

EFFECT OF COMPOST AND CHEMICAL FERTILIZER ON GROWTH AND CHEMICAL COMPOSITION OF DATE PALM SEEDLING cv. *Bertamoda*

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ABSTRACT

An investigation was conducted under the green house conditions at the Central Laboratory of date palm Research and development, Giza, Egypt, during 2014 and 2015 seasons to study the effect of different media ; pure sand (s) as a control, Sand+animal manure compost (AMC) at a ratio of (3:1, v/v), Sand+plant remnant compost (PRC) at ratio of (3:1, v/v) and S+AMC+PRC at ratio of (2:1:1, v/v /v) as well as fertilizer with kristalon (as soil drench) (19:19:19+micronutrients) at the rates of 0, 0.25, 0.5 and 0.75 g/l, besides their interactions on growth and chemical composition of date palm cv. *Bertamoda*, grown in 20 –cm- diameter plastic pots filled with about 2.5 kg of one of the previous media.

The results indicated that the medium fortified with plant remanant compost was the best medium for enhancing vegetative growth. This was true for the treatment with kristalon solution (as a soil drench) at the concentration of 0.5 g/l which gave the highest increment in vegetative growth rather than the other rates. However, combining medium and fertilization with krisalon exhibited more improvement in growth, especially the combination between planting in S+PRC (3:1) medium and fertilizer with 0.5 g/l kristalon solution. This combination gave the best growth in the two seasons. In addition, S+AMC(3:1) medium recorded the highest content of chlorophyll a in both seasons, while S+PRC (3:1) medium registered the highest content of clorophyll b. As for carotenoids content, it reached the maximum when the plantlets were cultivated in S+AMC+ PRC (2:1:1) medium. Content of total indoles (ppm) was significantly increased by the 3 used media that gave means closely near together in the two seasons. On the other hand, kristalon solution at 0.5 g/l scored the highest means of all the previous constituents in both seasons. Regarding the interactions, results showed that planting in S+ PRC (3:1) medium and fertilizer with 0.5g/l kristalon(as a soil drench) registered the most high averages in all previous constituents relative to control and all other combinations in both seasons.

It can be recommended to cultivate the one-year-old seedling of date palm cv. *Bertamoda* in the medium amended with plant remanant compost+ kristalon fertilization solution (as soil drench) at 0.5 g/l level to score the best growth and the highest quality under the green house conditions.

Key words: *date palm, Phoenix dactylifera, animal manure compost, plant remnant compost, fertilizer, kristalon.*

1. INTRODUCTION

Phoenix dactylifera L., Date palm as one of the most important economic crops that belong to the Family. Palmaceae, still the most common and cheap fruit grown in tropical and subtropical areas. The species *dactylifera* includes many cultivars, some of them give dry fruits such as Malacabe, Sukry, Gargoda, Dhagna and Bertamoda. However, the latter cv. has higher quality than the others ,being taller and has moderate intensity top. The leaflets are tiny, short and are not apart from each other on the

frond's midrib.

the use of organic compost, as a cheap substitute for peatmoss, in amending growing medium of small plantlets or seedlings may help them to grow well under nursery conditions because organic matter plays a vital and important role in improving soil physical, chemical and biological fertility. In this concern, Duong (2013) mentioned that municipal soil wastes, straw and manure composts significantly increased aggregate stability and water holding capacity of sandy soil , as well as soil cation

exchange capacity, soil N and P availability, wheat growth and shoot N and P contents. On *Ficus benjamina* cv. *Samantha* and *Schefflera arboricola* cv. Gold capella, shahin *et al.* (2013) found that a mixture of sand + peatmoss improved only plant height and the number of leaves /plant, while sand+FYM compost mixture improved all the vegetative and root growth parameters, as well as leaf content of chlorophyll a, b, carotenoids, proline and total carbohydrates. Likewise, EL-sayed *et al.* (2013) revealed that a growing medium consists of sand+alive meal compost+soybean meal compost+broad bean peels compost at equal parts by volume was the most suitable for the best growth and quality of *Euenymus* as foliage –pot-plant. Similar observations were also elicited by Abdel-Fattah *et al.* (2008) on *Schefflera*, Kassem *et al.* (2009), on rosemary, Shahin *et al.*, (2012) and Youssef and El-sayad (2013) on *Euonymus japonicas* cv. Aureus.

