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EFFECT OF NANO FERTILIZERS AND APPLICATION METHODS TO YIELD CHARACTERISTICS OF DATE PALM

S. M. Jubeir and W. A. Ahmed

Departmentof Horticulture and Landscape Gardening, College of Agricultural and Engineering Sciences, University of Baghdad, Iraq.
E-mail : shwithjatm@gmail.com

Abstract

This experiment was carried out at the 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 factor was three application methods; foliar application, injection with trunk and soil fertilization (A1, A2, A3) respectively. The second factor was different types of fertilizer, (Super Fifty) seaweed extractof the nanotechnology product with two concentrations, (F1) (1,0.5,2)ml.$L^{-1}$and (F2) (2,1,4) ml.L^{-1} respectively, depending on the method of application and optimus-plus fertilizer the product of nanotechnology with two concentrations, (F3) (1,0.5,2) ml.L^{-1} and (F4) (2,1,4) ml.L^{-1} respectively depending on method of application also used NPK fertilizers (F5) (2,1,4) g.L^{-1} and control treatment (F0).The results showed the significant effect of fertilization by injection at increase in fruit pulp weight of (4.56 g) , bunch weight (7.21 kg).the treatment(F2) was increased weight of fruit pulp (4.64 g) and bunch (7.35)kg. The highest percentage of phosphor appeared in (F3) at (0.24%). F4 and F5 treatments showed an increase of fruit nitrogen content of (0.83, 0.87)% and protein content of (5.20 , 5.45)%respectively, and highest percentage of potassium at (1.18)%. Therefore, concluded that using nano fertilizer and NPK enhances the vegetable and fruit characteristics of date palm.

Key words : Date palm, Nano seaweed extract, Nano amino acid, Injection fertilizer, Soil fertilizer.

Introduction

The date palm *Phoenix dactylifera* L. is one of the oldest fruit trees they are known to be important fruit trees in the subtropical regions of the family (*Palmaceae*) *Arecaceae* order *Palmae*, which includes 200 genus,4000 species Its most important species are four species of which phoenix which contains 12 species, the most important *dactylifera* (Ibrahim, 2008). *Al-Khastawi* is one of the most important species in Iraq, which comes second after *Al-Zahdi* in cultivar of productivity. It comes primarily in Baghdad for 2015 (CSO, 2016). The process of fertilization is one of the most important processes necessary for the date palm, need fertilizers like other fruit trees,it's need to fertilize nutrients regularly and without neglect of this process, which affects the productivity of trees significantly (Ibrahim, 2014). Seaweed extract are environmentally friendly and non-toxic to the user by their biological nature,no residues are left on the plant and soil, it's also considered as an organic source used in agricultural production,and a partial substitute for chemical fertilizers or complementary to it, Contribute to lower production costs (Khan *et al*., 2009 and Zamani *et al*., 2013). The plant needs amino acids mainly for growth and Increase the quantity and quality of the yield, amino acids enter into building other organic compounds such as amines, alkaloids, 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's a source of carbon, energy and cell protection from ammonia poisoning (Abdel Aziz *et al*., 2010 and Ibrahim *et al*., 2010). 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, lost nutrient losses are reduced by direct absorption by the plant. As well as avoiding the interaction of nutrients with soil, living creatures and water (Liu *et al*., 2006). The method of absorption of nutrients through the roots is the usual way so the fertilizer is added to the soil extensively (DeRosa *et al*., 2010). Although, the plant is preparation with nutrients and added elements in this way, there is an excess loss in the amount of fertilizers added, especially when added in large areas of agricultural, which led researchers to search for efficient methods to add fertilizers (Mengal, 2005). 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 broadly used in the control of pests and diseases (Dang *et al.*, 2005). As well as use of limited amounts of fertilizer when conducting fertilization by injecting the stem (Drwesh, 2015). Therefore, the objective of this experiment is to study the effect of the methods of adding fertilizer and fertilizer type in vegetative and fruit qualities of "*Al-KHastawi*" date palm.

