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RESPONSE OF DRACAENA AND RUSCUS PLANTS TO HUMIC ACID AND BIOFERTILIZER SUPPLY

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ABSTRACT

Two independent pot experiments were conducted under plastic house at the nursery of Hort. Res. Inst., ARC, Giza, Egypt during 2007 and 2008 seasons to study the effect of dressing with either humic acid liquid fertilizer or biofertilizer when added monthly as a foliar spray at 5 ml/l level or as a soil drench at 10 ml/l level for each, individually or in combination on growth and chemical composition of 6-months-old transplants of both *Dracaena marginata* "Bicolor" Lam. and *Ruscus hypoglossum* L. grown in 20-cm-diameter plastic pots filled with 1.5 kg of washed sand + loam + peatmoss mixture (1:1:1, v/v/v).

The obtained results indicated that all fertilization treatments significantly improved all vegetative and root growth parameters, as well as the active constituents in the leaves of both studied plants. The superiority was for the combined biofertilizer treatment, in which a biofertilizer was added as a foliar spray at the rate of 5 ml/l plus adding it as a soil drench at the rate of 10 ml/l, as this combined treatment gave the utmost high means compared to those of control and all other treatments in the two seasons. It was also noticed that biofertilizer treatments recorded better results than humic acid ones in both studied plants, and addition of the treatments as soil drench was the best method. So, in order to get the best growth and good performance of both *Dracaena marginata* "Bicolor" Lam. and *Ruscus hypoglossum* L. plants, it could be recommended to fertilize them monthly with a biofertilizer containing many races of beneficial micro-organisms, as a soil drench at the rate of 10 ml/l plus spraying it at the rate of 5 ml/l.

INTRODUCTION

Nowadays, using of natural and bio-fertilizers of humate has become one of the most important requirements to protect environments from pollution, besides getting a safe and clean product, especially if this product will be used by man indoors, as pot plants. Among pot plants that are mainly used for decoration of the low-light intensity places may be Dracaena and Ruscus. The former (*Dracaena marginata* "Bicolor" Lam.) belongs to Fam. Agavaceae, with slender and thin stem up to 3 m. height; and narrowly sword-shaped leaves, somewhat concave towards base, margins purple. Madagascar. Stem resin of Dracaena is one source of dragon's blood, used in the varnish and photoengraving. The latter (*Ruscus hypoglossum* L.) belongs to Fam. Liliaceae, with elliptic to oblanceolate clodophyils and branched stem. South Europe (Mediterranean region) (Bailey, 1976).

Humic acid and biofertilizers are being used widely now for production of most horticultural crops, as the formers can provide soil microbs with energy, improve nutrients retention in the soil and enhance the water holding capacity (Dorer and Peacock, 1997). However, the latters contain microorganisms, which fix atmospheric N in a free living state, e.g. *Azotobacter* and *Azospirillum* (Darwish, 2002). Moreover, Azotobacter bacteria secrete some growth promoting factors, e.g. gibberellin, cytokinin-like substances, auxins, as well as some vitamins such as thiamine, riboflavin, pyridoxine, nicotinic and pantothenic acids (Darwish, 2002). Subba Rao (1993)

indicated that *Azotobacter chroococcum* bacteria synthesize antifungal anti-biotics, which gave it additional advantage for the use in field of production.

Many efforts, however have been done in this respect, as Evans and Li (2003) who revealed that humic acid at 2500 and 5000 mg/l increased lateral root number, lateral root length and dry root weight of *Catharanthus roseus, Pelargonium hortorum, Tagetes patula* and *Viola tricolor*. Hunter and Butler (2005) reported that humic acid significantly increased height, density and herb fresh and dry weights of *Agrostis stolonifera* turf with improving leaf colour and P content. On Schefflera (*Brassaia actinophylla*), El-Sayed and El-Shal (2008) found that humic acid at 5 ml/l as a foliar spray, 10 ml/l as a soil drench and both of them in combined treatment every two weeks greatly improved plant height, stem diameter, leaf No./plant, fresh and dry weights of foliage and roots, as well as leaves content of N, P, K, Zn, Fe and Mn. Similar observations were also gained by Muscolo *et al.* (1999) on *Pinus laricio*, Zhang *et al.* (2003) and Hunter and Anderos (2004) on *Agrostis stolonifera* and Abdel-Fattah *et al.* (2008) who postulated that humic acid at 20 ml/l as a soil drench significantly enhanced growth, density, colour and chemical composition of Tifway Bermudagrass plants under salinity stress.

