

## EFFECT OF NANOFERTILIZERS AND APPLICATION METHODS ON VEGETATIVE GROWTH AND YIELD OF DATE PALM

Sh.M. Jubeir

Assist. lecturer

W.A.Ahmed

Prof.

Dept. of Horticulture and Landscape Gardening- College of Agriculture -University of Baghdad shwithjtm@gmail.com

### ABSTRACT

The aim of this study is to investigate the effect of nano fertilizers and application method on growth and yield of date palm. The experiment was carried out at AL- Rabeaa date palms station - Department of Horticulture - Ministry of Agriculture on 10 years old of *Khastawi* date palm cultivar during 2016 - 2017. Factorial experiment (3×6) within randomized complete block design with three replications .carried out using two factors: the first was three application methods; foliar application, injection with trunk and soil fertilization (A1, A2, A3) respectively. The second factor was different types of fertilizer, seaweed extract of the nanotechnology product with two concentrations: first (F1) (1,0.5,2)ml.L<sup>-1</sup> and the second (F2) (2,1,4) ml.L<sup>-1</sup> respectively, depending on the method of application and optimus-plus fertilizer the product of nanotechnology with two concentrations: first (F3) (1,0.5,2) ml.L<sup>-1</sup> and the second (F4) (2,1,4) ml.L<sup>-1</sup> respectively depending on the method of application also used NPK fertilizers (F5) (2,1,4) g.L<sup>-1</sup> and control treatment (F0).The results showed that treatment (F1) was increased fruit weight (5.26 g). While (F2) produced 36.75 kg yield. The highest percentage of maturity appeared in (F3) (73.56%). Treatments F4 and F5 showed an increase of amino acids in fruits (9.68 and 10.88 mg<sup>-1</sup> dry weight).injection treatment superior in the percentage of dry matter in leaves (38.60%), chlorophyll content (32.19 mg, 100 g<sup>-1</sup>),and yield (36.07 kg). we could be concluded that using nutrients and injection fertilizer improved vegetative growth and increase yield of date palm.

Keyword: Nano seaweed extract, Nano amino acid, injection fertilizer, soil fertilizer, NPK

\*Part of Ph.D. Dissertation of the first author

جبير واحد

مجلة العلوم الزراعية العراقية -2019: 50(1):267-274

تأثير الأسمدة النانوية وطرائق اضافتها في النمو الخضري وحاصل نخيل التمر

وليد عبد الغني احمد

شيماء محمد جبير

استاذ

مدرس مساعد

قسم البستنة وهندسة الحدائق - كلية الزراعة - جامعة بغداد

المستخلص

تهدف هذه الدراسة معرفة تأثير الأسمدة النانوية وطرائق اضافتها في نمو وحاصل نخيل التمر. نفذت التجربة في محطة الربيع للنخيل - الزعفرانية - دائرة البستنة - وزارة الزراعة على أشجار النخيل صنف الخستاي بعمر 10 سنوات خلال 2016 - 2017 حسب تجربة عاملية (3\*6) وفق تصميم القطاعات الكاملة المعشاة وبثلاث مكررات. تضمنت التجربة عاملين الأول هو استخدام ثلاث طرائق للتسميد وهي الرش والحقن والتسميد الأرضي (A1 ، A2 ، A3) بالتتابع. والعامل الثاني هو استعمال الأسمدة الاتية: مستخلص الطحالب البحرية سوبر فيفتي المنتج بتقنية النانوتكنولوجي بتركيزين: الأول (F1)(2,0.5,1)مل.لتر<sup>-1</sup> والثاني (F2)(4,1,2) مل.لتر<sup>-1</sup> بالتتابع حسب طريقة الإضافة، والتسميد بالمركب اوبتيمس- بلص المنتج بتقنية النانوتكنولوجي بتركيزين: الأول (F3)(2,0.5,1)مل.لتر<sup>-1</sup> والتركيز الثاني (F4)(4,1,2) مل.لتر<sup>-1</sup> بالتتابع حسب طريقة الإضافة، والتسميد (NPK متعادل)(F5)(4,1,2)غم.لتر<sup>-1</sup>، بالاضافة الى معاملة المقارنة باستعمال الماء (F0). أظهرت النتائج تفوق معاملة التسميد (F1) في إعطاء اعلى وزن طري للثمرة بلغ (5.26غم) بينما تفوق المعاملة (F2) في زيادة كمية الحاصل بالنخلة (36.75 كغم)، أما المعاملة (F3) فاعطت اعلى نسبة مئوية للنضج (73.56%) وسببت المعاملة (F4 و F5) زيادة في محتوى الثمار من الاحماض الامينية (9.68 و 10.88 ملغم.غم<sup>-1</sup> وزن جاف). كما أدى التسميد بالحقن الى زيادة النسبة المئوية للمادة الجافة في الأوراق (38.60%) ومحتوى الأوراق من الكلوروفيل الكلي (32.19 ملغم.غم<sup>-1</sup>) وكمية الحاصل بالنخلة (36.07 كغم). نستنتج من ذلك ان استعمال المغذيات وطريقة الحقن بالجذع قد حسنت من النمو الخضري وزيادة الإنتاج لنخيل التمر .

