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RESPONSE OF THE SLOW-GROWING MISTLETOE FIG (*FICUS DELTOIDEA* JACK.) PLANT TO FERTILIZATION TREATMENTS AND GROWTH ACTIVATOR
2. HUMIC ACID LIQUID FERTILIZER TREATMENT

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ABSTRACT: A series of pot experiments was conducted under plastic house at the nursery of Hort. Res. Inst., ARC, Giza, Egypt during 2012 and 2013 seasons to reveal the individual and combined effects of actosol (a humic acid NPK liquid fertilizer) when applied monthly as a foliar spray at the rates of 0.0, 2.5 and 5.0 ml/l and as a soil drench at the rates of 0.0, 10.0 and 15.0 ml/l on growth and chemical composition of mistletoe fig (*Ficus deltoidea* Jack.) transplants (6-months-old) grown in 20-cm-diameter plastic pots filled with about 2.5 kg of a mixture of sand, clay and peatmoss (1:1:1, v/v/v).

The obtained results indicated that all vegetative and root growth parameters, the photosynthetic pigments (chlorophyll a, b and carotenoids) in the leaves, as well as N, P, K, Fe, Zn and Mn concentration in the leaves and roots were markedly improved in response to spraying or drenching with humic acid liquid fertilizer at various levels, with the superiority of the combination between 5.0 ml/l level as foliar spray and 10.0 ml/l level as soil drench, which gave, in general the highest records in the two seasons compared to control and all other treatments.

Hence, it could be recommended to apply humic acid liquid fertilizer (actosol) monthly during the active growing period at the rate of 5.0 ml/l as foliage spray combined with 10.0 ml/l level as soil drench in order to get good and healthy mistletoe fig (*Ficus deltoidea* Jack.) plants suitable for commercial marketing.

Key words: Fertilization, humic acid, ornamental plants, *Ficus deltoidea* Jack.

INTRODUCTION

Some important and picturesque plants may slowly grow and need to a long period to reach a suitable size for marketing. Among these plants may be *Ficus deltoidea* Jack., mistletoe fig plant, that belongs to Fam. Moraceae. It is largely glabrous shrub or small tree to 7 m height, characterized with its deltoid leaves, which are bright green above and ferruginous to olive brown or ochre beneath. Used for landscaping as a solitary specimen, and also as a leaf pot plant (Huxley *et al.,* 1992).

The use of organic manures, however are recently recommended everywhere for minimizing the harmful effects of chemicals used in agriculture (Abdel-Gawwad, 1999). They provide the plants with slow-release natural nutrients and improve soil structure, aeration and water holding capacity (Herrera *et al.,* 1997).

Humic acids and humates, as one of the most important biofertilizers can provide soil microbs with energy, improve nutrients retention in the soil, increase nutrients uptake and enhance the water holding capacity (Dorer and Peacock, 1997). In this regard, Evans and Li (2003) revealed that humic acid at 2500 mg/l increased lateral root number, lateral root length and roots dry weight of *Catharanthus roseus, Pelargonium hortorum, Tagetes patula* and *Viola tricolor.* Likewise, El-Sayed and El-Shal (2008) noticed that humic acid as foliar spray or soil drench greatly improved vegetative and root growth traits of Schefflera plant, as well as leaf content of chlorophylls, N, P, K, Fe, Mn and Zn. Similarly were those results postulated by Muscolo *et al.* (1999) on *Pinus laricio*, Hunter and Butler (2005) on *Agrostis stolonifera,* Mueller and Kussow (2005) on creeping bentgrass and El-Sayed *et al.* (2008) on Tifway grass.

This work aims to investigate the individual or combined effects of the organic liquid fertilizer (actosol) as a foliar spray or/and a soil drench at various levels on growth and chemical composition of mistletoe fig plant.

MATERIALS AND METHODS

A set of pot experiments was carried out under plastic house at the nursery of Hort. Res. Inst., ARC, Giza, Egypt during the two consecutive seasons of 2012 and 2013 to examine the response of mistletoe fig plant to actosol applied in different methods and levels.

So, uniform transplants of mistletoe fig (*Ficus deltoidea* Jack.), six-months-old were planted on March 15th for the two seasons in 20-cm-diameter plastic pots (one transplant/pot) filled with about 2.5 kg of an equal mixture of sand, clay and peatmoss (1:1:1, v/v/v). The physical and chemical properties of the used sand and clay, as well as those of peatmoss are shown in Tables (a) and (b), respectively in the part, 1 of this paper. Throughout the course of this study, air temperature and relative humidity inside the plastic house ranged between 22.5-37.5°C and 50-75%, respectively, while irrigation was done twice every week with 200 mm of fresh water/pot.