Concerning the beneficial effects of biofertilizers, Quoreshi (2003) stated that inoculation with mycorrhizal fungi raised growth and nutrients uptake by *Picea mariana* seedlings. Likewise, Martin *et al.* (2003) mentioned that height and trunk diameter of *Quercus palustris* and scarlet oak (*Q. coccinea*) seedlings colonized with ecto-mycorrhizae were better than those of uncolonized ones. On *Lilium longiflorum* cv. Polina, Mohamed *et al.* (2005) pointed out that foliar spray with yeast at the rates of 1, 2 and 3 g/L increased leaf number, flower diameter, fresh and dry weights of flowers and flowering stalks, as well as total carbohydrates in the leaves and flowers. On the same line, were those results of Suzuki and Nakano (2002) on Lilium, Agapanthus and Muscari, Hussien (2004) on *Iris tingitana* cv. Wedgewood, Attia and Abdel-Azeem (2005) on *Populus nigra*, Sarhan *et al.* (2007) on jojoba, El-Sayed *et al.* (2007) on *Peperomia obtusefolia* cv. Variegata, and El-Sayed *et al.* (2007) who declared that biogien at 10 g/plant improved vegetative and root growth of *Ficus binnendijkii* (Amstel King) plants, as well as the contents of pigments, N, P and K in the leaves.

The objective of this work, is to detect the effect of fertilization with humic acid liquid fertilizer and biofertilizer (as either foliar spray or soil drench), or both in combinations on growth and active constituents of Dracaena and Ruscus plants.

MATERIALS AND METHODS

Two independent pot experiments were consummated under plastic house at the nursery of Hort. Res. Inst., Giza, Egypt during the two successive seasons of 2007 and 2008 to study the response of Dracaena and Ruscus transplants to both foliar spray and soil dressing with either humic acid liquid fertilizer or biofertilizer, alone or in combination.

Therefore, six-months-old transplants of *Dracaena marginata* "Bicolor" Lam. with initial height of 30.0±2.0 cm, carrying about 12-14 leaves, and *Ruscus hypoglossum* L. with initial height of 28±2.0 cm, carrying about 14-16 leaves were planted on April, 1st for the two seasons in 20-cm-diameter plastic pots (one transplant/pot) filled with about 1.5 kg of a mixture of washed sand, loam and peatmoss (1:1:1, v/v/v). The physical and chemical properties of the used sand and loam are shown in Table (a), but those of the used peatmoss are shown in Table (b).

Table (a): Some physical and chemical properties of the used sand and loam during 2007 and 2008 seasons.

Soil type	Seasons	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^{--}
Sandy	2007	89.03	2.05	0.40	8.52	23.01	3.56	7.90	7.50	1.63	33.60	0.50	3.20	22.00	18.03
	2008	84.76	6.29	1.50	7.45	21.87	3.71	7.80	19.42	8.33	7.20	0.75	1.60	7.80	26.30
Loamy	2007	10.18	46.17	19.53	24.12	35.00	3.48	8.27	17.50	9.42	20.00	0.79	3.80	10.00	33.91
	2008	10.30	46.54	18.88	24.28	33.07	3.36	7.96	18.00	8.95	20.50	0.85	3.65	10.20	34.45

Table (b): Some physical and chemical properties of the used peatmoss in the two seasons.