Materials and Methods

The experiment carried out in the AL-Rabeaa station of the palms in Zafaraniyah of the Department of Horticulture, Ministry of Agriculture on 10 years old date palm trees of cv. *Khastawi* during 2016-2017. The experiment included two factors, the first of which is 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_2O 5%, NPK, growth regulators and Micro elements) with two different concentrations depending on the method of application at spraying (1, 2 $ml.L^{-1}$), at injection (0.5, 1 $ml.L^{-1}$) and at soil fertilization (2, 4 $ml.L^{-1}$)(F1,F2) and used Optimus-Plus Fertilizer the product of nanotechnology, which contains (5% nitrogen, 30% amino acids and 3% organic nitrogen) with two different concentrations depending on the method of application At spraying (1, 2 $ml.L^{-1}$), at injection (0.5, 1 $ml.L^{-1}$) and at soil fertilization (2, 4 $ml.L^{-1}$) as (F_3, F_4) and used NPK fertilizers (20% N, 20% P, 20% K) (F_5) (2,1,4)$g.L^{-1}$ depending on the method application and control treatment (F0). The second factor was Three application methods: Foliar application, injection with trunk and soil fertilization as (A1, A2, A3), respectively. The experimental design was factorial experiment (3×6) within RCBD with three replications, collected data were analyzed using Genstat statistical program and means were compared using least significant difference (LSD) test at 5% probability (AL Mohammadi and Fadel, 2012). The traits were studied such as seed weight (g), pulp(g), bunch weight (kg).as well as total sugars and reducing sugarsaccording to (Abbas and Abbas, 1992). Fruit content of nitrogen, phosphor, potassium according to Cresser and Parsons (1979) and percentage of protein of fruit according to A.O.A.C. (1970).

Results and Discussion

Effect of fertilizers and application methods and their interaction on yield character

The results in table 1 shows that the type of nutrient fertilizer has a significant effect on increasing the pulp weight of fruit date palm. The highest values was (4.65 g) at F2 which were not significantly different from F1while F0 treatment showed the lowest pulp weight of fruit at (3.82g). The fertilization methods also significantly increased the pulp weight especially (A2) which recorded the highest pulp weight at (4.56g) followed by A1 at (4.26g). While the lowest pulp weight atA3 (4.11g). There was a significant increase due to interference between treatments, especially treatment A2F2at (5.09g). This treatment was not significantly different from A1F1which value (5.03), While A1F0 showed the lowest weight of pulp fruit (3.47g). The increase in the weight pulp fruit may be due to the addition of fertilizers to date palm trees during the period of cell division and growth led to increase the osmotic pressure of the cells as a result of the penetration of nutrients to the inside, resulting in increased absorption of water and other nutrients into the fruits treated and then increase the pulp weight (Al-mobark, 2014). The reason for the superiority of the method of fertilization by injection may be due to the transfer of elements directly to the parts of the plant with the rising water and thus can overcome the excessive losses in the amount of fertilizers these results are consistent with Al-Mobark (2014).

The same table shows increased seed weight when treated with F1 (0.62g) followed by F5 which did not significantly different about herat (0.60g), while the lowest value was at the control F0(0.54g), the application methods did not significantly difference, Excelled all interference factors including A1F1 which recorded the highest weight of (0.64g) on a treatment A1F0 which gave less seed weight of 0.50 g. The increased of seed weight may be due to the reason for increasing ofseeds weight due to the content of marine algae extract from the essential nutrients of nitrogen, phosphorus and

Table 1 : Effect of fertilizers and application methods and their Interaction on (pulp, seed, bunch) weight.

Treat	Weight of pulp fruits(g)				Weight of seed fruits(g)				Weight of bunch(kg)			
	A1	A2	A3	Mean	A1	A2	A3	Mean	A1	A2	A3	Mean
F0	3.47	3.99	3.99	3.82	0.50	0.61	0.51	0.54	6.00	7.14	7.26	6.80
F 1	5.03	4.34	4.55	4.64	0.64	0.59	0.62	0.62	7.00	7.41	6.70	7.04
F 2	4.30	5.09	4.56	4.65	0.57	0.57	0.60	0.58	7.06	8.05	5.94	7.35
F 3	4.17	4.65	3.72	4.18	0.49	0.62	0.62	0.58	6.63	7.57	7.41	7.20
F4	4.24	4.48	4.21	4.31	0.56	0.52	0.59	0.56	7.62	6.56	6.60	6.93
F5	4.38	4.77	3.62	4.26	0.62	0.59	0.58	0.60	6.86	6.56	7.07	6.83
Mean	4.26	4.56	4.11		0.56	0.58	0.59		6.86	7.21	7.00	
L.S.D0.05	F	A	Interaction		F	A	Interaction		F	A	Interaction	
	0.42	0.30	0.73		0.06	0.04	0.10		0.42	0.29	0.72	

potassium, as well as plant hormones, especially Auxins, gibberellin and cytokines, as well as their containment of amino acids and organic matter. When absorbed from cellular tissues, it stimulates physiological processes and stimulates growth and plant development. Increases the quantity and quality of the yield (Francesco *et al*., 2010). As well as the role of marine algae in increasing cell division and size, as well as increase of photosynthesis and nutrients and withdrawal within the fruits, which reflected positively in pulp weight and seed fruit (Ozaga and Reinecke, 2003). These results are consistent with the other researcher's findings of Salama *et al*. (2014).