Fertilizing small plantlets and seedlings with complete chemical fertilizers usually leads to considerable growth and development responses. This fact was confirmed by Abdel-Galeil (2010a) who found that spraying leaves of date palm cv. Sokkouty plantlets with 20 ml/ 1 humic acid solution and drenching the soil with 2 ml/ 1 potssein-N (K-N) significantly improved plant length, the number of leaves, leaf width and leaf content chlorophyll a and b, carotenoids, N, P and K. A similar response was also obtained by Abdel-Galeil (2010a) on date palm cv Malacabe. Moreover, Shahin *et al.*, (2013) declared that plantings 6-month-old transplants of *Schefflera* and *Euonymus* in a mixture of sand+25% FYM compost plus fertilizing with kristalon at 2 g/ 1 pot greatly increased vegetative and root growth and content of photosynthetic pigments, total soluble sugars, N, P and K in the leaves of

both plants.

The aim of this study was to examine the effect of medium type, kristalon level and their interactions on growth and chemical composition of date palm cv. Bertmuda seedling under nursery conditions.

2. MATERIALS AND METHODS

Two pot experiments were conducted under the green house conditions of the central Lab. of Res. and Date palm, ARC, Giza, Egypt, throughout the two consecutive seasons of 2014 and 2015 to enhance growth and quality of the young seedling of *Phoenix dactylifera* L cv. *Bertamoda* by either chemical fertilizer. or amending the medium with organic compost, or both. One –year seedlings of date palm (produced by tissue culture technic) cv. **Bertamoda** at about 20-25 cm long with 3 leaves were planted on March, 10th for each season in 20 cm diameter plastic pots (one plantlet/pot filled with about 2.5 kg one of the following media: pure sand (s) as control , S+animal manure compost (AMC) at a ratio of (3:1,v/v), S +plant remanant compost (PRC) at a ratio of (3:1,v/v) and S+AMC+PRC at a ratio of (2:1:1, v/v/v). Physical and chemical properties of the sand ,as well as the animal and plant composts used in the two seasons were determined (Tables 1 and 2). After 3 weeks from planting (on first of April). kristalon fertilizer solution (19: 19: 19+micronuents) was added to the seedlings at the rates of 0, 0.25, 0.50 and 0.75 g/l as a foliar spray till the solution run –off, six times with one month interval .Futhermore, each level of kristalon was combind with each medium to form 16 combined treatments. All plantlets received the usual agricultural practices recommended for such plantation whenever needed.

Table (1): Some physical and chemical properties of the used sand during the two seasons.

season	Particle size distribution (%)				S.P	E.C. (ds/m)	pH	Cations (meq/l)				Anions (meq/l)		
	Coarse sand	Fine sand	Silt	Clay				Ca ⁺⁺	Mg ⁺⁺	Na ⁺	K ⁺	HCO ₃ ⁻	Cl	SO ₄ ⁻
2013	89.03	2..05	0.40	8..52	23.01	3.56	7.9	7.50	1.63	33.6	0.50	3.20	22.0	18.03
2014	84.76	6.30	1.49	7.45	21.87	3.7 8	7.8	19.42	8.33	7.2	0.75	1.60	7.8	26.30

Table (2): Some physical and chemical analyses of the used compost in the two seasons.

Component	Unit	Compost		Component	Unit	Compost	
		Animal	Plant			Animal	Plant
Weight of m ³	Kg	840.0	543.5	Organic matter	%	23.18	46.63
humidity	%	30.0	30.0	Organic carbon	%	13.45	27.04
Ph(1:10)	-	7.78	8.53	Ash	%	76.82	53.37
EC(1:10)	ds l	2.51	4.86	c/N ratio	-	16.2/1	17.2/1
Total N	%	0.83	1.33	Total P	%	0.77	1.24
NH ₄	ppm	50.0	205.0.	Total K	%	0.40	0.59
NO ₃	ppm	40.9	91.0	Nematoda	Worm200/g soil	20 free	n.f.