Organic matter.	**90-95%**	**P**	**0.23%**
Ash	5-10%	**K**	1.77 %
Density (Vol. dry	80-90 mg/l.	**Fe**	421 ppm
pH value	3.4	**Mn**	27 ppm
Water relation capacity	60-75%	**Mg**	346 ppm
Salinity	0.3 g/l.	**Zn**	41 ppm
N	1.09 %	**Cu**	8.8 ppm

After one month, the transplants received the following treatments:

1- No fertilization, referred to as control.
2- A humic acid NPK (10:10:10) liquid organic fertilizer was added monthly either as a foliar spray to runoff at the rate of 5ml/l, or as a soil drench at the rate of 10 ml/l (50 ml from the humic acid solution/pot). The different constituents of the used liquid organic fertilizer are shown in Table (c).
3- A combination between spraying of humic acid solution (at 5ml/l) and drenching it (at 10 ml/l).
4- A liquid biofertilizer containing 10^8 cells/ ml of *Azospirillum barasilense, Bacillus polymyxa, Azotobacter chroococcum, Klebsiella peneumonia* and *Pseudomonas putida* was also added monthly either as a foliar spray to runoff at the rate of 5 ml/l or as a soil drench at the rate of 10 ml/l (50 ml from the biofertilizer solution/pot).
5- A combination between spraying of biofertilizer solution (at 5 ml/l) and drenching it (at 10 ml/l).

Table (c): Main characteristics of the used liquid organic fertilizer during 2006 and 2007 seasons.

Components	Value	Components	Value	Components	Value
Humic acid (%)	2.9	**EC(dS/m)**	59.3	**B (mg/L.)**	70.00
Organic matter/total solid (%)	42.51	**N (%)**	10.00	**Fe (mg/L.)**	900.00
Total humic acids/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	**Cu (mg/L.)**	90.00
pH	8.20	**Mg (%)**	0.05		

The layout of the experiment in the two seasons was a randomized complete block design (Sendecor,G.W.andW.G.Cohren 1982) with three replicates, in each.7 tretments (plot=5plants)The usual agricultural practices recommended for such plantation were followed whenever needed.

At the end of each season (October, 15th), the following data were recorded: plant height (cm), stem diameter at the base (cm) for Dracaena only, branch No./plant for Ruscus only, leaf No./plant, root length (cm), root diameter (mm) for Ruscus only as well as fresh and dry weights (g) of leaves, stem and roots in Dracaena, while in Ruscus were for the whole aerial parts and roots. In fresh leaf samples taken from the middle part of the plants, photosynthetic pigments (chlorophyll a, b and carotenoids, mg/g f.w.) were determined according to Moran (1982), while in dry ones, the percentages of total carbohydrates (Herbert *et al.*, 1971), nitrogen using micro-Kjeldahle method as described by Pregl (1945) phosphorus colorimetrically as recommended by Luatanab and Olsen (1965) and potassium using flame-photometer set (Jackson, 1973) were measured.

Data were then tabulated and statistically analyzed according to SAS program (1994) using the method of L.S.D. at 5% (Mead *et al.*, 1993) for elucidating the significancy level between the means of various treatments.

RESULTS AND DISCUSSION

I. Effect of fertilization treatments on growth and chemical composition of *Dracaena marginata* "Bicolor" Lam. plants:

A. Effect on vegetative and root growth:

It is clear from data presented in Tables (1 and 2) that all fertilization treatments significantly increased plant height (cm), stem diameter (cm), No. leaves/plant, root length (cm) and diameter (mm), as well as fresh and dry weights (g) of the leaves, stem and roots compared to control in the two seasons with few exceptions for 5ml/l humic acid treatment, which slightly raised some parameters with non-significant differences. The superiority was for the combined treatment added as a foliar spray at 5 ml/l and soil drench at 10 ml/l, as this treatment gave the utmost high means comparing with control and all other treatments in both seasons. In general, it was noticed that biofertilizer treatments recorded better results than humic acid ones, and addition of the treatments as a soil drench was the best method.

Improvement of the vegetative and root growth may explain the role of humic acid in increasing the availability of nutrients in the soil through influencing on soil microbial activity, and biofertilizer, which fix more atmospheric N and secrete more vitamins and growth promoting substances necessary for good and healthy growth.