الكلمات المفتاحية: طحالب بحرية نانوية، احماض امينية نانوية، تسميد بالحقن، تسميد ارضي، NPK

\*البحث مستل من أطروحة دكتوراه للباحث الأول

\*Received:5/5/2018, Accepted:15/10/2018

## INTRODUCTION

Date palm *Phoenix dactylifera* L is one of the oldest fruit trees at the subtropical regions. Date palm management, very important process to increase the yield. Trees fertilization is one of the most important and necessary for the date palm, like other fruit trees. Date palm needs to regular fertilization and without cancel of this process, which affects the productivity of trees significantly (15). The seaweed extract are environmentally friendly and non-toxic to the user by their biological nature. No residues are left to the plant and soil. It is also considered as an organic source used in agricultural production. It is a partial substitute for chemical fertilizers or complementary to it, Contribute to lower production costs (22, 34). Al-Rawi et al (8) revealed that seaweed extract increased the vegetative growth characteristics and chlorophyll content of the leaves of peach trees .The plant needs amino acids mainly for growth and Increase yield quantity and quality, Amino acids enter into building other organic compounds such as amines, vitamins, enzymes and terpenoids, Amino acids also play an important role in vital signal to cells when they stimulate cell growth and increase plant resistance to stress. It is a source of carbon, energy and cell protection from ammonia poisoning (1, 16). The use of nanotechnology in fertilizers has also helped to regulate the release of nutrients from fertilizers the release of nitrogenous and phosphate fertilizers coincides with their absorption from crops Therefore, decrease in nutrient doses (11,19) The absorption method of nutrients through the roots is the usual way so the fertilizer is added to the soil extensively(22). The method of fertilization by injection is an important method because it leads to the survival of the material inside the tree as well as to prevent pollution of air and water and that this method is used control the pests and diseases (13). As well as limited amounts use of fertilizer when conducting fertilization by injecting the stem (27). The objective of this experiment is to study the effect of the methods of adding fertilizer and fertilizer type in vegetative and date palm yield characters.

## MATERIALS AND METHODS

This experiment was carried out in AL-Rabeaa date palm station in Zafaraniyah - Department of Horticulture - Ministry of Agriculture .Date palm trees used in this experiment were 10 years old of *Khastawi* date palm cultivar from 10/27/2016 until 21/10/2017. The experiment included two factors, first was three application methods: Foliar Application, Injection with trunk and Soil fertilization as (A1, A2, and A3) respectively. The second factor was the use of the following fertilizers : seaweed extract of the nanotechnology product which contains (high percentage of marine algae *Ascophyllum nodosum* ,organic matter 21%, Alginic Acid 0.8%, Gibberelic Acid 0.02%, K<sub>2</sub>O 5%, NPK, growth regulators and Micro elements) With two different concentrations: the first concentration (1,0.5,2)ml.L<sup>-1</sup> symbolized as (F1) , the second concentration (2,1,4) ml.L<sup>-1</sup> (F2) respectively depending on the method of application and optimus-Plus Fertilizer the product of nanotechnology Which contains (5% nitrogen, 30% amino acids and 3% organic nitrogen) with two concentrations: the first concentration (1,0.5,2) ml.L<sup>-1</sup> (F3) and the second concentration (2,1,4) ml.L<sup>-1</sup> (F4) respectively depending on the method of application also used NPK compound fertilizers (20% N, 20% P, 20% K) Dissolve in water (2,1,4) g.L<sup>-1</sup> (F5) depending on the method application and control treatment (F0). The experimental design was factorial experiment (3\*6) within Randomized Complete Block Design with three replications, collected data were analyzed using Genstat statistical program and means were compared using least significant difference (LSD) test at 5% (3). The traits were studied such as the percentage of the dry matter for the pinnae as (18), Chlorophyll concentration was estimated according to (21). The enzymatic efficacy of peroxidase was assessed in the leaves according to(28) .The percentage of fruit maturity ,fruit weight (g.fruit<sup>-1</sup>), tree yield (kg.tree<sup>-1</sup>), Amino acids in fruits ,T.S.S , Total acidity%. And the content of the fruits of Ca, Mg according to (10).and an account the fruits dropping .