*n.f.=Not found.

*The previous analyses were done on the basis of dry weight except humidity.

The layout of the experiments in both seasons was a complete randomized design in factorial experimental type (Das and Giri, 1986) replicated thrice as each replicate contained 3 plantlets . At the end of each season (October), data were recorded as follows: seedling length (cm) number of leaves / seedling and leaf width (cm).In fresh leaf samples ,photosynthetic pigments (chlorophyll a,b and carotenoids, (mg/l f.w) were measured using the method described by Saric *et al.*,(1976) and total Indoles (ppm) was assessed according to the method of A.O.A.C. (1980). Data were then tabulated and statistically analyzed using SAS Institute Program (1994), with Duncan' s Multiple Range test (Duncan, 1955) to verify the significancy among the means of the different treatments .

3. RESULTS AND DISCUSSION

3.1.Effect of growing medium, Kristalon rate and their interaction on

3.1.1.Vegetative growth characters

It can be seen from the data averaged in Tables (3, 4 and 5) that plant length (cm), the

number at leaves/ plantlet and leaf width (cm) were markedly improved as a result of either amending sand with organic compost or kristalon fertilizer. However, medium fortified with plant remnant compost (PRC) or plantlets fertilized with 0.5 g/l kristalon gave the highest means over the control and all other individual treatments in the two seasons. Similarly, all interaction treatments increased the means of various vegetative growth parameters with various significance levels as compared to the control means in both seasons, but the mastery was for planting in S+PRC(3:1) medium plus fertilizer with 0.5 g/ l kristaln. This combind treatment recorded the atmost high averages in the first and second seasons.

Stimulation of plant growth due to kristalon application would be reasonable since different nutrients usually activate vital processes which lead to produce essential compounds as carbohydrates, proteins, hormones, enzymes and energy - reserve materials (Mengel and Kirkby, 1979). On the other hand, organic compost also has high manurial value for crop yields

Table (3): Effect of medium, Kristalon and their interactions on plant length (cm) of *Phoenix dactylifera* L.cv. *Bertamoda* plantlets (cm) during 2014and 2015 seasons.

Kristalon rate g/l Medium	First season 2014					First season 2015				
	0.0	0.25	0.50	0.75	Mean	0.0	0.25	0.50	0.75	Mean
Sand(s)	20.37 e	22.01 e	23.00 de	24.05 d	22.36 c	22.28 d	24.10 d	25.18 cd	26.98 c	24.64 c
S+AMC(3:1)	24.36 d	32.67 b	34.65 ab	35.98 ab	31.92 b	26.40 c	33.40 b	33.98 bc	36.29 b	32.52 b
S+PRC (3:1)	28.83 c	35.43 ab	40.95 a	34.30 ab	34.88 a	31.53 cb	35.81 b	45.12 a	38.61 b	37.77 a
S+AM+PRC (2:1:1)	26.40 cd	35.29 ab	32.84 b	36.19 ab	32.68 b	28.86 c	35.12 b	35.78 b	36.5 0b	34.07 b

* AMC=Animal manure compost,and PRC=plant remnants compost.

* Means within the same row having the same letters are not significantly different according to Duncans multiple Range Test at 5% levele

Table (4): Effect of medium, Kristalon and their interactions on the number of leaves/plantlet of *Phoenix dactylifera* L.cv. *Bertmoda* plantlets (cm) during 2014 and 2015 seasons.

Medium \ Kristalon rate g/l	First season 2014					First season 2015				
	0.0	0.25	0.50	0.75	Mean	0.0	0.25	0.50	0.75	Mean
Sand(s)	3.33d	3.60cd	3.88c	4.20bc	3.75b	3.33e	3.50de	3.76d	4.00cd	3.65b
S+AMC(3:1)	3.76	4.20bc	5.17ab	5.13ab	4.57a	3.67	4.03cd	5.08bc	5.00bc	4.45a
S+PRC (3:1)	4.00cd	4.67b	6.67a	4.67b	5.00a	4.00cd	4.33c	7.47a	5.10bc	5.23a
S+AM+PR (2:1:1)	3.96cd	4.83b	4.83b	5.50ab	4.78a	3.84d	5.10bc	5.00bc	5.53b	4.87a
Mean	3.76b	4.33ab	5.14a	4.88a		3.71b	4.24ab	5.33a	4.91a	

* AMC=Animal manure compost, and PRC=plant remnants compost.