However, the previous results are in parallel with those of Muscolo *et al.* (1999) on *Pinus laricio,* Evans and Li (2003) on *Catharanthus roseus, Pelargonium hortorum, Tagetes patula* and *Viola tricolor,* Ahmed *et al.* (2005) on *Populus nigra,* Sarhan *et al.* (2007) on jojoba and Abdel-Fattah *et al.* (2008) on Tifway Bermudagrass.

B. Effect on chemical composition:

According to data averaged in Table (3), it is evident that application of humic acid and biofertilizer either as a foliar spray or as a soil drench, individually or in combinations caused a marked increment in the leaf content of chlorophyll a, b and carotenoids (mg/g f.w.), as well as in the percentages of total carbohydrates, N, P and K over the means of control plants, with the mastery of biofertilizer combination (C+D), which gave the highest records in all previous constituents. A similar trend to that gained in case of vegetative and root growth was also obtained concerning chemical composition, as biofertilizer treatments registered better results than those of humic acid ones, and applying the treatments as a soil drench was the best method.

Increasing the content of active constituents in tissues of the treated plants may indicate the role of humic acid in enhancing the metabolic activity of microorganisms and activity as a source of N, P and S for plants (Higa and Wididana, 1991).

Table (1): Effect of fertilization treatments on some vegetative growth traits of *Dracaena marginata* "Bicolor" Lam. plant during 2007 and 2008 seasons.

Treatments	Plant height (cm)	Stem diameter (cm)	Leaf No. /plant	Root length (cm)	Root diameter (mm)
	First season:2007				
Control	65.33	1.33	25.67	21.80	2.08
5ml/l humic acid (A)	70.25	1.40	27.09	26.57	2.23
10ml/l humic acid (B)	77.34	1.50	27.50	28.50	3.00
A+B	78.63	1.70	28.45	31.90	3.61
5 ml/l Biofertilizer (C)	83.67	1.46	31.55	34.06	4.01
10 ml/l Biofertilizer (C)	92.15	1.80	32.10	37.23	5.00
C+D	95.23	2.00	37.67	40.26	5.20
L.S.D. at 5%	3.28	0.07	1.40	2.10	0.18
	Second season:2008				
Control	62.15	1.30	26.40	22.57	2.00
5ml/l humic acid (A)	67.29	1.55	27.41	24.63	2.30
10ml/l humic acid (B)	81.46	1.60	29.64	27.60	2.41
A+B	84.23	1.70	31.25	31.65	2.78
5 ml/l Biofertilizer (C)	84.90	1.80	28.81	30.33	3.90
10 ml/l Biofertilizer (C)	87.18	1.83	32.50	35.10	4.00
C+D	89.56	1.92	42.56	37.67	4.67
L.S.D. at 5%	3.25	0.08	1.72	2.41	0.16

Table (2): Effect of fertilization treatments on leaves, stem and roots fresh and dry weights of *Dracaena marginata* "Bicolor" Lam. plant during 2007 and 2008 seasons.

Treatments	Fresh weight (g)			Dry weight (g)		
	Leaves	Stem	Roots	Leaves	Stem	Roots
	First season 2007					
Control	53.94	41.17	51.44	12.56	10.32	18.52
5ml/l humic acid (A)	62.73	46.53	88.62	13.04	15.70	30.01
10ml/l humic acid (B)	66.74	50.37	93.17	14.35	16.45	28.90
A+B	69.50	52.58	95.90	15.03	18.22	33.16
5 ml/l Biofertilizer (C)	70.56	53.02	97.27	17.45	20.83	34.58
10 ml/l Biofertilizer (D)	77.03	71.50	115.60	17.96	23.65	36.89
C+D	85.58	78.65	120.58	18.50	27.48	40.52
L.S.D. at 5%	3.97	3.34	8.46	1.42	1.67	1.94
	Second season 2008					
Control	50.01	33.71	49.28	12.00	9.92	16.92
5ml/l humic acid (A)	68.76	38.46	86.10	14.04	15.10	27.41
10ml/l humic acid (B)	71.32	43.37	89.91	15.43	16.91	28.76
A+B	77.88	52.10	99.50	16.70	18.11	32.66
5 ml/l Biofertilizer (C)	75.62	53.23	103.46	17.04	19.23	35.50
10 ml/l Biofertilizer (D)	81.10	64.12	117.33	17.65	21.17	36.21
C+D	84.72	74.35	121.27	18.00	24.22	39.11
L.S.D. at 5%	3.37	2.70	8.96	1.46	1.71	1.98

* A and C treatments were added as a foliar spray, while B and D ones were added as a soil drench.

