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IMPROVING THE GROWTH OF DATE PALM CV. SAKKOTY PLANTLETS BY SOME FERTILIZATION TREATMENTS

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ABSTRACT

An investigation was conducted under the green house condition at Central Laboratory of date palm Research and development, Giza Egypt, during 2008 and 2009 seasons to study the effect of fertilization with humic acid, which contained NPK (10:10:10) liquid fertilization at 0, 10, 20 and 30 ml/L (as a soil drench) and potassein-N (K-N) at 0, 1, 2 and 3 (as a foliar spray) on growth of 6-month-old date palm cv. Sakkoty plantlets. Moreover each level of humic acid (as a soil drench) was combined with each one of potassein-N (as a foliar spray) to obtain 16 interaction treatments. Transplants were grown in 20 cm plastic pots (one plantlet/pot) filled with a mixture of peat and sand (3:1, by volume). The obtained results indicated that plant height, number of leaves/plant, leaf width and leaves content of chlorophyll a, b and carotenoids, N, P and K were significantly increased in response to various treatments used in the study in the two seasons with the superiority of the combined treatment between 20ml/L HA and 2ml/L potassein-N, which gave in general the utmost high means in all previous measurements compared to the means of control and all other treatments. So, it is recommended to use a combination of potassein N (K-N) as a foliar spray at 2 ml/L plus humic acid at 20ml/L as a soil drench monthly to improve vegetative growth and promoting the nutrients uptake of date palm cv. Sakkoty plantlets.

INTRODUCTION

The date palm (*Phoenix dactylifera L.*) is considered common fruit grown in the tropical and subtropical countries. Improving the vegetative growth without adversely affecting the environment, is a major goal of horticulturists. It could be achieved by biostimulants

which were defined by Russo and Berlyn (1990) as being non fertilizers which benefit plant growth. Foliar fertilization with macro- and micro-nutrients leads usually to considerable growth and development responses. This is mainly due to the fact that foliar nutrients application easily overcomes limiting soil physiochemical conditions for root nutrients uptake and because nutrients are directly applied to foliage at times when demand is particularly to high and rapid responses may be desired (Alexander, 1987). Potassium is a very effective macro-element on growth, development, flowering and yield of different plants. Potassein is a liquid fertilizer containing 3% K, produced by Ministry of Agric., Egypt. This fertilizer is available with nitrogen (Potassein-N). Many investigators as El-Maghraby *et al.* (1998), El-Shafai (2001) and Ismail *et al.*, (2002) scored a significant stimulation on growth, root sugars and yield of sugar-beet plants fertilized with either forms of potassein. Likewise, Naguib (2002) on thyme and Mohamed and Naguib (2002) on fenugreek indicated that plant height, number of branches/plant, fresh and dry weights of herb, chlorophylls pigments, carbohydrates and minerals content in the leaves were significantly improved as a result of spraying with K-P potassein at the rates of 3 or 6 L./Fed. Moreover, Humates applied as various commercial products, have been found to improve growth and increase yield and water uptake by different citrus species (Webb and Biggs, 1988) and improve growth of chardonnay grapevines (Reynolds *et al.*, 1995). However, this study aims to improve vegetative growth and nutrients uptake of the young date palm plantlets cv. Sakkoty.

MATERIALS AND METHODS

A trial was conducted under the greenhouse conditions at the Central Laboratory of Research and development of date palm, Giza, Egypt during the two successive seasons of 2008 and 2009 to improve vegetative growth and promoting the nutrients uptake of young date palm plantlets cv sakkoty by using organic fertilizer (Humic acid) and potassein-N (K-N). Six- month- old cv. Sakkoty plantlets with average 10-12 cm height and 2-3 leaves/plantlet were planted in 20 cm diameter plastic pots (one plantlet/pot) filled with a mixture of peat and sand (3:1, by volume). A commercial liquid organic fertilizer NPK (10:10:10) was applied as a soil drench at 0, 10, 20 and 30 ml/L and potassein-N (K-N) applied as a foliar spray at 0,1, 2 and 3ml/L.

Control plants were sprayed in the same times with a tap water. Moreover, each level of humic acid as a soil drench was combined with each one of potassein-N (K- N) as a foliar spray to obtain 16 interaction treatments. The treatments were applied monthly from March to October, All plants under various treatments were irrigated once every 6 days with 500 ml of fresh water/pot.

