Evaluation the Effect of Humic Acid and Some Soil Amendments on Rooting and Growth of *Dracaena marginata* Cuttings

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ABSTRACT

This search was conducted to investigate the impact of Humic acid (H.A.) fertilizer (0.0,10.0,20.0 and 30. 0 g l^{-1}) and different media (100% peat moss , 50% peat moss + 50% perlite and 50% peat moss + 50% sand) and their combinations' effect on rooting and growth of *Dracaena marginata* under greenhouse conditions at the Nursery, Department of Floriculture, Ornamental Horticulture and Landscape Gardening, Faculty of Agriculture, Alexandria University, Egypt during the growing seasons 2021 and 2022. The results showed that terminal cuttings pretreated with H.A. combined with media had significant effects on survival %, rooting %, roots number /cutting, root length (cm), root fresh and dry weight (g). The highest significant values of rooting and growth obtained when Dracaena cuttings cultured in medium composed of 50% peat moss + 50% perlite combined with Humic acid (H.A) at 30.0 gm l^{-1} concentration. As well as, the highest significant results for total carbohydrates and total leaf chlorophyll content (a + b) were obtained after applying the aforementioned treatments. Chemical analysis also indicated that N, P and K content were markedly increased as H.A. concentrations increased up to 30.0 gml-1 with the growing media of peat moss 50% + perlite 50%. Dracaena cuttings in control treatment (without H.A.) grown in 100% peat moss recorded the lowest significant mean values for all characteristics under study in both seasons. Therefore, it is suggested that growing high-quality Dracaena plants for various aesthetic reasons be performed by treating Dracaena cuttings with H.A. at 20.0 or 30.0 gml-1 and cultivating in a mixture of 50% peat moss + 50% perlite.

Key word: *Dracaena marginata*, post propagation, indoor and outdoor plant ,organic fertilizers, Humic acid , soil amendments , growing media ,rooting , greenhouse and shade plants

Abbreviations: Humic acid (H.A.), (GMI) Growing media: peat moss 100% , (GMII) Growing media: peat moss 50 % + perlite 50% ,(GMIII) Growing media: peat moss 50%+ sand 50%, L.S.D $_{(0.05)}$ = Least significant differences at 0.05 probability level.

INTRODUCTION

Dracaena, genus of about 170 species (Asparagaceae formerly liliaceae) *Dracaena marginata* more commonly known as a dragon tree or red edged dracaena. A popular indoor and outdoor plant known as the drago n tree, native to Madagascar.

A little tree or shrub, it grows slowly. The standard *Dracaena marginata* has green leaves with red edges. Plant taxonomists have recently reclassified Dracaena marginata and given it the new Latin name, *Dracaena cincta*. Humic acid (H.A.) is a possible natural resource that can be used to maximi ze yield, nutrient availability, and growth (Sharif *et al*., 2002).It is a natural polymer with carboxyl and phenolic regions for the exchange process. As humic acid is a very stable byproduct of the degradation of organic mat erials, it builds up in environmental systems. H.A. make s significant improvements to soil stability, fertility, and flower quality that promote excellent plant growth and micronutrient absorption. A component of organic mate rials is humic acid. (Asik *et al*., 2009 and Katkat *et al*., 2009). It is commonly recognized that two of the most significant elements impacting the roots and growth of greenhouse and shade plants are potting medium and humic acid. However, no reports are available on production of indoor plants (Ibrahim *et al*., 2016), especially *Dracaena marginata* under greenhouse conditions and there is very little studies on the usage of humic compounds in the diffusion of ornamentals. Mackowiak *et al*. (2001) reported that H.A raise mineral element absorption to lengthen roots and raise fresh and dry weights for various plants. EI-Shanhorey *et al*. (2014) revealed that the maximum significant values of root length, dry weight, chlorophyll, proline, and carbohydrate contents of the *Jatropha curcas* plant were obtained at 1000 p.p.m. of Humic acid. The application of Humic acid, according to Lilian *et al*.,'s research (2015), increased the number of Croton and Hibiscus cuttings that originated roots.