Table (3): Effect of fertilization treatments on chemical composition of *Dracaena marginata* "Bicolor" Lam. plant during 2007 and 2008 season.

Treatments	Pigments content (mg/g f.w.)			Total carbohydrates (%)	N (%)	P (%)	K (%)
	Chlor. a	Chlor. b	Carot.				
Control	0.551	0.257	0.633	58.32	1.33	0.203	1.16
5ml/l humic acid (A)	0.563	0.281	0.651	62.98	1.46	0.211	1.23
10ml/l humic acid (B)	0.578	0.300	0.663	63.85	1.58	0.217	1.29
A+B	0.593	0.318	0.691	64.31	1.63	0.224	1.37
5 ml/l Biofertilizer (C)	0.588	0.291	0.687	64.10	1.50	0.219	1.34
10 ml/l Biofertilizer (D)	0.696	0.354	0.700	66.59	1.69	0.231	1.41
C+D	0.745	0.389	0.749	70.26	1.78	0.248	1.56

* A and C treatments were added as a foliar spray, while B and D ones were added as a soil drench.

In addition, a biofertilizer as a preparation containing many races of beneficial bacteria that can fix atmospheric N and can release nutrients from rocks and organic matter in the soil to become available for plants (Quoreshi, 2003). On the same line, were those results attained by both Zhang *et al.* (2003) and Hunter and Anderos (2004) on *Agrostis stolonifera,* Attia and Abdel-Azeem (2005) on *Lawsonia inermis,* El-Sayed and El-Feky (2007) on *Ficus binnendijikii* (Amstel King) and El-Sayed and El-Shal (2008) on Schefflera (*Brassaia actinophylla*).

II. Effect of fertilization treatments on growth and chemical composition of *Ruscus hypoglossum* L. plants:

A. Effect on vegetative and root growth:

Data in Table (4) exhibit that all fertilization treatments applied significantly elevated all vegetative and root growth traits comparing with control means in the two seasons, except for 5 ml/l humic acid treatment, which slightly raised branch No./plant and root length (cm) in the first season and branch No./plant, leaf No./plant and root length in the second one. Moreover, a slight improvement was observed in root length character due to humic acid treatment at the rate of 10 ml/l in the first season, and in plant height due to 5 ml/l biofertilizer treatment in the second one. The mastery, was however for the combined biofertilizer treatment (C+D) that gave in general, the utmost high averages in comparison with control and all other treatments in both seasons. Generally, fresh and dry weights of aerial parts and roots were the most respondent measurments to fertilization treatments employed in such trial, as they were greatly increased even at the low level of either humic acid or biofertilizer. A similar trend to that of Dracaena, was also noticed in Ruscus, as biofertilizer treatments gave better results than humic acid ones, and the soil drench method was the best compared to the foliar spray one.

The previous results may be interpreted and discussed as previously stated in case of *Dracaena marginata* "Bicolor" plant.

B. Effect on chemical composition:

From data in Table (5), it could be concluded that there was a pronounced increment in pigments content (chlorophyll a, b and carotenoids, mg/g f.w.), as well as the percentage of total carbohydrates, N, P and K in the leaves of fertilized plants comparing with unfertilized ones. The excellence resulted from the combination between 5 ml/l biofertilizer as a foliar spray and 10 ml/l as a soil drench that gave the highest values for all the forgoing constituents. Also, biofertilizer treatments and soil drench method were in superior rank relative to humic acid treatments and foliar spray method, respectively.

Such gains could be explained and discussed as done before in case of Dracaena plant.