Table (1): Main characteristics of actosol® used in the two seasons.

Components	Value	Components	Value	Components	Value
Humic acid (%)	2.9	EC(dS/m)	29.3	B (mg/L.)	70.00
Organic matter/total	42.51	N (%)	10.00	Fe (mg/L.)	900.00
Total HA/total solid	165.80	P (%)	10.00	Mn (mg/L.)	90.00
Organic carbon (%)	24.64	K (%)	10.00	Zn (mg/L.)	90.00
C/N ratio	2.46	Ca (%)	0.06		
pH	8.10	Mg (%)	0.05		

The layout of the experiment in the two seasons was a complete randomized design in factorial experimental type (Mead *et al.*, 1993), with 3 replicates, as each one contained 3 Plantlet. At the end of each season (October, 30 th) the following data were recorded: plant height (cm), number of leaves/plant and leaf width. in fresh leaf samples, photosynthetic pigments (chlorophyll a, b and carotenoids) as mg/g F.W. were determined according to Moran (1982), while in dry samples, the content of nitrogen using micro-Kjeldahle method described by Jackson (1973), Phosphorus colorimetrically as recommended by Cottenie *et al.*, (1982) and potassium using Flame Photometer (Jackson, 1973) were measured as mg/g D.W. Data were then tabulated and subjected to analysis of variance according to SAS program (1994) while Duncan's Multiple Range Test (1955) was used to explore the significancy between the means of various treatments.

RESULTS AND DISCUSSION

Effect of potassein- N, humic acid and their interaction on vegetative growth parameters:-

Data presented in Table (2) showed that plant height (cm), number of leaves/plant and leaf width were significantly increased due to different treatments used in the study in both seasons, with the

superiority of the combined treatment between 2 ml/L potassein-N + 20 ml /L humic acid, which gave the highest records of plant height (35.34 and 37.06 cm), leaf width (1.63 and 1.73 cm) and number of leaves/plant (5.67 and 5.73 per plant) in the first and second seasons respectively.

Concerning the effect of humic acid applied as soil drench, the results showed that the highest significant increases in plant height (30.52 and 31.25 cm), leaf width (1.08 and 1.12 cm) and number of leaves/plant (4.57 and 4.56) were obtained from plants treated with humic acid at 20 ml/L. Atef *et al.*, (2005) concluded that, the use of humic acid on leconte pear and Canino apricot trees gave the highest vegetative growth parameters. Abdel-Galiel *et al.* (2009) on date palm cv. malacabe plantlet, found that humic acid at 20 ml/L as soil drench and 2 ml/L as foliar spray improve the growth parameters.

Regarding the effect of potassein-N treatment as a foliar spray the results indicated that heighest of plants (28.19 and 28.59 cm) and greate number of leaves/plant (4.38 and 4.37) in the first and second seasons, respectively were recorded from plants treated with 2 ml/L potassein as a foliar spray. In addition the widest leaf (1.03 and 1.04 cm) in the first and second seasons, respectively was recorded from plants treated with 2 m/L potassein as a foliar spray. In this concern, Shahin *et al.*, (2004) on *Dodonaea viscosa*, Moustafa *et al.*, (2005) on *Nerium oleander* and Salem and El-Fiky (2006) on marjoram reported that adding either N or P fertilizers in the presence of K markedly improved plant growth.

In addition to the great contribution of N in plant materials, as it is a main constituent of all proteins and nucleic acid, as well as, of both structural and non-structural components of plant cells, besides, involving P in energy transfer process and in building of phospholipids and nucleic acids (Yeonhee *et al.*, 2000).