According to Mahdieh and Elham (2016), Humic acid was only effective on morphological characteristics and had no influence on the germination percentage (p<1%) of *Borago officinalis* such as radical fresh weight, pedical length of the seedlings. The treatment of 30.0 mg l^{-1} of Humic acid was successful in promoting plant germination and was effective in germination of the species. *Catharanthus roseus* L. was the subject of a

DOI: 10.21608/asejaiqjsae.2022.279136

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Received November 25, 2022, Accepted, December 29, 2022.

research by Nofal *et al*. in 2021. The acquired findings demonstrated that, when compared to control treatment, the applied bio-stimulants considerably enhanced all growth and root parameters as well as their fresh and dry weights. Additionally, the chemical components of chlorophyll a and b, as well as their N, P, and K% and total alkaloids, increased in the leaves. Humic acid at 6.0 ml/l produced the greatest effects.

The development of ornamental plants, particularly annual plants, can be significantly influenced by the texture of the soil as a growing medium. To produce high-quality horticulture crops, appropriate growth medium or substrates must be used. The promise of soil amendments is to improve the characteristics of soil fertility, such as reducing or eliminating the need for fertilizer elements, increasing the availability of native soil elements to plants, providing balanced soil fertility, or inoculating soil with the right or improved strains of bacteria, enzymes, or hormones (James & Topper,1993 and Davis & Wilson, 2005).

The longest *Hippeastrum vittatum* plants were grown, according to EL-Maadawy *et al.* (2006), using a peat moss and clay combination, whereas, the moisture of sand + clay was the best for leaf formation. Media containing peat moss and clay significantly increased both leaf fresh and dry weights. Conversely, using clay alone or mixed with peat moss produced the smallest bulbs. On the contrast, growing plants in sand + peat moss or sand + clay and sand + clay + peat moss mixture produced the heaviest bulbs and highest numbers of bulblets / plant. They added that the mixture of sand + peat moss increased the total carbohydrates and P contents in inflorescence. On the other hand, the mixture of sand+ peat moss+ clay increased N in the bulbs, P- content in leaves and bulbs. The same medium also increased K content in plant leaves, while sandy soil increased K content in bulbs. *Gardenia jasminoides*' development and blooming patterns as impacted by the growing conditions were investigated by Al-Menaie *et al*. in 2008. According to the findings, *Gardenia jasminoides*' proliferation and flowering were significantly influenced by the growing medium. A comparison of the effects of different growing media revealed that potting soil of peat moss and perlite in a 1:1 ratio for outdoor plants and peat moss and perlite in a 1:1 ratio for indoor plants both had a positive impact on the development of healthy canopies and, as a result, increased flower production. Similar to this, both the indoor and outdoor kinds benefited from the treated plants' canopies.

Rosa hybrids were the subject of a study by Idrovo - Novillo *et al*. (2019). Three different types of compost were employed as organic additions. The results showed that plants without fertigation took longer to reach their first harvest. Compost treatments with fertigation produced stem lengths with the greatest average values, and compost-supplied roses had heavier stems.

Therefore, the major goal of the current study was to assess the individual and combined impacts of three chosen growing media and four chosen doses of humic acid on the rooting, growth, and chemical composition of Dracaena plants over the period of the growing season.

MATERIALS AND METHODS

The current study was conducted in the Nursery, Department of Floriculture, Ornamental Horticulture, and Landscape Gardening, Faculty of Agriculture, Alexandria University, Egypt, throughout the course of two succeeding growing seasons in 2021 and 2022. *Dracaena marginata* terminal cuttings were applied consistently. In a pot experiment, cuttings with a length of 20 cm, a leaf count of around 15, and a stem diameter of about 1.5 cm were selected from 2-year-old mother plants. Cuttings were soaked for 24 hours in a Humic acid (H.A.) solution at concentrations of 0.0, 10. 0, 20.0, and 30.0 gm l^{-1}. The chemical characteristics of the Humic acid (H.A.) utilized are described in (Table A).