According to the aforementioned results, it could be recommended to fertilize the 6-months-old transplants of either

Dracaena marginata "Bicolor" or *Ruscus hypoglossum* grown in 20-cm-diameter plastic pots filled with about 1.5 kg of washed sand + loam + peatmoss mixture (1:1:1, v/v/v) with a biofertilizer containing many races of beneficial bacteria added as a soil drench at 10 ml/l, besides additing it as a foliar spray at 5 ml/l to get the best growth and good performance.

Table (4): Effect of fertilization treatments on some vegetative growth traits of *Ruscus hypoglossum* L. plant during 2007 and 2008 seasons.

Treatments	Plant height (cm)	Branch No./plant	Leaf No./ plant	Root length (cm)	Fresh weight (g)		Dry weight (g)	
					Aerial parts	Roots	Aerial parts	Roots
	First season: 2007							
Control	58.33	13.25	81.16	40.36	33.15	51.64	8.61	20.34
5ml/l humic acid (A)	73.67	14.36	112.34	41.56	47.68	75.32	14.57	29.68
10ml/l humic acid (B)	74.32	15.17	126.53	42.35	52.36	82.37	15.21	32.64
A+B	76.00	15.62	136.20	51.44	58.56	93.16	15.76	38.77
5 ml/l Biofertilizer (C)	67.54	18.42	134.25	48.55	76.05	100.13	17.26	36.90
10 ml/l Biofertilizer (D)	75.61	18.96	145.38	53.42	78.53	115.40	20.80	43.15
C+D	77.82	26.33	174.55	60.71	85.19	131.76	27.71	48.10
L.S.D. at 5%	3.11	1.40	7.51	3.74	3.38	4.61	1.78	1.64
	Second season: 2008							
Control	66.20	12.35	101.09	39.20	37.40	43.20	9.20	17.20
5ml/l humic acid (A)	68.72	13.22	102.40	42.00	51.46	72.11	15.37	27.08
10ml/l humic acid (B)	73.35	16.00	114.20	46.21	59.12	76.23	16.10	31.17
A+B	76.48	17.39	137.28	48.00	61.30	87.71	17.43	34.10
5 ml/l Biofertilizer (C)	66.39	16.35	144.00	52.21	69.17	83.34	18.20	35.00
10 ml/l Biofertilizer (D)	70.67	19.50	151.68	59.00	80.10	98.10	19.87	40.00
C+D	77.33	23.34	169.65	64.10	84.16	117.21	25.71	44.12
L.S.D. at 5%	3.86	1.46	8.12	3.68	3.59	4.23	1.71	1.33

Table (5): Effect of fertilization treatments on chemical composition of *Ruscus hypoglossum* L. plant during 2007 and 2008 seasons.

Treatments	Pigments content (mg/g f.w.)			Total carbohydrates (%)	N (%)	P (%)	K (%)
	Chlor. a	Chlor. b	Carot.				
Control	1.471	0.841	1.326	62.40	1.52	0.408	1.33
5ml/l humic acid (A)	1.513	0.853	1.354	65.22	1.63	0.437	1.42
10ml/l humic acid (B)	1.534	0.869	1.385	67.14	1.74	0.451	1.50
A+B	1.586	0.891	1.412	68.38	1.86	0.467	1.56
5 ml/l Biofertilizer (C)	1.550	0.876	1.381	71.23	1.72	0.459	1.52
10 ml/l Biofertilizer (D)	1.633	0.907	1.436	72.85	1.93	0.489	1.68
C+D	1.811	0.979	1.533	75.40	2.16	0.503	1.88

*A and C treatments were added as a foliar spray, while B and D ones were added as a soil drench.

REFERENCES

Abdel-Fattah, Gehan H.; El-Sayed Boshra, A. and Shahin, S. M. (2008): The role of humic acid in reducing the harmful effect of irrigation with saline water on Tifway turf. J. Biol. Chem. Environ. Sci., 3(1):75-89.

Ahmed, Amany A.; Ahmed, F.A. and Omar, F.D. (2005): Response of *Populus nigra* seedlings to *Azotobacter vinelandii* transformation isolates and N-fertilization. Proc. 6th Arab. Conf. Hort., March 20-22, Dept. Hort., Fac. Agric., Ismailia, Egypt:91-108.

