osmotic	
Zahdi	111.33	0	80.41	0	90.79
		0.5	119.28	1	114.72
Khastawi	105.02	1	124.83	2	119.00
L.S.D	1.512	1.852		1.852	

cultivar	Nano fertilizer			cultivars	despir osmotic		
	0	0.5	1		0	1	2
Zahdi	84.31	122.33	127.33	Zahdi	93.31	117.67	123.00
Khastawi	76.50	116.22	122.33	Khastawi	88.28	111.78	115.00
L.S.D	2.619			L.S.D	2.619		

Nano fertilizer	despir osmotic		
0	0	1	2
0	52.55	93.17	95.50
0.5	105.83	121.00	131.00
1	114.00	130.00	130.50
L.S.D	3.208		

cultivar	Nano fertilizer	despir osmotic		
	0	0	1	2
Zahdi	0.5	57.93	97.00	98.00
	1	107.00	122.00	138.00
	0	115.00	134.00	133.00
Khastawi	0.5	47.17	89.33	93.00
	1	104.67	120.00	124.00
	1	113.00	126.00	128.00
L.S.D	4.536			

It was also noted that the bilateral interaction between the cultivar and the type of fertilizer had a significant effect on the leaf content of iron. The control treatment of the Zahdi cultivar was given the lowest content (88.28 $mg.g^{-1}$). The same table also shows that the bilateral interaction between the nano fertilizer and disper osmotic caused a significant increase in the leaf content of iron as the concentration exceeded (0.5 and 2 $g.l^{-1}$). The triple interaction between the cultivar, nano fertilizer and disper osmotic showed a significant increase in leaf content of iron.

In this work ,the results revealed that the chemical and mineral content of plant foliar were increased significant when plant was grown in the media enriched with nano fertilizers. This finding may be resulted from the role of microelements in reducing the effect of salt stress on the plant and protecting the chlorophyll molecule from demolition and prolonging its life, zinc indirectly contributes to the formation of chlorophyll activation of the enzyme Carbonic anhydrase, which acts as a buffer of the pH inside the chloroplasts to protect proteins from loss of their biological nature in addition to its active role as an antioxidant catalyst (Allen & David, 2007).

Iron also plays an important role in biological processes and its directly involving in the activation of enzymatic activities of the plant, if iron introduces as a catalyst in the activation of reactions to form green dyes through a series of compounds ending with the formation of the chlorophyll molecule, low iron level reduces plant growth due to lack of photosynthesis or representation Nitrogen, combined with zinc, boron, copper and molybdenum, in the synthesis of antioxidants such as catalase, peroxidase, and scrubs this lead reduce free radical damage by various stresses and protect chlorophyll from early demolition (Joly, 1993; Dudal & Roy, 1995). It may be due to the role of nano fertilizer in increasing the leaf content of proline, which associated with the increasing chlorophyll content and maintain the enzymatic activity of green chloroplasts (Singh *et al*., 2013). The amino acid proline stimulates a special mechanism that selectively absorbs essential ions (N, P, K,Ca, Zn and Fe), including magnesium, which is the building block of the chlorophyll molecule (Yassin, 1992). Thus stimulating the process of photosynthesis and CO2 representation and absorption of mineral elements and increase the creation of carbohydrates.

The increased concentration of proline in the leaf of palm trees for both cultivars when treated with nano fertilizers may be due to the effect of micro-nano structures that make fertilizer in reduce the effect of saline stress by regulating the permeability of cell membranes and absorption of nutrients and building proteins and amino acids, including amino acid proline. The increased leaf content of amino acid proline is considered as an important indicator in the tolerance of trees to the environmental stresses of being one of the amino acids that go into building protein and prevent the breakdown of proteins inside plant cells and thus prevents its decomposition and its presence strengthens the bonds between protein amino acids (Yaish & Kumar, 2015).

The high palm leaf content of N, K, P, Ca, Zn, Fe and its low content of Cl and Na under saline stress conditions may be attributed to the role of nano fertilizers and its sulfate minerals, which reduce the salinity damage by reducing the degree of soil reaction. And increase the readiness of nutrients in the soil and ease of absorption by the plant (Saad *et* *al*., 2016). In addition, the nanostructure has a unique characteristic because of its large surface area and small minutes, which accelerates the process of penetrating the cell walls easily to the vascular beams (Ma *et al*., 2010).

Conclusions

The results indicated that there is a discrepancy between the school cultivars as well as between the nano fertilizers and disper osmotic of concentrations.

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Conflict of interest

The authors declare that they have no conflict of interest.

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تقييم كفاءة التسميد النانوي و Disper osmotic في معالجة تأثير ملوحة ماء الري في الصفات الكيميائية والمعدنية لنخيل التمر (*Phoenix dactylifera* L.) صنفي الزهدي والخستاوي

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المستخلص: اجريت هذه الدراسة خلال موسمي النمو (2018 و 2019) في محطة نخيل الحسينية، دائرة البستنه والغابات، وزارة الزراعة، محافظة كربلاء .تم انتخاب (54) نخلة من اشجار نخيل التمر صنفي الزهدي والخستاوي بواقع 27 نخلة لكل صنف متجانسة في النمو الخضري ومتماثلة في الحجم والشكل .حيث يلاحظ من النتائج تفوق الصنف الزهدي في محتوى الاوراق من الكلوروفيل والبرولين حيث سجلت 0.939 ملغم .غم $^{-1}$ و 12.854 مايكروغرام .غم $^{-1}$ على التوالي في حين تفوق الصنف الخستاوي في محتواها من الكربوهيدرات 9.564 ملغم.غم $^{-1}$ وقد اظهرت النتائج ايضا تفوق التريكز 1غم .لتر$^{-1}$.نخلة $^{-1}$ في كل الصفات المدروسة وقد تباينت الدراسة في اعطاء التركيز 2 غم .لتر$^{-1}$. نخلة $^{-1}$ من السماد Disper Osmotic فروقات معنوية في معظم صفات الدراسة. وللتباينات الثنائية والثلاثية الاثر المعنوي الواضح في كل الصفات المدروسة.

الكلمات المفتاحية: نخيل التمر، التسميد النانوي، الخواص التناضحية، الكيميائية، المعدنية.