

EFFECT OF INDOLE BUTYRIC ACID AND GROWING MEDIA TYPES ON RAISING THE NURSRLINGS OF *HIBISCUS ROŞA-SINENSIS* L. UNDER SINAI CONDITIONS

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ABSTRACT

The experiment was carried out at the Experimental Farm of Faculty of Environmental Agricultural Sciences, in El-Arish, Suez Canal University, during 2000-2001 and 2001-2002 seasons. The main object of this research was to study the effect of IBA concentrations and different media types and their interactions on the vegetative growth and chemical constituents of *Hibiscus rosa-sinensis* L. nursrlings.

The obtained results showed that dipping *Hibiscus rosa-sinensis* L. semi hard stem cuttings in IBA up to 4000 ppm for 30 second enhanced fresh and dry weights of root and shoots (leaves + stems) in addition to leaves number and shoots height / nursrling. The tested media including [peatmoss, sand, composted olive cake and mixtures of peatmoss + sand, peatmoss + composted olive cake, sand + composted olive cake at rate of (1:1-v.v) and mixture of peatmoss + sand + composted olive cake at rates of (1:1:1-v.v)] showed that composted olive cake media alone or combined with peatmoss (1:1) proved to be the efficient media to raise the nursrlings concerning the vegetative characters. Also, the interaction treatments between the tested media and IBA were significant and indicated that the best combination treatment for raising the nursrlings was dipping cuttings in IBA at 4000 ppm and planted them in composted olive cake medium or composted olive cake + peatmoss medium. The highest percentages of NPK and total carbohydrate in the leaves were also obtained from the previously mentioned treatments, hence using composted olive cake media in raising the nursrlings of *Hibiscus rosa-sinensis* L. under Sinai conditions can be advised since it is available as a side product of olive oil pressing manufacture which save the costs of using peatmoss.

Keywords: IBA- *Hibiscus rosa-sinensis* L. cuttings-nursrlings-peatmoss-composted olive cake.

INTRODUCTION

Hibiscus rosa-sinensis L., Fam: Malvaceae , a china species. This species is a shrub or small tree is used as an outdoor ornamental and hedge for its red flowers and brilliancy leaves. It is propagated usually by stem cuttings. According to Zucker (1966) hibiscus grow well in many soils but prefer one with plenty of organic matter that holds moisture. They wilt easily when summers are dry and should be watered during drought. They survive city conditions, tolerate some shade (but bloom better in full sun) and are useful in narrow places where wider – growing shrubs would need constant pruning.

The frequent references to the possible role of indole butyric acid (IBA) and other auxin in cell division and rooting are too well know to reiterate in detail (Hartmann and Kester, 1978). Auxin treatments of cuttings are a

particularly effective method for obtaining rooting in the difficult subjects and enhance rooting in easy-to-root ones. However, the exogenous application enhanced rooting only in the presence of certain endogenous substances, which are present in easy – to – root plant, but absent in the difficult ones.

The cultivation and processing of olives for olive oil production are the most important industries in Mediterranean countries, where approximately 98% of the world's commercial olive trees are located. These industries generate large amounts of organic wastes leaves, olive oil mill waste water, wet semi dry and dry olive cakes.

Under North Sinai conditions which sand is a dominant media lack in organic matter, olive cake represent the majority of agro-industrial by-products. There are about 35000 ton yields annually of olive crop and about 3000 ton (as an olive oil extractor solid waste) olive cake (Information Centre of North Sinai Governorate, Agricultural Department, March 2000).

Thus the aim of this work was to investigate the effect of treating cuttings with IBA and possibility of using composted olive cake in raising *Hibiscus rosa-sinensis* L. nurslings considering at composted olive cake was not previously experienced in raising ornamental nursling as an available material under Sinai Governorate conditions.