**RESULTS AND DISCUSSION****Effect fertilizers and application methods**

**on vegetative growth:** The results in Table 1 shows that the type of fertilizers has a significant effect on increasing dry matter percentage in leaves ,The highest dry matter percentage was 42% at F5 followed by F4 While treatment F0 showed the lowest percentage of dry matter at 34.63%. The fertilization methods also differed significantly of matter percentage in leaves (A2) recorded the highest percentage of dry matter in the leaves (38.60%). While the leaves with lowest dry matter was (35.66%) in A1. There was a significant increase due to interaction between treatments, especially treatment A3F5 44.78%. This treatment was not significantly different from A2F5 and A2F4, which were 43.95% and 40.56% respectively, While A1F0 showed the lowest dry matter of leaves at 33.56%. The increase in dry matter percentage may be due to the role of neutral manure in that, and in particular the element of nitrogen that stimulates plant growth to produce cytokines(12), Which cause an increase the dry weights of plant parts relate with vegetation increase (24) The reason for the superiority of the fertilization method by injection may be due to the transfer of elements directly to the other parts of the plant with the rising water and thus can overcome the excessive losses in the amount of fertilizers (17,27). The same Table shows increased leaf chlorophyll content when treated with F5 (34.08 mg.100g<sup>-1</sup>) Followed by treatment F4 (33.36 mg.100g<sup>-1</sup>)While the lowest value was at the control F0(29.81 mg.100g<sup>-1</sup>),treatment A2 led to significant increase in chlorophyll content of the leaves, which reached( 32.19 mg.100g<sup>-1</sup>) compared with A1 which recorded the lowest value(31.24 mg.100g<sup>-1</sup>) , Excelled all interference factors including A2F5 , A3F5 Which recorded the highest values (34.06 and 34.53) mg.100g<sup>-1</sup> on a treatment A1F0 Which gave less value (29.46 mg.100g<sup>-1</sup>). The increased leaves chlorophyll content may be due to the effect of these elements in the bio-building processes porphyrin ring Which are involved in building the chlorophyll molecule . While , phosphorus plays an important role in the formation of amino acids and proteins

important in the construction of chloroplasts, as well as the role of potassium, which contributes to the activation of many enzymes that process the formation of chloroplasts (30) These results are consistent with the other researcher's findings(5 and 29). The effectiveness of peroxidase was increased due to the use of nutrients ,F5 gave the highest value It was (27.28 unit.g<sup>-1</sup>) Compared with F0 Which showed less effective for peroxidase enzyme(17.52 unit.g<sup>-1</sup>).also The effectiveness of peroxidase was increased when application method A3 Which reached (24.07 unit.g<sup>-1</sup>) While recorded A1 Less effective (20.91 unit.g<sup>-1</sup>) . The interaction between the two factors significantly affected the effectiveness of the enzyme pyroxidase All treatment significantly exceeded on interaction on treatment(A1F0) Which gave less effectiveness (17.10 unit.g<sup>-1</sup>),As for A3F5 showed the highest effectiveness (27.83 unit.g<sup>-1</sup>) ,Then A3F4 and A2F5 (27.30 and 27.25 unit.g<sup>-1</sup>) respectively. Perhaps the reason for increasing the effectiveness of pyroxidase , Is due to the increase of amino acids and proteins that may contribute to increase the effectiveness of this enzyme as one of the means of defense of the cell in order to reduce the negative impact of the active groups of Auxin for its direct role in the disposal of hydrogen peroxide (23), These results are consistent with the other researcher's findings (26).