Table (2): Effect of humic acid and potassein-N on some vegetative growth parameters of Sakkoty plantlets during 2008 and 2009 seasons

Soil Drench foliar Spray	Plant height (cm)					Leaf width (cm)					Number of leaves/plant				
	0	10 ml/ L	20 ml/ L	30 ml/ L	Mean	0	10 ml/ L	20 ml/ L	30 ml/ L	Mean	0	10 ml/L	20 ml/L	30 ml/L	Mean
	First season: 2008														
0	19.17	27.08	30.11	21.89	24.56	0.55	0.78	0.83	0.64	0.70	3.00	3.67	4.83	3.33	3.71
1 ml/L	22.10	28.75	28.24	28.42	26.88	0.77	0.79	0.75	0.77	0.77	3.94	4.00	3.99	3.96	3.97
2 ml/L	25.36	23.84	35.34	25.36	27.47	0.84	0.78	1.63	0.86	1.03	4.02	3.79	5.67	4.05	4.38
3 ml/L	31.50	26.18	28.40	26.66	28.19	0.67	0.73	1.12	1.52	1.01	3.67	3.74	3.77	3.67	3.71
Mean	24.53	26.46	30.52	25.58		0.71	0.77	1.08	0.95		3.66	3.80	4.57	3.75	
LSD Drench	1.998					0.191					0.325				
LSD spray	1.998					0.191					0.325				
LSD DrenshxSpray	3.996					0.383					0.651				
	Second season: 2009														
0	22.50	26.55	32.68	24.96	26.67	0.57	0.77	0.83	0.66	0.71	3.44	3.78	4.73	3.62	3.89
1 ml/ L	25.55	27.79	27.67	27.40	27.10	0.75	0.80	0.75	0.77	0.77	3.98	4.10	3.96	3.91	3.99
2 ml/L	26.53	25.91	37.06	26.80	29.08	0.82	0.77	1.73	0.85	1.04	4.00	3.85	5.73	3.89	4.37
3 ml/l	33.39	26.55	27.59	26.85	28.59	0.69	0.74	1.15	0.82	0.85	3.55	3.89	3.81	3.77	3.75
Mean	26.99	26.70	31.25	26.50		0.71	0.77	1.12	0.78		3.74	3.90	4.56	3.80	
LSD Drench	1.568					0.095					0.268				
LSD spray	1.568					0.095					0.268				
LSD DrenshxSpray	3.136					0.190					0.536				

Chemical composition:**Nitrogen content (% DW):**

Data in Table (3) indicated that, the highest percentages of N (4.91 and 4.92%) in the first and second seasons, respectively were recorded in the leaves of plants treated with 20 ml/L as soil drench while foliar spray with potassein at 2 ml/L recorded 4.86% and 4.89 % in the first and second seasons respectively the control treatment however recorded the lowest values (4.24 in both seasons). Concerning the interaction between foliar spray with potassein at 2 ml/L and soil drench with humic acid at 20 ml/L, the highest percentage were 5.54 and 5.58% in the first and second seasons respectively.

Phosphorus content (%DW):

The significant by highest phosphorus percentage, table (3) resulted by humic treatments (as a soil drench) at 10 ml /L in both seasons (1.28 and 1.31 %) respectively. Whereas the control treatment significantly gave the least values of (0.94 and 0.95%) in two seasons respectively of the experiment, successively. Referring the effect of potassein-N (as foliar spray) the treatment of 2ml/L potassein-N showed its superiority in increasing phosphorus accumulation in leaves (1.35 and 1.39 %) in the two seasons respectively. The results of the interaction between humic acid as a soil drench at 10 ml/l + potassein N at 2ml/l indicated that, the highest p % was 1.77 in the two seasons

Potassium content (%DW):

The significant and highest phosphorus percentage resulted from plants treated with humic acid as a soil drench at 10 ml/L (0.76 and 0.75% in both seasons, respectively) On the other hand there is no significant differences between the concentrations of humic treatments as soil drench, whereas the control gave the least percentage of 0.50 and 0.52% in both seasons, respectively.

The data in table (3) indicated that foliar spray with Potassein-N at 1ml/l recorded 0.78% and 0.77% in first and second season respectively. However the superiority in both seasons was found due to combined treatment of 10 ml/L humic acid as a soil drench + 1 ml/L potassein as a foliar spray, as this combination gave the highest averages 0.88 and 0.86 % in both seasons respectively.

Several workers referred to stimulatory effect of K, P and N fertilization on chlorophylls and other constituents formation as Yeonhee *et al.*, (2000) on *Aster tataricus* and *Chrysanthemum boreal*.