* Means within the same row having the same letters are not significantly different according to Duncans multiple Range Test at 5% levele

Table (5): Effect of medium, Kristalon and their interactions on leaf width (cm) of *Phoenix dactylifera* L.cv. *Bertamoda* plantlets (cm) during 2014 and 2015 seasons.

Medium \ Kristalon rate g/l	First season 2014					First season 2015				
	0.0	0.25	0.50	0.75	Mean	0.0	0.25	0.50	0.75	Mean
Sand(s)	1.71d	1.85cd	1.99c	2.12cb	1.92b	1.73e	1.89d	2.00d	2.20cd	1.96b
S+AMC(3:1)	1.86cd	2.69bc	3.04ab	2.90ab	2.62a	1.81de	2.67bc	3.07bc	2.93bc	2.62a
S+PRC (3:1)	2.10cb	2.81b	3.93a	2.30bc	2.79a	2.13dc	2.72bc	4.30a	2.35cd	2.88a
S+AM+PR (2:1:1)	2.00c	2.48bc	3.28ab	2.85b	2.65a	2.01d	2.75bc	3.40b	2.81bc	2.74a
Mean	1.92b	2.46ab	3.06a	2.54ab		1.92c	2.51b	3.19a	2.57b	

* AMC=Animal manure compost, and PRC=plant remnants compost.

* Means within the same row having the same letters are not significantly different according to Duncans multiple Range Test at 5% levele

(Drechsel and Reck,1998).In this connection ,Handreck and Black (2002) demonstrated that organic compost improved the electrical conductivity (EC),pH and humates in the soil . The well composted organic matter may improve soil structure and texture, increase cation exchange capacity (CEC) and fertility (Singh, 1999). Besides, rising the water holding capacity of the growing medium and consequently water uptake by plants which leads finally to activate vital processes to produce more constituents necessary for more growth and high quality (Gonzalez and cooperband, 2003).

These results are consistent with these of Abdel-Galeil (2010b) on date palm cvs. Malacabe and sakkoty, Shahin *et al.* (2012) and Youssef and EL-sayed (2013) on *Euonymus japonicus* cv. Aureus and shahin *et al.* (2013) on *Ficus benjamina* cv Samantha and *Scheffera arboricola* cv. Gold capella.

3.1.2. Chemical composition

According to the data presented in Table (6), it is clear that S+AMC (3:1) medium gave the highest content of chlorophyll a (mg / g f.w.)in both seasons,while S+PRC (3:1) medium gave

the highest content of chlorophyll b. As for carotenoid content, it was true for S+AMC+PRC(2:1:1) medium which recorded the utmost high content in the two seasons. However, the total indole content (ppm) was significantly increased by the 3 used media as they gave means closely near each other with non-significant differences among them. On the other hand kristalon at the rate of 0.5 g/ l gave the highest content of all constituents mentioned above compared to the other levels in both seasons. In the matter of interaction treatments, combining between planting in S+PRC(3:1) medium and fertilizer with 0.5 g/ l kristalon caused the highest increment in all previously mentioned constituents relative to all other combinations in the two seasons.

The aforesated results may indicate the role of both organic matter compost and kristalon in supplying the plantlets with nutrients necessary for accelerating biosynthesis processes which increase, as a result, the content of active constituents in plantlet tissues. In this regard, Gonzalez and Cooperband (2003) observed that duck manure compost increased soil content of C, N, P and Cu, as well as available P, S, Ca,

Table (6): Effect of medium ,Kristalon and their interaction on some chemical constituents of *Phoenix dactylifear l.cv. Bertamoda* plantlets (cm) during 2014 and 2015 seasons.