**Effect fertilizers and application methods on fruit characteristics:**

Results in Table 2 indicate a significant increase in of fruit maturity due to the effect of fertilizers, especially F3, which had the highest percentage (73.56%) followed by F1 and F4, which did not differed significantly (69.34%) and (69.18%) respectively while the control treatment had the lowest values (53.99%). It was also observed that significant differences in maturity due to the application methods treatment especially A2 which had the highest rate (71.07%). The interaction between application methods and fertilizer type was significant to increasing the maturity percentage. The highest was (87.77%) at the A3F3 treatment. The treatment A3F2 showed the lowest percentage (36.31%). The increase in maturity percentage when treated with

amino acids and seaweed extracts may be due to the role nanoparticles, which characterized by high penetration efficiency of cell membranes to their functional duty stations, which are essential for vital processes, nutrient availability, energy transfer, metabolism, and cell division (25). The results in same Table shows the fruit weight in the Tamar stage was significantly affected by the fertilizers treatment, F1 increased fruit weight to (5.26 g), followed that F2 (5.23g), with no significant differences between them. Control treatment, produced the lowest fruit weight at (4.36 g). The application methods affected to the fruit weight with the highest weight (5.14g) at A2, which differed significantly from A1 with a weight of (4.83 g) and A3 (4.69 g). It was found that the interaction had a significant effect. The interaction (A2F2) had the highest fruit weight (5.67 g) while the fruit weight at A1F0 decreased to (3.97 g). The increase in fruit weight may be due to the role nanoparticles which characterized by high penetration efficiency of cell membranes to their functional duty stations (25). The results in table 2 shows the plant yield where the highest values were found from the F2 treatment (36.75 Kg.tree<sup>-1</sup>) and followed F3 (36.01 Kg.tree<sup>-1</sup>) but the differences didn't significant. Plants at the control treatment produced lowest (34.00 Kg.tree<sup>-1</sup>). The same results were showed that application methods had an effect on increasing the yield, especially the treatment of A2. It was found that the interaction between the factors had a significant effect on the yield. The interaction (A2F2) produced the highest yield of (40.23Kg.tree<sup>-1</sup>), but the treatment A1F0, produced the lowest yield (29.98 Kg.tree<sup>-1</sup>). The increase in the yield due to treatment with seaweed extract and amino acid nanoparticles may be attributed to the role of these compounds in enhancing fruits weight(table 2) which reflected to increase yield.

#### **Effect fertilizers and application methods on the chemical properties of date palm fruits**

Results in Table 3 reveal the content of fruits to amino acids and indicate that highest produced from using the treatments F5,F4,F3 but didn't differed significantly (10.88 ,9.68 , 9.46 mg.g<sup>-1</sup> dry weight respectively), while

the lowest value of amino acids in fruit of the plants were found in control treatment (F0) (5.07 mg.g<sup>-1</sup> dry weight). Fruits of the plants at treatment A2 produced the highest content (10.48 mg.g<sup>-1</sup> dry weight). While the fruit decreased content significantly to (6.71 mg.g<sup>-1</sup> dry weight) at treatment A1. The interaction between the factors of the research to a significant increase in this trait , especially in treatment A2F5, which gave the highest content of free amino acids in fruits (12.82 mg.g<sup>-1</sup> dry weight), While the content of fruits of this trait decreased to 4.34 and (4.93 mg.g<sup>-1</sup> dry weight) in the treatments A3F0 and A1F0, respectively. Perhaps the reason for the increase in the content of fruits to amino acids as a result of containing the composition of this fertilizer a high proportion of amino acids which directly equipped the trees with amino acids or perhaps due to the effect of these nutrients in increasing the activity of protease enzyme for its role in the degradation of proteins, which increases the content of amino acids (6). The results in Table3 show significant differences for the percentage of total soluble solids of fruits as a result of their effect with the research treatments. F2 led to significant increase, in T.S.S (66.71%) compare with F0 which gave the lowest value which amounted to (58.11%). But the application methods non significance in increasing the percentage of total soluble solids in date palm fruits. The interaction between the factors of this study significantly affected the T.S.S% in the fruits (A2F2, A2F3) with no significant differences between them (67.86, 67.06 % respectively). While showed in A2F0 which has the lowest value of (53.00 %). The increase of T.S.S in fruits when treated the plants with seaweed extract fertilizer may be explained by the role of its components in the extraction of photosynthetic process products and their transfer to fruit (2) these results were in agreement with the results of other researchers (7). The results in the same Table shows decreases in fruit of total acidity in F5 which recorded the lowest value (0.122 %), while control treatment recorded the highest percentage of total acidity of (0.159 %). It is also noted that the application methods had a significant effect on the percentage of total acidity in fruits, The