Table (3) : Effect of humic acid and potassein-N on chemical composition of Sakkoty plantlets leaves during 2008 and 2009 seasons

Soil Drench Foliar Spray	Nitrogen %					Phosphorus %					Potassium %				
	0	10 ml/L	20 ml/L	30 ml/L	Mean	0	10 ml/L	20 ml/L	30 ml/L	Mean	0	10 ml/L	20 ml/L	30 ml/L	Mean
First season: 2008															
0	2.36	4.81	5.00	4.78	4.24	0.21	1.00	0.33	0.75	0.57	0.23	0.62	0.82	0.69	0.59
1 ml/L	4.57	5.07	4.68	4.67	4.75	1.61	1.41	1.26	1.11	1.35	0.75	0.88	0.73	0.78	0.78
2 ml/L	4.47	4.62	5.54	4.83	4.86	1.38	1.77	0.96	0.98	1.27	0.55	0.79	0.74	0.70	0.70
3 ml/L	4.59	4.69	4.43	4.32	4.51	0.57	0.96	1.09	1.09	0.93	0.48	0.75	0.67	0.70	0.65
Mean	4.00	4.80	4.91	4.65		0.94	1.28	0.91	0.98		0.50	0.76	0.74	0.72	
LSD Drench	0.277					0.095					0.059				
LSD spray	0.277					0.095					0.059				
LSD DrenchXspray	0.554					0.190					0.118				
Second season: 2009															
0	2.48	4.64	5.10	4.73	4.24	0.22	0.99	0.34	0.74	0.57	0.28	0.63	0.82	0.69	0.60
1 ml/L	4.56	4.89	4.58	4.60	4.66	1.63	1.42	1.28	1.23	1.39	0.75	0.86	0.73	0.77	0.77
2 ml/L	4.48	4.73	5.58	4.75	4.89	1.36	1.77	0.96	0.99	1.27	0.55	0.78	0.75	0.71	0.70
3 ml/L	4.81	4.03	4.41	4.28	4.39	0.58	1.06	1.16	1.19	1.00	0.48	0.75	0.67	0.69	0.65
Mean	4.87	4.57	4.92	4.59		0.95	1.31	0.93	1.04		0.52	0.75	0.74	0.71	
LSD Drench	0.277					0.123					0.053				
LSD spray	0.277					0.123					0.053				
LSD DrenchXspray	0.554					0.247					0.105				

Moustafa *et al.*, (2005) on *Nerium oleander*, Abdel-Galiel (2009) on malacabe plantlet found that humic acid promoting the uptake of nutrients.

Chlorophyll a content in the leaves (%):

The results which are presented in Table (4) showed the effect of humic acid on chlorophyll a, b and carotenoids contents of leaves of sakkoty plantlets. The data indicated that the highest value of chlorophyll a, (5.08 and 4.79 mg/g F.W) in both seasons respectively was recorded from plantlets treated with 20 ml/L humic acid as a soil drench. In this concern Abdel-Galiel (2009) on date palm cv. malacabe plantlets reported that adding humic acid at 20 ml/L gave the highest value of chlorophyll a.

In addition, the highest means were recorded from plantlets treated with of potassein N at 2 ml/L (4.48 and 4.56 mg/g F.W.) in both seasons respectively.

Concerning the interaction between humic acid at 20 ml/L plus potassein-N at 2 ml/L it gave the best results (5.51 and 5.43 mg/g F.W.) in the two seasons, respectively. Whereas control treatment recorded the lowest value, (3.00 and 3.10 mg/g F.W.) in two seasons, respectively).

Chlorophyll b content:

The data in table (4) indicated that, the highest value of chlorophyll b, (2.76 and 2.73) mg/g F.W. was recorded in leaves of the plantlets treated with 20 ml/L as soil drench. The same results obtained with Abdel- Galiel (2009) who reported that humic acid at 20 ml/L increased chlorophyll content of date palm plantlet cv. malacabe. The best value of chlorophyll b (2.58 and 2.51 mg/g F.W.) were recorded in leaves of plantlets treated with 2 ml/L potassein as a foliar spray in first and second seasons respectively.

the interaction between soil drench (humic acid) at 20 ml/L + foliar spray (potassein-N) at 3 ml/L gave the highest value 4.03 in the first and second seasons.