MATERIALS AND METHODS

This experiment was conducted throughout the two successive seasons of 2000-2001 and 2001-2002 at the Experimental Farm of the Faculty of Environmental Agricultural Sciences at El-Arish, Suez Canal University. The aim was to investigate the effect of different growing media and indole butyric acid (IBA) concentrations on root growth and subsequent growth of *Hibiscus rosa-sinensis* L. cuttings. Stem cuttings (15 cm length, 10-12 mm diameter and semi hardwood cutting) were obtained from clonal material of *Hibiscus rosa-sinensis* L. (red variety) grown under full sunlight at the Experimental farm of Fac. of Environmental Agric. Scie. At El-Arish in March 15th each season, then the basal ends of cuttings were quickly dipped (about 30 sec.) in distilled water, 2000 or 4000 ppm IBA before planting in wet different media. The different media in this investigation included peatmoss (Floratorf Germany product), sand, composted olive cake [(dried and composted for 12 months without any nutrients addition). The chemical analysis of composted olive cake revealed that it contains: [N 4.38%, P 0.22%, K 7.30%, Cu 11.60 ppm, Zn 31.30 ppm, Mn 21.70 ppm, Fe 559 ppm, organic matter 49.67%, organic carbon 28.81% and C/N 6.58], mixture of peatmoss + sand (1:1-v.v.), peatmoss + composted olive cake (1:1-v.v.), mixture of sand + composted olive cake (1:1-v.v.) and peatmoss + composted olive cake + sand (1:1:1-v.v.).

The cuttings were planted individually in plastic 20 cm pots filled with different growing media types. Each treatment contained 20 pots. The treated pots were placed under seran house (65% shading) each 20 treated cuttings were used in each medium for each location and arranged in three replicates in a factorial design. Water was frequently added to keep the different media

always wet to maintain about 75 % of water holding capacity. After 12 months (March 15th) from cuttings planting, rooting was checked and the following data were recorded: fresh and dry weights of root and shoots (leaves + stem) (g) number of leaves and shoots height (cm)/ nursling.

Samples of leaves were dried at 70°C for 72 hours wet digestion with sulphuric acid and perchloric acid (3:1) to determine total nitrogen percentage according to the method described A.O.A.C. (1980), phosphorus percentage according to Hucker and Catroux (1980), potassium percentage according to Brown and Lilleland (1946) and total carbohydrates percentage according to Dubois *et al.*, (1956).

The complete randomized block design in factorial experiment was followed. The data were subjected to statistical analysis of variance and the means were compared using Duncan multiple range tests at the 5% levels according to Steel and Torrie (1980).

RESULTS AND DISCUSSION

1. Effect of IBA concentrations and growing media types on the vegetative growth of *Hibiscus rosa-sinensis* L. cuttings.

Data in Tables (1 and 2) revealed that the main effect showed a parallel increase in fresh and dry weights of root as IBA concentration increased to 4000 ppm. Also, the highest weight of root resulted from peatmoss medium followed descending order by peatmoss + composted olive cake media, sand + composted olive cake , peatmoss + composted olive cake + sand and sand media.

Table (1): Effect of indole butyric acid concentrations and growing media types on fresh weight of roots (gm) of *Hibiscus rosa-sinensis* L. nurslings during of 2000-2001 and 2001-2002 seasons

Media Types IBA Concentrations (ppm)	(P)	(S)	(O)	Mixture of (P)+(S)	Mixture of (P)+(O)	Mixture of (S)+(O)	Mixture of (P) + (S)+(O)	Means
First season								
0	7.86 de	3.70 a	6.60 c	4.44 ab	6.84 cd	6.12 bc	5.28 b	5.82 A
2000	9.68 f	7.08 cd	8.56 e	6.68 c	8.44 e	7.54 d	8.16 de	8.02 B
4000	14.68 i	11.82 g	14.30 i	13.10 h	14.46 i	13.62 hi	12.96 h	13.56 C
Means	10.74 c	7.52 a	9.82 bc	8.08 ab	9.90 bc	9.10 b	8.80 ab	
Second season								
0	6.00 ab	4.74 a	6.70 ab	4.98 a	7.50 b	5.84 ab	6.18 ab	6.26 A
2000	12.40 c	8.90 bc	11.24 c	9.42 bc	12.42 c	9.36 bc	10.90bc	10.66 B
4000	19.04 f	13.96 d	17.04 e	15.34de	18.26 ef	16.42 e	17.02 e	16.72 C
Means	13.10 g	9.20 a	11.66 e	9.92 b	12.72 f	10.54 c	11.36 d	