Attia, Elham M. and Abdel-Azeem Hoda, H.M. (2005): Effect of biofertilization on yield and active materials in *Lawsonia inermis* L. plants. Proc. 6th Arab. Conf. Hort., March 20-22, Dept. Hort., Fac. Agric., Ismailia, Egypt:109-128.

Bailey, L.H. (1976): Hortus Third. Macmillan Publishing Co., Inc., 866 Third Avenue, New York, N.Y. 10022. printed in USA, 1290 pp.

Darwish, F.M. (2002): Effect of different fertilizer sources and levels on growth, yield and quality of tomato. Ph.D. Thesis, Fac. Agric., Cairo Univ., Egypt.

Dorer, S.P. and Peacok, C.H. (1997): The effect of humate and organic fertilizer on establishment and nutrition of creeping bentgrass putting greens. Inter. Turfgrass Soci. Res. J., 8:437-443.

El-Sayed, Boshra A. and El-Feky, A.H. (2007): Effect of biofertilizers (*Rizobacteren, nitrobien* and *biogien*) on growth of *Ficus binnendijkii* L. (Amstel King) plant. Egypt. J. Appl. Sci., 22(10A):157-170.

El-Sayed, Boshra A. and El-Shal, S.A. (2008): Effect of growing media and humic acid on Schefflera quality. J. Agric. Sci., Mansoura Univ., 33(1):371-381.

El-Sayed, Boshra A.; Shahin, S.M. and Eliwa, Naglaa, Y.L. (2007): How far nitrobien and gibberellic acid can improve growth and chemical composition of *Peperomia obtusifolia* cv. Variegata (L.) A. Dietr. transplants. J. Biol. Chem. Environ. Sci., 2(4):167-179.

Evans, M. and Li, G. (2003): Effect of humic acid on growth of annual ornamental seedling plugs. HortTech., 13(4):661-665.

Herbert, D.; Philips, P.J. and Strange, R.E. (1971): Determination of total carbohydrates. Methods in Microbiology, 5(8):290-344.

Higa, T. and Wididana, G.N. (1991): Changes in the soil microflora induced by effective microorganisms. Proc. The 1st Inter. Conf. of Kyusei Nature Farming, U.S. Dept. Agric., Washington, D.C., USA. p:153-162.

Hunter, A. and Anderos, A. (2004): The influence of humic acid on growth and development of creeping bentgrass. Acta Hort., 661:257-264.

Hunter, A. and Butler, T. (2005): Effect of humic acid on growth and development of *Agrostis stolonifera* grass in a sand-based root zone. Inter. Turfgrass Soci. Res. J., 10:937-943.

Hussein, H.S.M. (2004): Physiological studies on Iris plant. M.Sc. Thesis, Fac. Agric., Cairo Univ.

Jackson, M.L. (1973): Soil Chemical Analysis. PrenticeHall of India Private Ltd. M-97, New Delhi, India, 498 pp.

Luatanab, F.S. and Olsen, S.R. (1965): Test of an ascorbic acid method for determining phosphorus in water and $NaHCO_3$ extracts from soil. Soil Sci. Soci. Amer. Proc., 29:677-678.

Martin, T.P.; Horris, J.R.; Eaton, G.K. and Miller, O.K. (2003): The efficacy of ectomycorrhizal colonization of pin and scarlet oak in nursery production. J. Environ. Hort., 21(1):45-50..

Mohamed, Safaa M.; El-Khayat, A.S. and El-Shayeb, N.S. (2005): Influence of P, K and yeast nutrition on growth, flowering and chemical composition of *Lilium longiflorum* cv. Poliana plants. Proc. 6th Arab. Conf. Hort., March 20-22, Ismailia, Egypt:129-141.

Moran, R. (1982): Formula for determination of pigments extracted with N,N-dimethyl formamide. Plant Physiol., 69:1376-1381.

Muscolo, A.; Panoccio, M.R. and Nardi, S. (1999): Effect of two different humic substances on seed germination of *Pinus laricio*. Seed Sci. and Tech., 27(2):799-803.