The results come in response to the role played by N in chlorophylls and amino acid synthesis and P which contributes in regulating the opening and closing of stomata and possibility membrane turgor that affects chlorophyll formation through its radioactive properties (Marschner, 1995). Several workers referred to

the stimulatory effects of K, P and N fertilization on chlorophylls and other constituents formation as Yeonhee *et al.*, (2000) on *Aster tataricus*, Moustafa *et al.*, (2005) on *Nerium oleander*. From the previously stated results, it could be recommended to spray the young plantlet with potassein-N at 2 ml /L + 20 ml /L humic acid one month interval to improve vegetative growth and nutrient uptake.

Carotenoids content:-

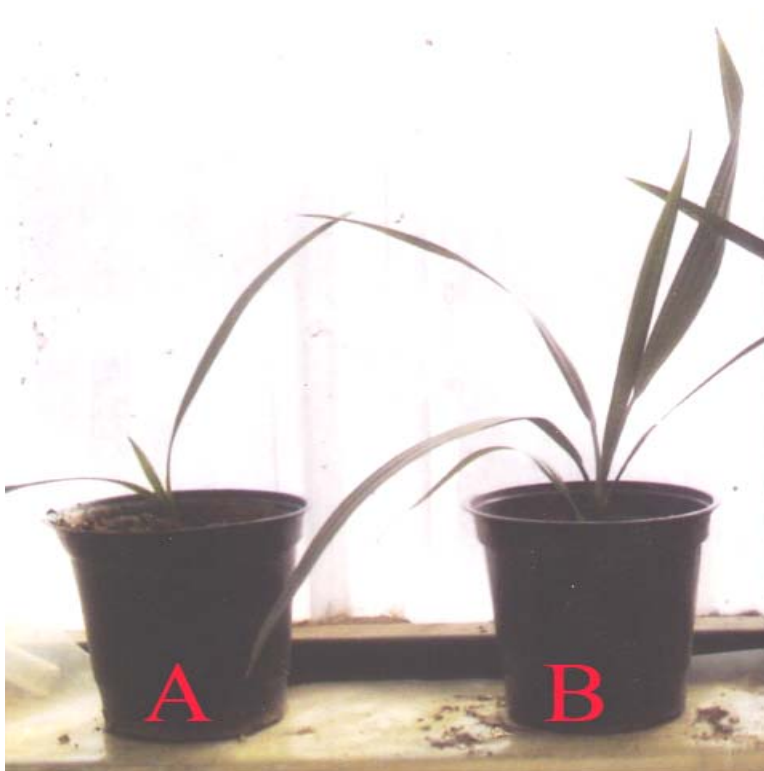
The data in table (4) indicated that, the best percentages of carotenoids (2.88 and 3.10 %) in both seasons respectively were recorded in the leaves of the plants treated with humic acid (as a soil drench) at 20ml /L. Concerning potassein-N (as a foliar spray) the best results of carotenoids 2.73 was recorded in the leaves of plants treated with 2 ml/L potassein in both seasons respectively. Concerning the interaction between soil drench (humic acid) +foliar spray(potassein-N) , the highest value were 3.43 and 3.66 recorded from plants treated with humic acid at 20 ml/L + potassein at 3 ml/L in both season respectively

From the previously stated results, it could recommended to treat the young plantlet of date palm cv.sakkoty with a combination of 2 ml/L potassein-N(as foliar spray) +20 ml/L humic acid (as a solil drench) with one month interval to get the best growth and nutrient up take(photo,1).

Table (4): Effect of humic acid and potassein-N on chlorophylls a,b and carotenoids (mg/Gf.w.) of Sakkoty plantlets during 2008 and 2009 seasons