fruit of the treatment A2 recorded the lowest percentage of total acidity amounted to (0.124%). but The highest percentage of total acidity was at A1, which had 0.150%. The interaction between the research factors resulted in significant differences in the percentage of total acidity, especially in the treatment A2F1, which had the lowest percentage of total acidity (0.101%) and did not differed significantly from the treatment A2F2, which was (0.105%). While increased the percentage of total acidity to (0.191%) at the treatment A2F0. The reason for the decrease in the percentage of total acidity in fruits when treated with marine algae fertilizer may be explained by its role in stimulating the production of ethylene within the fruit tissue, which stimulates the enzymes responsible for the analysis of organic acids in the fruit at maturity, either by consuming them or diverting them to sugars, related to the fruit maturity (14).

#### **Effect fertilizers and application methods on fruits Calcium, Magnesium content and Fruits Dropping**

The results in Table 4 indicate significant differences in the percentage of calcium in date palm fruits as the addition of seaweed extract to the plants gave an increase of 0.85% in the treatment of F1, Compared to the treatment F0, which gave the lowest percentage of (0.67%). The percentage of calcium in the fruits was affected by application methods, especially the treatment of A2, which exceeded the highest percentage of (0.83%), while the lowest percentage of calcium in the fruits was showed by treatment A3, (0.76%). The effects of A1F1, A2F5, and A2F4 showed the highest percentage of calcium (0.93, 0.91 and 0.90%) respectively, other than A3F0, which gave the lowest calcium percentage of (0.63%). The reason for the increase in calcium in fruits when fertilizing with marine algae extracts may be due to the role of this extract in regulating and activating the movement and transfer of mineral elements to the fruit tissue and its use in the metabolism associated with the construction of cellular tissues in the fruit As well as containing this extract on some minor

elements, including calcium. The results in the same table indicate that the percentage of Magnesium was significantly differed when adding nutrients. The treatment F2 was the highest with (0.45%) while the control treatment had the lowest percentage of magnesium at (0.26%), the treatment of fertilization by injection (A2) was characterized by giving the highest percentage of magnesium in the fruits was (0.42%) which exceeded the treatment A1 and A3, which had a magnesium ratio of (0.37 and 0.36)% respectively. The interaction showed its significant effects increasing the magnesium ratio, especially the treatment of A2F2, which reached the highest percentage of magnesium and was (0.51%), While the percentage decreased significantly to (0.22%) at treatment A1F0. The increase of magnesium in fruits may be due to the containment of the fertilizers used in the experiment on this element. The results recorded in Table 4 shows that the type of fertilizer had a significant effect on the Fruits dropping percentage, due to the use of seaweed extracts (F1), a significant decrease in the percentage of Fruits Dropping which was 5.48%, and did not significantly differed from the treatment (F2, F3), but (F0) which recorded the highest Fruits Dropping of 7.56%. The application methods were followed by a similar behavior in the effect on the fruits dropping in date palms. Interaction between the studies factors significantly affected the percentage of fruits dropping, especially the treatment (A2F2), which gave the lowest percentage of 4.55%, (A1F0) recorded the highest percentage loss of 7.83%, which did not significantly differed from the treatment (A2F0) and the treatment (A3F0). The reason for the decrease in the percentage of fruits dropping in the treatment with the seaweed extract may be due to the fact that this extract contains growth regulators such as gibberellin, which increasing the fruits set because of the Auxins Produced by Gibberellin which reduces the fruits dropping. Gibberellin increases the level of active oxides by reducing non-free Auxins by preventing the breakdown of calcium lactate (2).