Pregl, F. (1945): Quantitative Organic Micro-Analysis, 4th Ed., J. and A. Churchill Ltd., London, p: 203-209.

Quoreshi, A.M. (2003): Nutrional preconditioning and ectomycorrhizal formation of *Picea mariana* (Mill) B.S.P. seedlings. Eurasian J. Forests Res., 6:1-63.

Sarhan, A.Z.; El-Maadawy Effat I. and Surour, S.S. (2007): Effect of biopromoters and biofertilizers application on growth and chemical composition of jojoba plants. J. Agric. Sci., Mansoura Univ., 32(8):6575-6598.

SAS Institute (1994): SAS/STAT User's Guide: Statistics. Vers. 6.04, 4th Ed., SAS Institute Inc., Cary, N.C., USA.

Sndecor,G.W.and W.G. cochran (1982) statislical Methods 7 ed.,lowa state univ press ,lowa,usa.

Subba Rao, N.S. (1993): Biofertilizers in Agriculture, 3rd Ed., Oxford & IBH Publishing Co. Ltd., New Delhi, Bombay. Calcutta, 242 pp.

Suzuki, S. and Nakano, M. (2002): Agrobacterium mediated transformation in liliaceous ornamental plants. J. Japan. Agric. Res., Quarterly, 36(3):119-127.

Zhang, X.Z.; Ervin, E.H. and Schmidt, R.E. (2003): Physiological effects of liquid application of humic acid on creeping bentgrass. J. Amer. Soc. Hort. Sci., 128(4):492-496.

استجابة نباتات الدراسينا والسفندر للإمداد بحمض الهيوميك والسماد الحيوي

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أجريت تجربتان منفصلتان بإحدى الصوب البلاستيكية بمشتل معهد بحوث البساتين بالجيزة، مصر خلال موسمي ٢٠٠٧، ٢٠٠٨ لدراسة تأثير التسميد أما بحمض الهيوميك السائل أو بمحلول السماد الحيوي، إما رشاً على الأوراق بمعدل (٥مل/لتر) أو للتربة بمعدل (١٠ مل/لتر)، منفصلة أو في توليفة شهريا، على النمو والتركيب الكيميائي لشتلات نباتات كلٍ من الدراسينا (*Dracaena marginata* "Bicolor" Lam.) والسفندر (*Ruscus hypoglossum* L.) عمر ستة أشهر، المنزرعة في أصص بلاستيك قطرها ٢٠سم مملوءة بحوالي،١٥ كجم من مخلوط متساوي من الرمل المغسول، الطمي والبتموس (حجماً).

ولقد أوضحت النتائج المتحصل عليها أن جميع معاملات التسميد التي طبقت بهذه الدراسة قد أحدثت تحسناً معنوياً في جميع قياسات النمو الخضري والجذري، وكذلك محتوى الأوراق من المكونات الكيميائية النشطة بكلا النباتين موضع الدراسة، مع تفوق المعاملة المشتركة للسماد الحيوي (والتي أضيف فيها هذا السماد رشاً على الأوراق بمعدل ٥ مل/لتر بجانب إضافته للتربة بمعدل ١٠ مل/لتر)، حيث أعطت هذه المعاملة المشتركة أعلى المتوسطات على الإطلاق مقارنة بالكنترول وجميع المعاملات الأخرى في كلا الموسمين. وقد لوحظ أيضاً أن معاملات السماد الحيوي أعطت نتائج أفضل من معاملات حمض الهيوميك (سواء عند إضافتها منفردة أوفي توليفة)، وأن الإضافة في صورة محلول للتربة كانت أفضل من الإضافة رشاً على الأوراق.

وعليه.. فانه للحصول على أفضل نمو ومظهر جيد لنباتي الدراسينا والسفندر، يوصى بتسميدها شهريا بسماد حيوي (يحتوي على العديد من سلالات البكتريا النافعة)، شريطة أن يضاف في صورة محلول للتربة بتركيز ١٠ مل/لتر بجانب رشه في الوقت ذاته على الأوراق بتركيز ٥ مل/لتر.