After soaking, cuttings were planted one per pot in plastic pots 20 cm in diameter filled with the three selected growing media: GM_I (100% peat moss), GM_{II} (50% peat moss + 50% perlite), and the third growing medium (GM_{III}), which contained 50% peat moss + 50% sand (Table B). This was done in a greenhouse under conditions of 90 ± 5% RH and 25 ± 2 ^{0}C on March 15, 2021, and March 2022, Table (C) provides the results of the chemical analysis of the study's growth media, peat moss and sand .

Split-plot design was used in the experiment to arrange the pots in three replicates, each replicate included 12 treatments (4 of Humic acid concentrations x 3 growth media) and five plants for each. In the main treatments, the growth media were arranged, while the sub-treatments' Humic acid concentrations were distributed at random. When necessary, fundamental agricultural operations were carried out, just as local producers did. The methods described by Snedecor and Cochran (1990) were used to statistically analyze the data. To compare the means of treatments, LSD $_{0.05}$ % was used.

Table A.Chemical properties of the used Humic acid (H.A.)

Characteristics					Macro-elements			Micro-elements		
EC dSm^{-1}	pH	OM %	C %	C/N %	N %	P %	K %	Fe ppm	Zn ppm	Mn ppm
1.13	2.8	52.03	30.25	14.14	2.14	0.27	3.16	393	213	168

Table B. The components of the growing media treatments

Treatment No.	Medium components		
	Peat moss	Perlite	Sandy soil
Growing media I	100%	0%	0%
Growing media11	50%	50%	0%
Growing media 111	50%	0%	50%

Table C. The main chemical properties of the used peat moss and sandy soil

Growing Media	pH	EC (dSm^{-1})	Available macro and micronutrients (mg Kg^{-1})						
			N	P	K	Cu	Fe	Mn	Zn
Peat moss	6.66	0.6	4250	310	960	-	362	32.16	28.43
Sand	8.10	1.25	92.01	14.20	103.03	1.76	14.39	4.58	3.00

Data recorded for both seasons of *Dracaena marginata* plants after 60 day from planting date (El-Naggar , 2004) in the two successive seasons included: survival % , rooting % , roots number /cutting , root length (cm), root fresh and dry weight (g) as well as leaf total chlorophyll content (a + b) , total carbohydrates , N, P and K % . The chemical analysis of leaves i.e. the procedures outlined by Greig *et al*. (1968) were used to measure chlorophyll content. According to Herbert *et al*. (1971) the total carbohydrate content of dried leaf samples was calculated. The dried leaves' nitrogen content and phosphorus percentage were assessed using the techniques given by Chapman and Pratt (1961) and Bringham (1982). According to Brown and Lilleland (1946) and Chapman and Pratt (1961), the potassium percentage was calculated using a Flame Photometer .

RESULT AND DISCUSSION

Survival %

Data in Table (1) showed that different growing media, humic acid (HA) treatments and interactions between them had significant effects on that trait in the two growing seasons of study. Generally, data clearly showed that treatment of 30 gml^{-1} humic acid was the best among treatments for all characteristics under study. The highest mean values for survival percent was 82.95 and 87.39 % when cuttings grew in 100 % peat moss (GM_I), 97.89 and 98.39 for cuttings grew in 50% Peat moss + 50% Perlite (GM_{II}). It was the best results across treatments. When cuttings cultivated in pots containing 50% Peat moss + 50% sandy soil and 30 $gml^{-1}$of humic acid added, the survival rate was 83.92 and 87.28 %, respectively, for the two seasons. This might be due to the higher rooting percentage, which would be the result of earlier roots in HA treated cuttings. The enhanced permeability of the root cells' plasma membrane, which increases nutrient absorption, may be the cause of Humic acid's better root development, root system length, and dry weight. beside the role played HA in the synthesis of protein and carbohydrates as reported by Turkman *et al*. (2004) and Fadhil *et al*. (2018), this leads to a higher survival percentage Theses results agree with earlier work of El-Naggar (2004) on *bougainvillea glabra* and El-Naggar *et al*. (2020) with *Gazania splendens* .