**Table 1. Effect fertilizers and application methods and their Interaction on vegetative characterizes**

Treat.	dry matter in leaves (%)				Chlorophyll concentration mg.100g <sup>-1</sup>				Peroxidase unit.g <sup>-1</sup>			
	A1	A2	A3	Mean	A1	A2	A3	Mean	A1	A2	A3	Mean
F0	33.56	35.55	34.78	34.63	29.46	29.90	30.08	29.81	17.10	17.37	18.10	17.52
F1	35.34	36.98	38.30	36.87	30.39	30.43	30.43	30.42	17.73	22.66	22.31	20.90
F2	35.90	36.45	34.96	35.77	30.47	32.93	33.33	32.24	20.22	23.44	24.35	22.67
F3	35.66	38.11	37.15	36.97	30.42	32.78	30.73	31.31	20.93	23.34	24.49	22.92
F4	36.19	40.56	35.76	37.50	33.08	33.06	33.95	33.36	22.69	23.16	27.30	24.38
F5	37.28	43.95	44.78	42.00	33.64	34.06	34.53	34.08	26.76	27.25	27.83	27.28
Mean	35.66	38.60	37.62		31.24	32.19	32.17		20.91	22.87	24.07	
L.S.D	F	A	Interaction		F	A	Interaction		F	A	Interaction	
0.05	2.67	1.89	4.63		0.06	0.04	0.11		0.27	0.19	0.47	

**Table 2. Effect of fertilizers and application methods on physical properties of date palm fruits**

Treat.	Fruit maturity (%)				Weight of fruit(g)				Yield of plant (kg.tree <sup>-1</sup> )			
	A1	A2	A3	Mean	A1	A2	A3	Mean	A1	A2	A3	Mean
F0	54.61	62.34	45.01	53.99	3.97	4.60	4.50	4.36	29.98	35.70	36.31	34.00
F1	71.94	63.59	72.51	69.34	5.67	4.93	5.17	5.26	35.01	37.03	33.51	35.18
F2	49.31	71.97	36.31	52.53	4.87	5.67	5.17	5.23	32.00	40.23	34.72	36.75
F3	54.95	77.95	87.77	73.56	4.67	5.27	4.33	4.76	33.14	37.85	37.03	36.01
F4	54.95	77.50	75.08	69.18	4.80	5.00	4.80	4.87	38.10	32.80	33.02	34.64
F5	48.16	73.06	46.01	55.74	5.00	5.37	4.20	4.86	34.28	32.78	35.34	34.13
Mean	55.66	71.07	60.45		4.83	5.14	4.69		34.30	36.07	34.99	
L.S.D	F	A	Interaction		F	A	Interaction		F	A	Interaction	
0.05	9.36	6.62	16.21		0.21	0.15	0.37		1.90	1.34	3.29	

**Table3. Effect of fertilizers and methods of application on chemical properties of date palm fruits**

Treat.	amino acids (mg.g <sup>-1</sup> dry weight)				Total soluble solids (%)				Total acidity (%)			
	A1	A2	A3	Mean	A1	A2	A3	Mean	A1	A2	A3	Mean
F0	4.93	5.94	4.34	5.07	58.13	53.00	63.20	58.11	0.130	0.191	0.154	0.159
F1	6.67	10.11	8.24	8.34	66.93	63.20	60.40	63.51	0.165	0.101	0.136	0.134
F2	6.88	10.77	8.50	8.72	65.20	67.86	67.06	66.71	0.163	0.105	0.141	0.136
F3	6.72	11.34	10.32	9.46	59.06	63.46	66.40	62.97	0.157	0.133	0.129	0.140
F4	7.20	11.85	10.00	9.68	60.40	63.86	55.73	60.00	0.151	0.106	0.121	0.126
F5	7.88	12.82	11.94	10.88	66.66	62.26	61.46	63.46	0.131	0.106	0.128	0.122
Mean	6.71	10.48	8.89		62.73	62.27	62.37		0.150	0.124	0.135	
L.S.D	F	A	Interaction		F	A	Interaction		F	A	Interaction	
0.05	2.94	2.08	5.09		4.63	3.27	8.02		0.019	0.013	0.032	

**Table4. Effect of fertilizers and application methods on Calcium, Magnesium and Fruits Dropping percentage of Date Palm Fruits**