Results in table 1 shows the effectiveness of bunch weight was increased due to the use of nutrients ,F2 gave the highest value it was (7.35 kg) which not significant different from F3 of (7.20 kg) compared with F0 which showed less weight bunch (6.80 kg). Also weight bunch was increased when application method A2 which reached at (7.21 kg) while recorded A1 less weight bunch (6.86 kg) . The interaction between the two factors significantly affected the weight bunch. A2F2 gave the highest weight bunch of (8.05 kg)while showed less value in A1F0 (6.00 kg).

Perhaps the reason for increasing the weight bunch. Is due to the role of these fertilizers in increasing the rate of fruit weight and the proportion of dry matter in fruits and formation of DNA and RNA and energy compounds ATP and ADP and enzymatic accomplices that have a role in biological and physiological processes such as photosynthesis (Abd–Alkader *et al*., 1982), which caused a significant increase in the fruit weight as shown in the previous table thus increasing the weight bunch these results are consistent with the other researcher's findings of Harhash and Abdel-Nasser (2010), AL-Sirdah (2014).

Effect fertilizers and application methods on fruits nitrogen, phosphor andpotassium content

The results in table 2 indicate significant differences in the percentage of nitrogen in date palm fruits as the using the nutrient. The highest percentage of nitrogen showed in F5 and F4 (0.87, 0.83%) respectively. Compared to the treatment F0, which gave the lowest percentage of (0.66%). The percentage of nitrogen in the fruits affected by application methods, especially the treatment of A3, which exceeded the highest percentage of (0.83%), while the lowest percentage of nitrogen in the fruits was showed by treatment A1 was (0.72%). The effects of A3F5, A3F4 and A2F5 showed the highest percentage of nitrogen (0.91, 0.90 and 0.86%) respectively, other than A1F0, which gave the lowest nitrogen percentage of (0.62%). This may be due to the direct addition of nitrogen. As well as the fact that amino acids are a source of nitrogen ready for absorption and representation directly (Cardozo *et al.*, 2007).

The results in the same table indicate that the percentage of phosphor was significantly differed when adding nutrients. The treatment F3 was the highest with (0.24%) while the control treatment had the lowest percentage of phosphor at (0.11%), the results in the same table showed that the application methods did not significant of percentage of phosphorus.

The interaction showed its significant effects increasing the phosphor ratio, especially the treatment of A3F3, which reached the highest percentage of phosphor at (0.47%), while the percentage decreased significantly to (0.11%) at A1F0 treatment. The increase of phosphor in fruits may be due to the containment of the fertilizers optumis plus used in the experiment on this element.

Results in table 2 indicates a significant increase in

Table 2 : Effect fertilizers and application methods their Interaction on fruits Nitrogen phosphor potassium content.

Treat	Nitrogen in fruits(%)				Phosphor in fruits(%)				Potassium in fruits(%)			
	A1	A2	A3	Mean	A1	A2	A3	Mean	A1	A2	A3	Mean
F0	0.62	0.66	0.71	0.66	0.11	0.11	0.12	0.11	0.75	0.81	0.86	0.81
F 1	0.66	0.67	0.80	0.71	0.11	0.11	0.11	0.11	0.78	0.83	0.81	0.81
F 2	0.68	0.84	0.86	0.80	0.12	0.12	0.14	0.13	0.88	0.98	1.08	0.98
F 3	0.69	0.79	0.81	0.77	0.12	0.12	0.47	0.24	0.84	1.05	1.10	0.99
F4	0.80	0.80	0.90	0.83	0.14	0.13	0.15	0.14	1.04	1.03	1.16	1.08
F5	0.85	0.86	0.91	0.87	0.13	0.14	0.11	0.13	1.10	1.21	1.23	1.18
Mean	0.72	0.77	0.83		0.12	0.12	0.18		0.90	0.99	1.04	
L.S.D0.05	F	A	Interaction		F	A	Interaction		F	A	Interaction	
	0.05	0.04	0.09		0.13	0.09	0.23		0.04	0.03	0.07	

Table 3 : Effect fertilizers and application methodstheir Interaction on total sugars, reducing sugars and percentage of moisture content in fruit.