Rooting percentage, roots number and length (cm)

Table 1 demonstrated a definite impact of the applied Humic acid treatments on rooting percentage, roots number and root length compared to the control for the two seasons. treating the cutting of *Dracaena marginata* plants with Humic acid (HA) gave a significant effect on rooting % , roots number and length and this characteristic was increased by increasing humic acid (HA) concentrations, However, the treatment of 30.0 $gml^{-1}$of Humic acid / plant recorded the highest significant mean values achieved (89.36 and 92.48, 94.92 and 97.39 and 81.93 and 83.93% for rooting percentage, 63.92 and 67.9, 66.33 and 68.77 and 47.26 and 50.78 for roots number/ cutting and 19.12 and 18.48 cm, 19.33 and 19.99 and 16.2 and 16.87 cm for rooting length, for the first and second seasons of growing media GM_I, GM_{II} and GM_{III}, respectively). Among treatments, The interactions between the two studied factors, i.e. (growing media and the humic acid (HA) fertilization were significantly affected on rooting percentage, roots number and root length ,the highest significant mean value obtained when plants grew in medium composed of 50% peat moss + 50 % perlite (GM_{II}) with addition of 30 gml^{-1} of humic acid for both seasons, While the followed values were obtained by growing medium (GM_{III}) contained 50% peat moss + 50% sand plus 30.0 gml^{-1}humic acid (HA) 13.57 and 14.28 branch/plant for both seasons. This increase in the rooting percentage, number of roots, and length in *Dracaena marginata* plants may be attributable to cell multiplication, cell enlargement, and cell differentiation, which have led to an increase in the rooting percentage, number and length of the roots. It may also be connected to the beneficial effects of such amendments on the physical and chemical properties of the soil in addition to their nutrient content, as well as the increase in the rooting percentage by adding Humic acid, numerous enzymes, including oxidase, phosphatase, and dehydrogenase, become more active. Other enzymes, such peroxidase and IAA oxides, become less active (Faust, 1998). Humic acid helps roots grow more quickly. Humic acid promotes root development and encourages cell division and elongation in a manner similar to that of auxin (Ali, 2011). Additionally, HA may affect the root's ability to induce meristematic activity, which led to a rise in the proportion of rooted cuttings overall. Sherif and EL-Naggar (2005) on *Zantedeschia aethiopica*, Al-Temimi *et al*. (2019) on *Prunus armeniaca* plants noticed a similar pattern of findings.

Root fresh and dry weight (gm)

Data from Table 2 revealed that media had insignificant effects on fresh and dry weight of roots, while different media, humic acid HA treatments and interaction between media and concentrations had significant effect on roots fresh and dry weight (g) over the two study seasons. Information shown in Table 2 demonstrated that there is a direct proportion between the used concentrations of humic acid (HA) and the obtained results. The lowest significant value of root fresh and dry weight resulted from the group of untreated cuttings (control) then, data increased gradually with the increase of the used does of humic acid (HA). For the interaction between treatments, the highest mean value of root fresh weight (22.54 and 22.9 g) achieved from the treatment of cuttings with 30.0 gm l^{-1} and grew in medium GM_{II} (50% peat moss + 50 % perlite). With regard to root dry weight, the same indication obtained .Across the interaction within treatments , the best results on that trait results were obtained from the treatment of cuttings with HA at 30.0 $gml^{-1}$and grew in medium GM_{II} (4.39 and 4.33 g , for the two seasons respectively). This increase in root fresh and dry weight might be the result of more and longer roots. These findings agreed with El-Naggar (2004) on *bougainvillea glabra* , El-Naggar (2004) on *Cyperus papyrus*, Hassan (2015) *Paspalum vaginatum*,L, Bashir *et al*. (2016) on *Gladiolus grandiflorus* L., Ibrahim *et al*. (2016) *Limonium sinuatum, L.*, El-Naggar *et al*. (2020) with *Gazania splendens* plants.