Treat.	Calcium (%)				Magnesium (%)				Fruits Dropping (%)			
	A1	A2	A3	Mean	A1	A2	A3	Mean	A1	A2	A3	Mean
F0	0.66	0.71	0.63	0.67	0.22	0.33	0.24	0.26	7.83	7.18	7.65	7.56
F1	0.93	0.83	0.78	0.85	0.39	0.35	0.30	0.35	4.70	6.02	5.71	5.48
F2	0.88	0.80	0.77	0.78	0.46	0.51	0.38	0.45	6.87	4.55	7.37	6.26
F3	0.73	0.82	0.75	0.77	0.34	0.41	0.41	0.39	6.36	6.80	5.58	6.25
F4	0.77	0.90	0.82	0.83	0.43	0.44	0.39	0.42	5.16	6.36	7.51	6.35
F5	0.82	0.91	0.79	0.84	0.40	0.46	0.41	0.42	6.52	6.97	7.45	6.98
Mean	0.80	0.83	0.76		0.37	0.42	0.36		6.24	6.32	6.88	
L.S.D	F	A	Interaction		F	A	Interaction		F	A	Interaction	
0.05	0.04	0.03	0.07		0.06	0.04	0.10		1.38	0.97	2.39	

**REFERENCES**

1. Abdel Aziz, N. G., A. A. M. Mazher and M. M. Farahat. 2010. Response of vegetative growth and chemical constituents of *Thuja orientalis* L. plant to foliar application of different amino acids at Nubaria. J. Am. Sci. 6(3): 295-301
2. Abu Zaid ,A.N.2000. Plant Hormones and Agricultural Applications. Dar Al Arabia Publishing and Distribution Book. The Egyptian Arabic Republic. pp:608
3. AL Mohammadi, S. M. and M. H. Fadel. 2012. Statistics and Experimental Design. Dar