Soil Drench Foliar Spray	Chlorophyll- a%					Chlorophyll- b %					carotenoids %				
	0	10 ml/L	20 ml/L	30 ml/L	Mean	0	10 ml/L	20 ml/L	30 ml/L	Mean	0	10 ml/L	20 ml/L	30 ml/L	Mean
First season: 2008															
0	3.00	4.25	5.14	3.70	4.02	2.10	2.40	2.27	2.07	2.21	2.50	2.40	2.67	2.13	2.43
1 ml/L	4.47	4.07	5.14	3.90	4.39	2.33	1.80	2.15	2.23	2.13	2.50	2.13	2.10	2.10	2.21
2 ml/L	5.20	3.56	5.51	3.63	4.48	2.60	2.53	2.60	2.60	2.58	3.30	2.10	3.30	2.20	2.73
3 ml³/L	3.57	4.34	4.52	3.90	4.08	1.83	1.97	4.03	2.17	2.50	1.80	2.13	3.43	2.13	2.38
Mean	4.06	4.05	5.08	3.78		2.22	2.18	2.76	2.27		2.53	2.19	2.88	2.14	
LSD Drench	0.283					0.399					0.146				
LSD spray	0.283					0.399					0.146				
LSD DrenchX spray	0.566					0.798					0.293				
Second season: 2009															
0	3.10	4.09	5.07	3.69	3.99	1.99	2.27	2.17	2.10	2.13	2.50	2.50	3.43	2.16	2.65
1 ml/L	4.03	4.99	4.20	3.93	4.29	2.20	1.83	2.12	2.20	2.09	2.60	2.30	2.26	2.13	2.33
2 ml/L	5.06	4.17	5.43	3.58	4.56	2.50	2.40	2.60	2.53	2.51	3.47	2.23	3.06	2.13	2.73
3 ml/L	4.07	4.07	4.46	4.00	4.15	1.77	2.00	4.03	2.10	2.48	1.77	2.23	3.66	2.13	2.44
Mean	4.07	4.33	4.79	3.80		2.12	2.13	2.73	2.23		2.58	2.32	3.10	2.14	
LSD Drench	0.228					0.395					0.074				
LSD spray	0.228					0.395					0.074				
LSD DrenchXspray	0.456					0.791					0.149				

Photo (1): Effect of humic acid and potassien-N on growth of cv sakkoty platlets



A:Control

B: Acombination between 20 ml/ L humic acid and 2ml/L potassien-N

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تحسين نمو نبيتات نخيل البلح صنف سكوتي ببعض معاملات التسميد

لبنى محمد عبد الجليل

المعمل المركزي لأبحاث و تطوير نخيل البلح

أجرى هذا البحث في إحدى الصوبات الخاصة بالمعمل المركزي لأبحاث و تطوير نخيل البلح – الجيزة – مصر خلال عامين متتاليين ٢٠٠٨ و ٢٠٠٩ لدراسة تأثير التسميد بحمض الهيوميك و المحتوي على (10:10:10 NPK) عند أضافته أرضيا بمعدل صفر، ١٠، ٢٠، ٣٠ مللى / لتروالبوتاسين-ن (بوتاسيوم، نيتروجين) عند أضافته رشاً على الأوراق بمعدل صفر، 1 و 2 و 3 مللى / لتر و المعاملات المشتركة بينهما على نمو نبيتات صنف نخيل البلح السكوتى. و زرعت النباتات في قصاري من البلاستيك قطرها ٢٠ سم ملأت بمخلوط من البيت موس + الرمل (٣:١). و لقد أوضحت النتائج المتحصل عليها ان جميع المعاملات أدت الى حدوث زيادة في طول و عدد أوراق النبيتات و زيادة في عرض الورقة كذلك زيادة في محتوى الأوراق من النيتروجين و الفسفور و البوتاسيوم ، زيادة في محتوى الأوراق من الكلوروفيل أ ، ب و الكاروتينويدات في كلا الموسمين مع تفوق المعاملة المشتركة بين 20 مللى / لتر حمض الهيوميك + ٢ مللى/ لتر بوتاسين - ن و التي أعطت بصفة عامة أعلى المتوسطات في جميع القياسات المذكورة سابقاً عند مقارنتها بالكنترول و المعاملات الأخرى.

و لذلك يفضل معاملة نبيتات نخيل البلح صنف سكوتى عمر ٦ أشهر بتوليفة من ٢ مللى/ لتر بوتاسين – ن رشاً على الاوراق + ٢٠ مللى/ لتر حمض الهيوميك (كإضافة أرضية) لمدة 8 أشهر بفاصل زمنى شهر بين كل معاملة لتحسين النمو الخضري ورفع محتوى الأوراق من المكونات الكيميائية .