Table 1. Impact of humic acid and growing media on survival, rooting %, roots number /cutting and root length (cm) of *Dracaena marginata* during growing seasons of 2021 and 2022

Growing Media	Humic Acid gml^{-1}	Survival %		Rooting %		Roots N. /cutting		Root length (cm)	
		1st	2 nd	1st	2 nd	1st	2 nd	1st	2 nd
GM_I	0.00	52.93	55.90	53.83	55.83	36.02	35.92	08.29	08.58
	10.0	63.93	67.31	75.38	78.39	45.29	47.49	13.26	12.38
	20.0	68.35	70.47	77.28	79.03	56.27	58.23	15.38	17.30
	30.0	82.95	87.39	89.36	92.48	63.92	67.90	19.12	18.48
GM_{II}	0.00	57.82	69.20	58.39	61.18	42.00	45.29	8.35	8.73
	10.0	67.39	69.31	79.39	82.48	48.29	48.83	13.29	14.93
	20.0	81.49	87.69	86.93	89.25	59.28	61.39	17.38	19.39
	30.0	97.89	98.39	94.92	97.39	66.33	68.77	19.33	19.99
GM_{III}	0.00	53.26	52.49	48.92	50.20	33.19	37.28	07.23	07.36
	10.0	62.89	65.35	63.29	62.19	38.91	42.94	11.62	11.74
	20.0	69.20	74.46	73.28	74.20	44.82	48.02	13.53	14.29
	30.0	83.92	87.28	81.93	83.93	47.26	50.78	16.20	16.87
$LSD_{0.05}$	GM	2.13	1.97	1.99	2.11	1.25	1.21	1.26	1.19
	HA	2.41	2.28	2.16	2.19	1.39	1.38	1.42	1.37
	Inter.	3.58	3.46	2.23	2.27	2.08	2.11	1.96	1.89

Table 2. Impact of humic acid and growing media on root fresh and dry weight (g) of *Dracaena marginata* during the growing seasons of 2021 and 2022

Growing Media	Humic Acid gml^{-1}	Root fresh weight (g)		Root dry weight (g)	
		1st	2 nd	1st	2 nd
GM_1	0.00	13.02	13.94	2.10	2.18
	10.0	15.39	16.30	2.27	2.29
	20.0	18.42	18.98	3.15	3.18
	30.0	18.99	19.38	3.86	3.87
GM_{II}	0.00	13.97	14.37	2.13	2.22
	10.0	16.29	18.35	3.73	3.77
	20.0	19.28	21.83	4.02	4,29
	30.0	22.54	22.90	4.39	4.33
GM_{III}	0.00	11.57	11.63	2.89	2.28
	10.0	13.84	14.93	3.00	3.19
	20.0	16.00	16.19	3.48	3.38
	30.0	17.27	18.08	3.97	3.98
$LSD_{0.05}$	GM	1.59	NS	0.21	0.20
	HA	1.98	1.12	0.09	0.11
	Inter.	2.31	1.26	0.29	0.28

Chemical constituents

Total Chlorophyll (a + b) and Carbohydrates (%)

Fresh leaf samples were chemically analyzed to see how different growth conditions and Humic acid (HA) treatments influenced the total chlorophyll content (mg/100 g L.F.W.) and carbohydrates (%). (Table 3). The plants cultivated in GMII (peat moss 50% + perlite 50%) had the greatest levels of total chlorophyll (a+b) content and carbohydrates (%) in both seasons. Additionally, compared to the control ($H.A_0$), the total Carbohydrates (%) content in the same table seemed to be higher with all Humic acid treatments (unfertilized plants). Concerning the interaction between Humic acid and growing medium, data presented in Table 3 showed that the maximum value of total chlorophyll content and carbohydrates percentage was recorded with plants treated with Humic acid at 20.0 and / or 30 gml^{-1}g/plant in group GM_{II}, while The poorest values of total chlorophyll content and carbohydrates percentage had in GM_I, in the two growing seasons of study. The total chlorophyll and anthocyanin contents of *Dracaena marginata* had shown significant augment with increase the concentrations of HA with 50% Peat moss + 50% Perlite. The rate of quenching of chlorophyll fluorescence was definitely raised in the HA sunflower leaves, and the steady state rate of quenching was better than in leaves that had not received treatment, according to Robert and Robyn (1982). The results pointed out the morphological indices the total chlorophyll contents, the chlorophyll fluorescence, and the chloroplast ultra-structure of crop plants healthier clearly after HA application compared by those of the untreated (Fan *et al*., 2014). It is possible to ascribe the impact of the coal-Humic fertilisers on plant biochemical activities including respiration, photosynthesis, and leaf pigmentation (Abolina and Tashkhadzhaev, 1968). Results obtained by El-Naggar and El-Nasharty (2009) on *Hippeastrum vittatum* and Ibrahim *et al*. (2016) on *Limonium sinuatum*, L. plants are in agreement with those of the current study.