Treat	Total sugars(%)				Reducing sugars (%)				Moisture (%)			
	A1	A2	A3	Mean	A1	A2	A3	Mean	A1	A2	A3	Mean
F0	35.61	36.43	37.01	36.35	25.26	25.46	25.91	25.54	8.44	6.79	6.96	7.40
F 1	36.38	37.15	37.61	37.04	25.40	25.75	25.02	25.39	8.28	6.95	6.64	7.29
F 2	37.21	47.61	48.32	44.38	25.72	31.34	31.35	29.47	6.82	5.15	5.85	5.94
F 3	37.45	50.23	54.01	47.23	26.15	31.34	37.09	32.31	8.48	7.99	8.05	8.17
F4	48.55	53.78	55.21	52.51	31.32	36.96	37.51	35.26	8.80	7.40	8.40	8.20
F5	52.36	54.60	55.51	54.16	36.78	37.95	38.96	37.89	9.02	7.53	6.95	7.83
Mean	41.26	46.63	47.95		28.44	31.86	32.64		8.31	6.97	7.14	
L.S.D0.05	F	A	Interaction		F	A	Interaction		F	A	Interaction	
	0.30	0.21	0.53		0.20	0.14	0.35		1.19	0.84	2.07	

percentage of potassium due to the effect of fertilizers, especially F5, which had the highest percentage at (1.18%) followed by F4 of (1.08 %) while the control treatment had the lowest values of (0.81%). It was also observed that significant differences in percentage of potassium due to the application methods treatment especially A3 which had the highest rate at (1.04%), followed A2 of (0.99%). A1 gave the less value of (0.90%). The interaction between application methods and fertilizer type was significant to increasing the percentage of potassium. The highest was (1.23, 1.21%) at the A3F5, A2F5 treatments. The treatment A1F0 showed the lowest percentage (0.75%). The addition of nutrients reduces the water potential, which facilitates the absorption of elements that move towards the storage cells (Ali, 2012).

Effect fertilizers and application methods on total sugars, reducing sugars and percentage of moisture content in fruit

The results in table 3 shows the total sugars in the Tamar stage was significantly affected by the fertilizers treatment, F5 increased total sugars to (54.16%), followed that F4 (52.51%). Control treatment, produced the lowest value fromtotal sugars at (36.35%). The application methods affected to the total sugars with the highest value (47.95 %) at A3, followed by A2 (46.63%). the lowest values of (41.26 %) at A3 It was found that the interaction had a significant effect. The interaction (A3F5) had the highest total sugar of (55.51%), which non-significant from A3F4 of (55.21%) whilethe percentage of total sugars decreased to (35.61) at A1F0.

These results in the same tableshowed the percentage of reducing sugars affected with fertilization treatments. The highest values were found from the F5 treatment of

(37.89%) and followed F4 (35.26%). Plants at the F1 treatment produced lowest reducing sugars (25.39%). The same results showed that application methods had an effect on increasing the reducing sugars, especially A3 treatment of (32.64%) but the lowest value was A1 at (28.44%). It found that the interaction between the factors had a significant effect on the reducing sugar in fruit. The interaction (A3F5) gave the highest valueof (38.96%) followed A2F5 of (37.95%), but the treatments A3F1 and A1F0gives the lowest value (25.02 and 25.26) % respectively. The increase in the reducing sugars due to increased activity Inverses Which affects the transformation of sucrose to reducing sugars (glucose, fructose) in addition to the transmission of sucrose from the head of the palm to the fruits and the continued flow of sugars manufactured in the leaves to the fruits (Shabana *et al*., 2006).

Results in table 3 reveals the percentages of moisture in fruits and the high moisture content was in the F4 which reached of (8.20%) but didn't differed significantly from F3 of (8.17%), while the lowest presentation of moisture in fruit were found in F2 of (5.94%).Fruits inA1treatment reached the highest moistureof (8.31%). while the fruit decreased content significantly to (6.97%) at A2 treatment. The interaction between the factors of the research to a significant increase in this trait, especially in treatment A1F5, which gave the highest percentage of moister (9.02%), while the content of fruits of this trait decreased to (5.15%) in the treatments A2F2. The reduction of water content in fruits when treated with seaweed may be due to the biological processes associated with fruit maturity, such as the rapid loss of water, which coincides with the increased accumulation of total soluble solids in fruit ,These results are consistent with Al-Mobark (2014), Al-taha and Taein (2011).

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