Kristalon rate g/l Medium	First season 2014					First season 2015				
	0.0	0.25	0.50	0.75	Mean	0.0	0.25	0.50	0.75	Mean
Chlorophyll a(mg g f.w.)										
Sand(s)	0.201i	0.241h	0.296f	0.273g	0.253c	.215f	0.256e	0.310de	0.281e	0.266c
S+AMC(3:1)	0.230hi	0.445e	0.601b	0.534c	0.453a	0.258e	0.535bc	0.605b	0.445d	0.461a
S+PRC (3:1)	0.250g h	0.250gh	0.78a	0.267g	0.387b	0.265e	0.270e	0.782a	0.226f	0.386b
S+AM+PR (2:1:1)	0.245h	0.439e	0.456d	0.293f	0.358b	0.261e	0.443d	0.461cd	0.287ed	0.363b
Mean	0.232c	0.344b	0.534a	0.342b		0.250c	0.376b	0.540a	0.310b	
Chlorophyll b (mg g f.w.)										
Sand(s)	0.170i	0.197h	0.229gh	0.232gh	0.207b	0.172g	0.193g	0.231f	0.226f	0.206b
S+AMC(3:1)	0.185h	0.337e	0.503b	0.246g	0.318ab	0.188g	0.341de	0.507b	0.750ef	0.322ab
S+PRC (3:1)	0.202h	0.372d	0.589a	0.287f	0.363a	0.210f	0.373d	0.592a	0.300e	0.369a
S+AM+PR (2:1:1)	0.193h	0.293f	0.434c	0.368d	0.322ab	0.200gf	0.301e	0.435c	0.376d	0.328ab
Mean	0.188c	0.300b	0.439a	0.283b		0.193c	0.302b	0.441a	0.288b	
Chlorophyll c (mg g f.w.)										
Sand(s)	0.112k	0.135j	0.178i	0.167i	0.148b	0.112i	0.140g	0.171f	0.193e	0.154c
S+AMC(3:1)	0.123jk	0.268f	0.315c	0.205h	0.228a	0.125gh	0.272cd	0.314bc	0.203e	0.229b
S+PRC (3:1)	0.136j	0.281e	0.360a	0.216 h	0.248a	0.140g	0.280cd	0.362a	0.120gh	0.226b
S+AM+PR (2:1:1)	0.131j	0.245g	0.322b	0.304d	0.251a	0.140g	0.244d	0.323b	0.304c	0.253a
Mean	0.126c	0.232b	0.299a	0.223b		0.129c	0.234b	0.293a	0.205b	

* AMC=Animal manure compost, and PRC=plant remnants compost.

* Meano within the same row having the same letters are not significantly different according to Duncans multiple Range Test at 5% levele

Table (7): Effect of medium, Kristalon and their interaction on constituents of *Phoenix dactylifear l.cv. Bertamoda* plantlets (cm) during 2014 and 2015 seasons

Kristalon rate g/l Medium	0.0	0.25	0.50	0.75	Mean	0.0	0.25	0.50	0.75	Mean
sand(s)	1.56k	1.87i	2.33h	1.98i	1.94b	1.53i	1.81h	2.48f	2.03g	1.69b
S+AMC(3:1)	1.70j	4.55d	4.69c	4.90b	3.96a	1.67hi	4.51c	4.68bc	4.88b	3.94a
S+PRC (3:1)	1.85i	4.76c	5.14a	2.66g	3.60a	1.82h	4.75b	5.25a	2.65e	3.62a
S+AM+PR (2:1:1)	1.63j	3.94e	4.45c	3.84f	3.54a	1.60i	3.93d	4.75b	3.77de	3.51a
	1.69c	3.76b	4.23a	3.34b		1.66c	3.75b	4.29a	3.44b	

Mg, K and Zn. On the same line, the same was true in the findings postulated by Abdel-Galeil (2010a) on date palm cvs. Malacabe and Sakkoty, Shahin *et al.* (2012) on *Schfflera* and *Euonymus* and Duong (2013) on wheat.

From the foregoing, it can be concluded that binding between cultivation in a mixture of

sand+plant remnant compost (3:1) and fertilizing with kristalon solution at 0.5 g/l as a soil derunch is the best way to lump the beneficial effects of both growth and quality of date palm cv. *Bertamoda* plantlets under nursery conditions.