N, P and K (%) content

Fresh leaf samples were subjected to chemical analysis, which demonstrated that the addition of humic acid (HA) to growth media, particularly GMII (50% peat moss + 50% perlite) and GMIII (50% peat moss + 50% sand), had a significant impact on the N, P, and K levels (Table 3). Untreated (control) plants showed lower mean N, P, and K content (%) in both seasons than plants receiving any amounts of humic acid (HA) supplemented with the study's growth medium. Plants treated with either 20.0 or 30.0 gml-1 of humic acid (HA) in the growth medium GMII showed the largest significant increases in the total mineral content as compared with the other treatments in the first and second growing season. This results may be attributed to the effect of humic acid (HA) as a source of N,P and K on increasing the availability in cutting and hence its accumulation in leaf tissues especially the suitable of growing media GM_{II}. The prior outcome may be attributed to the cation exchange capacity (CEC) of the soil and/or plant roots, which leads to adsorption and, subsequently, the absorption of the required quantity for growth. In contrast to other H.A concentrations, humic acid (HA) at the optimal rate (30.0 gml-1) enhanced the quantity of N, P, and K in leaves whether it was present

Table 3. Impact of humic acid and growing media on total chlorophyll (mg/100 g L.F.W.), total Carbohydrates (%) N, P and K (%) in the dried leaves of *Dracaena marginata* during growing seasons of 2021 and 2022

Growing Media	Humic Acid gml^{-1}	Chlorophyll mg/100g L.F.W.		Carbohydrates %		N %		P %		K %	
		1st	2 nd	1st	2 nd	1st	2 nd	1st	2 nd	1st	2 nd
GM_I	0.00	136.79	135.90	12.87	12.19	2.10	2.25	0.20	0.23	2.16	2.37
	10.0	149.56	148.62	17.38	17.82	2.46	2.65	0.26	0.25	2.48	2.85
	20.0	157.15	159.56	19.57	20.43	2.57	2.81	0.28	0.31	2.70	3.11
	30.0	161.58	163.93	20.69	20.91	2.81	2.93	0.28	0.35	2.93	3.29
GM_{II}	0.00	164.75	162.61	14.97	15.14	2.54	2.79	0.26	0.29	2.61	2.92
	10.0	179.82	281.81	19.58	20.30	2.93	3.20	0.31	0.34	3.14	3.48
	20.0	216.16	218.92	22.03	23.16	3.08	3.38	0.33	0.37	3.31	3.67
	30.0	222.87	224.57	23.62	23.51	2.29	3.61	0.36	0.39	3.56	3.92
GM_{II}	0.00	162.48	160.72	13.32	12.90	2.22	2.45	0.23	0.25	2.36	2.98
	10.0	173.22	115.69	16.71	17.67	2.64	2.91	0.28	0.30	2.82	3.12
	20.0	206.80	2٠9.88	18.92	19.81	2.80	3.16	0.29	0.32	2.95	3.26
	30.0	213.74	2١3.59	22.05	22.13	2.99	3.21	0.31	0.34	3.19	3.44
$LSD_{0.05}$	GM	2.03	1.67	NS	0.97	0.03	0.06	0.05	0.03	0.13	0.14
	HA	2.21	2.18	1.12	1.13	0.72	0.81	0.08	0.07	0.09	0.09
	Inter.	3.38	3.16	1.26	1.39	1.20	1.43	0.08	0.09	0.22	0.28

alone or in combination with the GMII growth medium. The promotion of active roots by humic acid (H.A) may be the cause of this. Fathy (2010) demonstrated that fulvic acid, which is part of the humic structure, has the impact of auxin in the cells, increasing its permeability and encouraging the passage of the element ions (N.P.K.) and its accumulation in leaf cells. This present results were in agreement with those obtained by Torky and Bedaiwy (1998) on *Rosa hybrida*, Gad (2003) on *Schefflera actinophylla,* and Ibrahim *et al*. (2016) on *Limonium sinuatum*, L. plants.