(P) = Peatmoss , (S) = Sand and (O) Composted olive cake

Table (2): Effect of indole butyric acid concentrations and growing media types on dry weight of roots (gm) of *Hibiscus rosa – sinensis* L. nurslings during of 2000-2001 and 2001-2002 seasons

Media Types IBA Concentrations (ppm)	(P)	(S)	(O)	Mixture of (P)+(S)	Mixture of (P)+(O)	Mixture of (S)+(O)	Mixture of (P) + (S)+(O)	Means
First season								
0	1.70 bc	0.74 a	1.40 bc	0.94 ab	1.48 bc	1.32 b	1.14 ab	1.25 A
2000	2.10 cd	1.44 bc	1.82 c	1.40 bc	1.84 c	1.62 bc	1.78 bc	1.72 B
4000	3.38 f	2.42 d	3.06 ef	2.76 de	3.10 ef	2.94 e	2.82 de	2.93 C
Means	2.39 c	1.54 a	2.09 b	1.70 ab	2.15 b	1.96 b	1.91 b	
Second season								
0	1.70 b	0.96 a	1.44 ab	1.04 a	1.60 b	1.24 ab	1.32 ab	1.33 A
2000	2.68 cd	1.86 b	2.42 c	1.98 bc	2.66 cd	2.02 bc	2.38 c	2.28 B
4000	4.12 f	2.88 d	3.82 ef	3.24 de	3.94 ef	3.52 e	3.72 e	3.61 C
Means	2.83 d	1.90 a	2.56 c	2.09 b	2.74 cd	2.26 bc	2.48 c	

(P) = Peatmoss , (S) = Sand and (O) Composted olive cake

The interaction between IBA and the media type indicated that using 4000 ppm IBA combined with peatmoss or composted olive cake media or peatmoss + composted olive cake (1:1) resulted in the highest root weight and the differences between those media were nearly negligible.

The main effect of IBA on fresh and dry weights of shoots was similar as that detected in root weight (Tables 3 and 4). On the other hand the main effect of media type on shoot weight proved the efficiency of composted olive cake media as it resulted in the highest value for shoot weight followed descending effect by peatmoss + composted olive cake (1:1), peatmoss alone, sand + composted olive cake (1:1), peatmoss + sand (1:1), peatmoss + sand + composted olive cake (1:1:1) and sand alone.

Table (3): Effect of indole butyric acid concentrations and growing media types on fresh weight of shoots (gm) of *Hibiscus rosa – sinensis* L. nurslings during of 2000-2001 and 2001-2002 seasons

Media Types IBA Concentrations (ppm)	(P)	(S)	(O)	Mixture of (P)+(S)	Mixture of (P)+(O)	Mixture of (S)+(O)	Mixture of (P) + (S)+(O)	Means
First season								
0	74.78cd	49.88a	93.92de	67.22bc	83.56d	73.56c	57.50ab	71.48A
2000	96.14 e	61.30b	103.50e	70.68c	95.00e	76.52cd	72.46c	82.22B
4000	121.68fg	91.64de	133.18g	103.18e	126.04g	113.70f	97.50e	112.41C
Means	97.53d	67.60a	110.20e	80.36b	101.53d	87.92c	75.82b	
Second season								
0	78.18cd	55.82a	93.72e	68.54bc	87.82de	75.88c	64.19b	74.87A
2000	101.64f	75.28c	113.44g	90.82e	102.44f	94.72ef	85.62d	94.85B
4000	132.66i	102.12f	139.24j	122.78h	133.26ij	128.38hi	117.04gh	125.06C
Means	104.16e	77.74a	115.46f	94.04c	107.84e	99.66d	88.95b	

(P) = Peatmoss , (S) = Sand and (O) Composted olive cake

Table (4): Effect of indole butyric acid concentrations and growing media types on dry weight of shoots (gm) of *Hibiscus rosa-sinensis* L. nurslings during of 2000-2001 and 2001-2002 seasons