- Osama for publication and distribution / Amman, Jordan. pp: 376
4. Al-dahab, A.A.2010. The Effect of the Bunch Thinning and the Spraying with Ethephin in the Maturity of Fruits and Characteristics for Dates Palm *Phoenix dactylifera* L. sugar. M.Sc. Thesis. Collage of Agriculture. University of Basra pp:154
  5. AL-hamadani, Kh.A.S.2015.Response Of three cultivar of date palm offshoots propagated by tissue culture and planted in gypsifrious soil to the chemical fertilizer. The Iraqi Journal of Agricultural Sciences – 46(5): 819-831
  6. Al-laham,Gh. , M.Sabooh and A. Ibrihem.2006. A study carrying genotypes of white corn *Sorghum bicolor* L. Different levels of salinity in stages of growth Primary. Damascus University Journal of Agricultural Sciences.22(1):255-270
  7. Al-Mobark,N.R.2014. Effect of Seaweed Extract "Kelpak" and NPK Fertilizer on Leaves and Fruits Characteristics and Yield Components of *Phoenix dactylifera* L. cv. Barhi. M.Sc Thesis. Collage of Agriculture. University of Basra. pp:198
  8. Al-Rawi, W. A. A; M. E.A. Al-Hadethi and A. A. Abdul-Kareem. 2016. Effect of foliar application of gibberellic acid and seaweed extract spray on growth and leaf mineral content on peach trees. The Iraqi Journal of Agricultural Sciences . 47: (Special Issue): 98-105
  9. Al-Taha, A.H. and D.A Taein.,2011. A Comparative study on the growth and maturation of date palm fruits in the Al-Basrah and Thi Qar Regions. Studies. Agricultural Sciences.38(1,2)1-12
  10. Cresser , M.S. and J.W. Parsons . 1979 Sulphuric , perchloric acid and digestion of plant material for magnesium. Analytical Chemical. Acta . 109: 431 -436
  11. DeRosa M.R. ,C. Monreal , M. Schnitzer, R.Walsh, and Y. Sultan . 2010. Nanotechnology in fertilizers. Nat. Nanotechnol. J 5, 91
  12. Ding, C. , J. You. , L. Chen, S. Wang and Y. Ding .2014. Nitrogen fertilizer increases spikelet number per panicle by enhancing cytokinin synthesis in rice. Plant Cell Rep., 33(2):363-371
  13. Drwesh. M.A.2015. Olive Tree Cultivation Techniques and Fruit Production . Press alfarah. Publications of the Ministry of Agriculture. Department of Horticulture. Project for the Development and Dissemination of Olives in Iraq.pp:459
  14. Ibrahim , Z. R. 2013. Effect of foliar spray of ascorbic acid, Zn, seaweed extracts (Sea) force and biofertilizers (EM-1) on vegetative growth and root growth of olive (*Olea europaea* L.) transplants cv. HojBlanca. International Journal of Pure and Applied Sciences and Technology. 17(2): 79-89
  15. Ibrahim, A.O. 2014. Date Palm, Cultivation, the Service, Technical Care and Manufacturing, ISA Culture Center.pp:512
  16. Ibrahim, S. M. M., L. S. Taha and M. M. Farahat. 2010. Influence of foliar application of pepton on growth, flowering and chemical composition of *Helichrysum bracteatum* plants under different irrigation intervals. Ozean J. Appl. Sci., 3(1):143-155
  17. Ibrahim, A.S.2017. Alleviation Of Alternate Bearing Phenomenon In Mango Trees Using Boron And <sup>15</sup>N–Tracer Technique. Thesis. Department of Pomology. Faculty of Agriculture. Cairo University. Egypt.pp:152
  18. Kadhim, R. A ; AS. J. Hussein ; and F. F. Jumaa . 2017. EFFECT of organic fertilizer extract (x- humate 85) and application method on growth and yield of apricot trees. The Iraqi Journal of Agricultural Sciences –1108-1114: (4) 48/
  19. Khan, W.; U. P. Rayirath; S. Subramanian; M.N. Jithesh; P. Rayorath; D.M. Hodges; A.T. Critchley; J.S. Craigie; J. Norrie and B. Prithiviraj. 2009. Seaweed extracts as biostimulants of plant growth and development (Review). Journal of Plant Growth Regulation pp:386-399.
  20. Liu X, Z. Feng, S. Zhang, J. Zhang, Q. Xiao and Y.Wang. 2006. Preparation and testing of cementing nano-subnano composites of slowor controlled release of fertilizers. Sci. Agr. Sin. J 39:1598-1604
  21. Mackinney, G. 1941. Absorption of light by chlorophyll solution . J. Biol. Chem., 140: 315 – 322
  22. Mengal, K. 2005. Alternative of complementary role of foliar supply in mineral nutrition. Acta Hortic., 594:33-47

23. Miller, A.E. and A. Heydland .2009. Endocrine interactions between plant and animals: Implications of exogenous hormone sources for the evolution of hormone signaling .General and comparative Endocrinology .31 : 225-237
24. Mohammed, A. A. K. and M.A. Younis. 1991, Basics of Plant Physiology, University of Baghdad, Dar Al-Hekmah, Ministry of Higher Education and Scientific Research. pp: 252
25. Nair, S.H. ; B.G. Nair, T. Maekawa, Y. Yoshida and D.S. Kumar .2010. Nanoparticulate material delivery to plants. Plant Science, 179: 154-163
26. Sadkhan, M.A.A. 2016. Effect of Spraying Some Environmental Stress Compounds on Some Physiological and Anatomical and Productivity Characters of *Phoenix dactylifera* L. CV. *Hillawi*. Ph.D. Dissertation. College of Agriculture, University of Basra. pp:251
27. Saleh , J. 2008. Yield and chemical composition of pirom date palm as affected by levels and methods fertilization. International, J. 2(3):207-213
28. Srivastava, G. C. and Prasad, N. K. 2010. Modern methods in plant physiology. New India Publishing Agency, *Pitam pura*, New Delhi – 110088
29. Taha ,F.H; M.R. Abood .2018. Influence of some organic fertilizers on date palm cv. barhi. Iraqi Journal of Agricultural Sciences .49(4):231- 238
30. Taiz , L. and E. Zeiger .2002. Plant Physiology . 3<sup>rd</sup> ed. , Sinauer Associates , Inc. , Publishers , Sunderland , Massachusetts . pp:623
31. Zamani, S; S, Khorasaninejad and B, kashefi. 2013. The importance role of seaweeds of some characters of plant. International Journal of Agriculture and Crop Sciences. 5(16):1789-1793.