Conclusion

As a result it can be recommended that producing high quality of *Dracaena marginata* for different decorative purposes in interior decoration and landscaping can be accomplished by soaking of termial dracaena cuttings in humic acid (H.A.) solution at 30.0 gml^{-1} for 24 hours and growing in the mixture of peatmoss 50% 50% + perlite 50%.

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الملخص العربي

تقييم أثر حامض الهيوميك وبعض محسنات التربة على تجذير و نمو عقل الدراسينا مارجيناتا

على حسن النجار و نجلاء محمد إسماعيل

تم إجراء هذا البحث خلال موسمي النمو (٢٠٢١ و ٢٠٢٢) فى مشتل قسم الزهور ونباتات الزينة وتنسيق الحدائق – كلية الزراعة – جامعة الاسكندرية لمعرفة تأثير حمض الهيوميك (H.A) بتركيزات (صفر، ١٠,٠ ، ٢٠,٠ و ٣٠,٠ جم/ لتر) وبعض أنواع بيئات النمو (١٠٠% بيتموس ، ٥٠ % بيتموس + ٥٠ % بيرليت وكذلك ٥٠ % بيتموس + ٥٠ % رمل) والتوليفات بين تلك المعاملات على تجذير ونمو العقل الطرفية لنبات دراسينا مارجيناتا *Dracaena margenata* تحت ظروف النمو فى الصوب.

وقد أظهرت النتائج أنه يوجد تفاعل عالى المعنوية بين كل من تركيز حمض الهيوميك وبيئة نمو عقل الدراسينا . حيث أظهرت العقل التى تم نقعها مسبقًا فى محلول حمض الهيوميك مع بيئات النمو تأثير معنوي على نسبة النجاح ، ونسبة التجذير ، وعدد الجذور/عقلة ، وطول الجذر (سم) ، ووزن الجذر الرطب والجاف (جم). على أى حال فان أعلى القيم المعنوية للتجذير والنمو تم الحصول عليها عند زراعة عقل الدراسينا مارجيناتا على بيئة نمو مكونة من ٥٠٪ من البيت موس + ٥٠٪ من البيرليت بعد نقعها مسبقا فى محلول حمض الهيوميك بتركيز ٣٠,٠ جم / لتر. بالاضافة الى ذلك ، فقد أعطى تطبيق المعاملة المذكورة سابقا أعلى قيم معنوية لمحتوى الورقة الكلي من الكلوروفيل (أ + ب) و الكربوهيدرات الكلية. كما أشار التحليل الكيميائي إلى زيادة ملحوظة في محتوى النيتروجين والفوسفور والبوتاسيوم . وعلى الجانب الاخر فقد سجلت عقل الدراسينا في مجموعة الكنترول (بدون المعاملة بحامض الهيوميك) والتي زرعت مباشرة على بيئة نمو مكونة من البيتموس بنسبة ١٠٠ ٪ أدنى قيم معنوية لجميع الصفات تحت الدراسة في كلا الموسمين. نتيجة لذلك ، يمكن التوصية بأنه لإنتاج نباتات دراسينا مارجيناتا عالية الجودة لإستخدامها فى أغراض الزينة المختلفة كنباتات تنسيق داخلى أو خارجى فانه يمكن تحقيق ذلك من خلال نقع العقل لمدة ٢٤ ساعة فى حامض الهيوميك بتركيز ٣٠,٠ جم / لتر ثم الزراعة على بيئة نمو مكونة من خليط من البيت موس ٥٠٪ + بيرليت ٥٠٪.