Media Types	(P)	(S)	(O)	Mixture of (P)+(S)	Mixture of (P)+(O)	Mixture of (S)+(O)	Mixture of (P) + (S)+(O)	Means
First season								
0	15.14c	9.68a	18.04d	13.14bc	16.54cd	14.26bc	11.26ab	14.00A
2000	19.28de	12.24b	19.98de	16.34cd	18.96de	14.70c	13.90c	16.48B
4000	25.00g	18.52de	26.18g	20.42e	25.92g	22.56f	19.64de	22.60C
Means	19.80d	13.48a	21.40e	16.63c	20.47de	17.17c	14.93b	
Second season								
0	16.00c	11.04a	19.02d	13.64b	17.14cd	15.02bc	12.96ab	14.98A
2000	20.88d	14.64bc	23.44e	18.12cd	20.26d	18.94d	17.34cd	18.08B
4000	28.36g	20.74d	29.18g	24.62ef	26.50fg	25.80f	23.94ef	25.58C
Means	21.74d	15.48a	23.88e	18.80bc	21.30d	19.92c	18.08b	

(P) = Peatmoss , (S) = Sand and (O) Composted olive cake

The highest shoot weight resulted from the interaction between IBA + media types were recorded mainly in the combination of composted olive cake media or peatmoss + composted olive cake (1:1) and 2000 ppm IBA. These treatments surpassed significantly all other interactions between media type and IBA concentration.

The main effect in Table (5) indicated that number of leaves/nursling was significantly increased as IBA concentration increased up to 4000 ppm while peatmoss media resulted in also the highest leaves number followed discerningly by composted olive cake, peatmoss + composted olive cake (1:1), peatmoss + sand (1:1), then came the least values from sand + composted olive cake (1:1), sand alone and peatmoss + composted olive cake + sand (1:1:1). However the interaction between IBA and media types was significant and showed the highest leaves number/nursling was belong to peatmoss medium combined with 4000 ppm IBA.

The data of nurslings height in Table (6) showed that the efficiency of 4000 ppm IBA in producing the tallest nurslings and peatmoss + composted olive cake + sand (1:1:1) media. These treatments showed significant interaction in producing the tallest nurslings for both treatments (118.60 & 108.60 cm respectively) in the two seasons. However in the second order descending was the interaction between 2000 ppm IBA combined with peatmoss + composted olive cake +sand (1:1:1) (105.20 & 92.00 cm respectively). The third descending order was 4000 ppm IBA combined with composted olive cake or sand + composted olive cake (1:1).

Table (5): Effect of indole butyric acid concentrations and growing media types on number of leaves of *Hibiscus rosa – sinensis* L. nurslings during of 2000-2001 and 2001-2002 seasons

Media Types IBA Concentrations (ppm)	(P)	(S)	(O)	Mixture of (P)+(S)	Mixture of (P)+(O)	Mixture of (S)+(O)	Mixture of (P) + (S)+(O)	Means
First season								
0	13.32bc	7.32a	12.00bc	8.00ab	10.00ab	9.32ab	8.00ab	9.70A
2000	16.00c	10.66b	13.32bc	15.32c	15.32c	10.66b	10.00ab	13.04B
4000	19.32d	12.66bc	15.32c	16.00c	16.66cd	14.00c	12.00bc	15.13C
Means	16.21c	10.21a	13.54b	13.10b	13.99b	11.32a	10.00a	
Second season								
0	12.66bc	8.00a	8.66ab	9.32ab	11.32b	8.00a	8.66ab	9.51A
2000	15.32cd	10.66ab	10.00ab	10.66ab	14.00bc	9.32ab	11.32b	11.61B
4000	17.32d	14.00bc	15.32cd	15.32cd	16.00cd	14.66c	13.32bc	15.13C
Means	15.10b	10.88a	11.32a	11.76a	13.77b	10.66 a	11.10a	

(P) = Peatmoss , (S) = Sand and (O) Composted olive cake

Table (6): Effect of indole butyric acid concentrations and growing media types on shoot height (cm) of *Hibiscus rosa – sinensis* L. nurslings during of 2000-2001 and 2001-2002 seasons