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تأثير الكومبوست والتسميد الكيماوى على النمو والمحتوى الكيماوى لشتلات نخيل البلح صنف برتمودا

لبنى محمد عبد الجليل

المعمل المركزى لبحاث وتطوير نخيل البلح - مركز البحوث الزراعية - الجيزة - مصر

ملخص

أجريت هذه التجربة فى الصوبة الزراعية التابعه للمعمل المركزى لأبحاث وتطوير نخيل البلح- مركز البحوث الزراعية ، الجيزة ، مصر ، خلال موسمى 2014 –2015 وذلك لدراسة تأثير بيئات النمو المختلفة وهى الرمل فقط (مقارنة) والرمل +كومبوست حيوانى (3:1) , الرمل +كومبوست المخلفات النباتية (3:1) والرمل +كومبوست حيوانى + كومبوست المخلفات النباتية (2:1:1) بالحجم وكذلك التسميد الارضى بسماد الكريستالون (19:19:19+عناصر صغرى). بمعدلات صفر ، 0.25 ، 0.5 ، 0.75 جم /لتر والتفاعلات بينهما على نمو والتركيب الكيماوى لشتلات نخيل البلح صنف برتمودا (صنف جاف) المنزرعة فى أصص بلاستيك قطرها 20 ملآت بحوالى 5.2 كجم من أحد البيئات سالفة الذكر فى تجربة عاملية تامة العشوائية .

أوضحت النتائج أن البيئة المدعومة بكومبوست المخلفات النباتية كانت أفضل البيئات لتحسين النمو الخضرى للشتلات. كما أن المعاملة الارضية بسماد الكريستالون بمعدل 0.5 جم /لتر كانت أفضل معاملة سمادية أحدثت أعلى زيادة فى النمو الخضرى مقارنة بمعدلات التسميد الاخرى بكلا الموسمين. الا أن الجمع بين بيئة الرمل +كومبوست المخلفات النباتية(3:1 بالحجم) والمعاملة الارضية بالكريستالون بمعدل 0.5 جم /لتر أدى الى اعطاء أفضل معدلات النمو الخضرى على الاطلاق بكلا الموسمين . اضافة الى ذلك، فان بيئة الرمل+الكومبوست الحيوانى (3:1 بالحجم) أعطت أعلى مستوى للكورفيل (a) بالاوراق فى كلا الموسمين بينما سجلت بيئة الرمل + الكومبوست المخلفات النباتية (بالحجم3:1) أعلى محتوى للكورفيل (B). أما بالنسبة لمحتوى الأوراق من الكاروتينات فقد بلغ أقصاه عند زراعة النبيتات فى مخلوط الرمل +الكومبوست الحيوانى +كومبوست المخلفات النباتية (2:1:1 بالحجم) بينما زاد محتوى الأوراق من الاندولات الكلية فى كل من المعاملات السابقة محل الدراسة وكانت المتوسطات متقاربة من بعضها فى كلا الموسمين على الجانب الاخر فان المعاملة الارضية بالكريستالون بمعدل بمعدل 0.5 جم /لتر سجل أعلى المتوسطات فى جميع المكونات الكيميائية سالفة الذكر مقارنة بالمعاملات الأخرى. فيما يتعلق بتأثير التفاعلات أوضحت النتائج أن الزراعة فى بيئة الرمل +كومبوست المخلفات النباتية (3:1 بالحجم) + المعاملة الارضية بالكريستالون بتركيز 0.5 جم /لتر قد سجلت أعلى المتوسطات فى محتوى جميع المكونات الكيميائية سا بقية الذكر بجميع التفاعلات الأخرى بكلا الموسمين . وعليه يمكن التوصيه بزراعة شتلات نخيل البلح صنف برتمودا عمر سنة فى بيئة الرمل المدعومة بكومبوست المخلفات النباتية (3:1 بالحجم) مع لمعاملة الارضية بسماد الكريستالون المركب بمعدل بتركيز 0.5 جم /لتر لتحقيق أفضل معدل للنمو ومحتوى كيماوى للأوراق .

المجلة العلمية لكلية الزراعة - جامعة القاهرة - المجلد (66) العدد الرابع (أكتوبر 2015): 326-320 .