Media Types IBA Concentrations (PPM)	(P)	(S)	(O)	Mixture of (P)+(S)	Mixture of (P)+(O)	Mixture of (S)+(O)	Mixture of (P) + (S)+(O)	Means
First season								
0	52.60c	34.00a	66.00de	51.20bc	60.00cd	55.32c	44.00b	51.87A
2000	59.32cd	36.66ab	71.20de	58.00cd	68.60de	64.60d	105.20g	66.23B
4000	67.32d	44.66bc	84.00f	77.20ef	73.20e	84.66f	118.60e	78.52C
Means	59.74b	38.44a	73.73d	62.13b	67.26c	68.19c	89.26e	
Second season								
0	52.00bc	37.32a	67.20cd	46.00ab	62.00cd	61.20c	52.00bc	53.96A
2000	68.60cd	42.00ab	72.60d	56.00bc	71.20d	72.00d	92.00e	67.77B
4000	79.20d	49.20b	88.00e	79.20d	80.00de	88.60e	108.60f	81.82C
Means	66.60c	42.84a	75.93d	60.40b	71.06de	73.93d	84.20e	

(P) = Peatmoss , (S) = Sand and (O) Composted olive cake

The above mentioned findings concerning the enhancing effect of IBA on the growth of root and shoot were in line with those obtained by Soudan *et al.*, (1986) on *Ficus retusa* and (1995) on *ficus elastica* and Sohair and Taleb (1995) on *Bougainvillea alba*, Rana *et al.*(1999) on kiwifruit, San Miguel *et al.*(1999) on *Bixa orellana*. Weaver (1972) early mentioned that IBA treatment to stem basis induced abundant roots on leafy cuttings of the red hibiscus variety on the other hand no roots were formed on the IBA treated white variety. The white variety failed to root not only because it

lacked auxin but also because its leaves failed to produce the other factor or factors which found in red variety.

2. Effect of IBA concentrations and growing media types on NPK and total carbohydrates percentages in leaves of *Hibiscus rosa-sinensis* L. nurslings :

The main effect of IBA on NPK percentages in leaves of *Hibiscus rosa-sinensis* L. in Tables (7,8 and 9) indicate significant increase parallel to the increased concentration of IBA. This may be attributed to the enhancement of root growth caused by IBA consequently mineral absorption.

Composted olive cake media caused significant increase and resulted in the highest percentages of NPK followed descendengly by peatmoss + composted olive cake medium (1:1) more than the other media types. The least percentages of NPK were recorded with sand medium. In this regard it was found that olive pomace (olive cake) in addition to sewage sludge and tomato residues enhance the availability of nitrogen and phosphorus in sandy and calcareous soils and reflected in an increase in shoot dry weight of barley plant (Marzouk, 2002) . Also, when pressed olive cake was used in combination with chicken manure in sandy soil, the best vegetative growth and fruit yield of tomato was obtained (El-Kassas and Abd El-Mowly, 1999).

Table (7): Effect of indole butyric acid concentrations and growing media types on nitrogen percentage in the leaves of *Hibiscus rosa-sinensis* L. nurslings during of 2000-2001 and 2001-2002 seasons

Media Types	(P)	(S)	(O)	Mixture of (P)+(S)	Mixture of (P)+(O)	Mixture of (S)+(O)	Mixture of (P)+(S)+(O)	Means
First season								
0	2.35bc	1.21a	2.98cd	1.84b	2.88cd	2.90cd	2.88cd	2.43A
2000	3.12cd	1.58ab	3.74de	2.56c	3.56de	3.65de	3.43d	2.96B
4000	3.26d	2.52c	3.95e	2.81cd	3.65de	3.50de	3.58de	2.97B
Means	2.91c	1.77a	3.55d	2.40b	3.36d	3.35d	3.30d	
Second season								
0	1.84ab	1.41a	2.38bc	1.59ab	2.30bc	2.06ab	2.27bc	1.98A
2000	2.32bc	2.10b	2.78c	2.15b	2.44bc	2.34bc	2.36bc	2.35B
4000	2.53bc	2.38bc	3.24c	2.42bc	3.14c	2.61bc	2.85c	2.74C
Means	2.23ab	1.96a	2.80c	2.05ab	2.63bc	2.34b	2.49bc	

(P) = Peatmoss , (S) = Sand and (O) Composted olive cake

The interaction between IBA and different media types was significant where the combination of IBA at 4000 ppm and composted olive cake media resulted in the highest percentages of NPK in the leaves of *Hibiscus rosa-sinensis* L. nurslings followed by using 4000 ppm IBA and peatmoss + composted olive cake (1:1) medium then came descending the other used media .

Table (8): Effect of indole butyric acid concentrations and growing media types on phosphorus percentage in the leaves of *Hibiscus rosa – sinensis* L. nurslings during of 2000-2001 and 2001-2002 seasons

Media Types IBA Concentrations (ppm)	(P)	(S)	(O)	Mixture of (P)+(S)	Mixture of (P)+(O)	Mixture of (S)+(O)	Mixture of (P) + (S)+(O)	Means
First season								
0	0.284bc	0.128a	0.524de	0.177ab	0.445d	0.306bc	0.412cd	0.325A
2000	0.376cd	0.230b	0.570ef	0.311bc	0.480de	0.411cd	0.444d	0.403B
4000	0.396cd	0.252b	0.630f	0.343c	0.546e	0.480de	0.516de	0.452C
Means	0.352c	0.203a	0.575f	0.277b	0.490e	0.400d	0.457e	
Second season								
0	0.345b	0.247a	0.470cd	0.306ab	0.425bc	0.350b	0.401bc	0.363A
2000	0.424bc	0.361bc	0.544d	0.406bc	0.468cd	0.440bc	0.449c	0.442AB
4000	0.494cd	0.419bc	0.569d	0.464cd	0.547d	0.518cd	0.539cd	0.507B
Means	0.421b	0.342a	0.528d	0.392ab	0.480c	0.436bc	0.463bc	

(P) = Peatmoss , (S) = Sand and (O) Composted olive cake

Table (9): Effect of indole butyric acid concentrations and growing media types on potassium percentage in the leaves of *Hibiscus rosa – sinensis* L. nurslings during of 2000-2001 and 2001-2002 seasons

Media Types IBA Concentrations (ppm)	(P)	(S)	(O)	Mixture of (P)+(S)	Mixture of (P)+(O)	Mixture of (S)+(O)	Mixture of (P) + (S)+(O)	Means
First season								
0	2.08bc	1.31a	2.41cd	2.01b	2.38cd	2.16bc	2.30c	2.09A
2000	2.58d	2.20bc	2.68d	2.51cd	2.66d	2.60d	2.65d	2.55B
4000	2.59d	2.49cd	2.81d	2.52cd	2.77d	2.70d	2.74d	2.66C
Means	2.41bc	2.00a	2.64c	2.35b	2.60c	2.49bc	2.56c	
Second season								
0	2.04b	1.64a	2.37c	2.04b	2.26bc	2.12b	2.18bc	2.09A
2000	2.52cd	2.06b	2.76de	2.38cd	2.70de	2.60d	2.67de	2.53A
4000	2.57cd	2.22bc	2.82e	2.44cd	2.77de	2.64de	2.68de	2.59A
Means	2.38bc	1.97a	2.65d	2.28b	2.58d	2.45c	2.51cd	

(P) = Peatmoss , (S) = Sand and (O) Composted olive cake

It appeared from Table (10) that the enhancement of NPK percentages in the leaves of *Hibiscus rosa-sinensis* L. nurslings was reflected in parallel increase with total carbohydrates percentage. The highest value with the treatment of 4000 ppm IBA and composted olive cake or composted olive cake + peatmoss media (1:1). It may be attributed to enhancement of chlorophyll synthesis consequently photosynthesis and other metabolic processes due to availability of the nutrient minerals from those media. In addition to well root growth caused by IBA this may enhance the absorption of minerals and water and reflected in high growth of the nurslings.

Table (10): Effect of indole butyric acid concentrations and growing media types on total carbohydrate percentage in the leaves of *Hibiscus rosa – sinensis* L. nurslings during of 2000-2001 and 2001-2002 seasons

Media Types IBA Concentrations (ppm)	(P)	(S)	(O)	Mixture of (P)+(S)	Mixture of (P)+(O)	Mixture of (S)+(O)	Mixture of (P)+(S)+(O)	Means
First season								
0	3.13ab	3.05a	3.89bc	3.09ab	3.87bc	3.34ab	3.57ab	3.42A
2000	3.86bc	3.72ab	4.59c	3.44ab	4.47c	4.04bc	4.08bc	4.03B
4000	4.55c	3.76b	5.38d	4.06bc	5.25d	4.69cd	4.81cd	4.64C
Means	3.85ab	3.51a	4.62c	3.53a	4.53c	4.02b	4.15b	
Second season								
0	3.14b	2.60a	3.78cd	3.06b	3.63bc	3.37bc	3.45bc	3.29A
2000	4.02cd	3.43bc	4.92ef	3.79cd	4.65ef	4.14d	4.27de	4.17B
4000	4.22de	3.66c	5.14f	3.97cd	5.01f	4.38de	4.58e	4.42C
Means	3.79bc	3.23a	4.61d	3.60b	4.43d	3.96c	4.10c	

(P) = Peatmoss , (S) = Sand and (O) Composted olive cake

The herein increase in NPK percentages can be attributed to the high contents of these minerals in composted olive cake, while sand contains virtually no mineral nutrients and has no buffering capacity, and mostly it is used in combination with organic materials, where peatmoss has high moister-holding capacity and contains a small amount of nitrogen (about 1.0%) but little or no phosphorus or potassium (Hartmann and Kester, 1975). So many investigators used silt, clay or peatmoss in addition to sand raising seedlings of some ornamental plants (Treder *et al.*, 1996; Fazli *et al.*, 1996; Mukhtar *et al.*, 1996 and Sher and Muhammad, 1996). In the herein work the composted olive cake proved to be the more suitable medium used alone or in combination with peatmoss or sand in raising *Hibiscus rosa-sinensis* L. nurslings which save other needed organic material in this regard may be not available in Sinai conditions. In addition, it may decrease the costs of imported peatmoss in this regard.

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تأثير اندول حمض البيوترك وأنواع البينات على إنتاج شتلات الهبسكس تحت ظروف سيناء

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تم إجراء هذا العمل بالمزرعة التجريبية لكلية العلوم الزراعية البيئية بالعريش جامعة قناة السويس خلال الموسمين ٢٠٠٠-٢٠٠١ و ٢٠٠١-٢٠٠٢.

كان الهدف الرئيسى من هذا البحث هو دراسة تأثير التركيزات المختلفة من اندول حمض البيوترك وأنواع مختلفة من البينات والتفاعل بينهم على النمو الخضري والمكونات الكيميائية لشتلات الهبسكس روزا شينينز.

واظهرت النتائج التى تم الحصول عليها ان غمس العقل الساقية للهبسكس فى اندول حمض البيوترك حتى ٤٠٠٠ جزء بالمليون ادى إلى زيادة الاوزان الطازجة والجافة للجذور والافرع (اوراق + سيقان) بالإضافة إلى عدد الاوراق وارتفاع الشتلة.

وتضمنت البينات (البيتموس ، الرمل وتفل زيتون مكمور ومخاليط البيتموس + الرمل ، البيتموس + تفل زيتون مكمور ، رمل + تفل زيتون مكمور بالنسب (١:١ بالحجم) ومخلوط البيتموس + الرمل + تفل الزيتون المكمور بنسبة ١:١:١ بالحجم) حيث أتضح ان بيئة تفل الزيتون المكمور بمفردها او بخلطها مع البيتموس بنسبة ١:١ حسنت مقدرة البينة على انتاج الشتلات خاصة من ناحية الصفات الخضرية . أيضا أدت معاملات التفاعل بين البينات المستخدمة واندول حمض البيوترك إلى نتائج معنوية واطهرت ان افضل معاملة تفاعل لانتاج الشتلات كانت بغمس العقل فى اندول حمض البيوترك ٤٠٠٠ جزء بالمليون وزراعتها فى بيئة تفل الزيتون المكمور او تفل الزيتون المكمور + البيتموس . ايضا زادت النسب المئوية للنيتروجين والفوسفور والبوتاسيوم والكربوهيدرات الكلية للاوراق باستخدام نفس المعاملات السابقة ، حيث يمكن التوصية باستخدام بيئة تفل الزيتون المكمور أو بخلطها مع البيتموس بنسبة (١:١) بعد غمسها فى اندول حامض البيوترك ٤٠٠ جزء فى المليون لإنتاج شتلات الهبسكس تحت ظروف سيناء باعتبارها من مخلفات صناعة عصر الزيتون وتوفر تكاليف استخدام واستيراد البيتموس .