The transplants were arranged in a factorial complete randomized design (Mead *et al.,* 1993) with three replicates as each replicate contained nine transplants. One month later, they were subjected to the following treatments:

1. No treatment, (control).
2. Actosol, a humic acid NPK (10:10:10) liquid organic fertilizer was added monthly either as a foliar spray at the rates of 0.0, 2.5 and 5.0 ml/l, or as a soil drench at the rates of 0.0, 10.0 and 15.0 ml/l. The constituents of actosol were determined and illustrated in Table (c).
3. Each level of the foliar spray treatment was combined with each one of soil drench treatment to form nine combined treatments.

Table c. Main characteristics of the used liquid fertilizer (Actosol) during 2012 and 2013 seasons.

Components	Value	Components	Value	Components	Value
Humic acid (%)	2.9	**EC(dS/m)**	59.3	**B (mg/l.)**	70.00
Organic matter/total solids (%)	42.51	**N (%)**	10.00	**Fe (mg/l.)**	900.00
Total humic acids/total solids (g/l.)	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		

All transplants under various treatments received the usual agricultural practices recommended for such plantation whenever needed. At the end of each season (on 15th of October), data were recorded as follows:

Plant height (cm), number of leaves and branches/plant, the longest root length (cm) and fresh and dry weights (g) of leaves, stem 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 samples taken from leaves and roots, the percentages of N, P and K, as well as the ppm of Fe, Zn and Mn were measured as described by A.O.A.C. (1995).

Data were then tabulated and statistically analyzed according to SAS program (1994) using Duncan's Multiple Range Test (1955) to compare among means of the different treatments.

RESULTS AND DISCUSSION

Effect of actosol treatments on:

1- Vegetative and root growth parameters:

It appears from data presented in Tables (1 and 2) that all vegetative and root growth characters were significantly improved in most cases of the two seasons due to applying actosol, either as foliar spray or as soil drench. Foliar spraying with the rate of 5.0 ml/l gave, in general the best records in comparison with the other rates, while for soil drenching method, this was true when actosol was drenched at 10.0 ml/l level. However, the prevalence in all growth parameters was for the combination between foliar spraying at 5.0 ml/l and soil drenching at 10.0 ml/l, as this combined treatment gave the highest means above all the other individual or combined treatments in both seasons.

The positive effects of actosol on improving vegetative and root growth of mistletoe fig plant could be ascribed to the role of humic acids in increasing the availability of nutrients in the soil through influences on soil microbial activity, increasing nutrients uptake through raising permeability of plant membranes (Russo and Berlyn, 1990) and enhancing water holding capacity (Dorer and Peacock, 1997). Astaraei (2008) mentioned that foliar spray with organic compounds caused a higher photosynthetic activity in plants, resulting in an increment in leaf, stem and total plant dry weight. These results go in line with those attained by Muscolo *et al.* (1999) on *Pinus laricio*, Evans and Li (2003) on *Catharanthus roseus, Pelargonium hortorum, Tagetes patula* and *Viola tricolor* and El-Sayed and El-Shal (2008) on *Brassaia actinophylla.*

2- Chemical composition:

Data averaged in Table (3) show that chlorophylls a and b content (mg/g f.w.) in the leaves of sprayed or drenched plants was significantly increased compared to control in the two seasons, with the superiority of spraying treatment at 5.0 ml/l and drenching one at 10.0 ml/l. However, the utmost high means in these two parameters were also registered by these two treatments when applied in combination (e.i. foliar spray at 5.0 ml/l + soil drench at 10.0 ml/l). The opposite was the right concerning carotenoids content (mg/g f.w.), as it was significantly reduced by the least and highest levels of soil drench treatment, as well as the highest rate of foliar spray method. So, the highest content of carotenoids in both seasons was obtained from only the individual soil drench treatment at 10.0 ml/l.

Regarding the percentages of N, P and K in the leaves and roots, data presented in Tables (4 and 5), exhibit that they were progressively elevated with raising the rate of actosol when added either as foliar spray or as soil drench with few exceptions in the two seasons. However, the best values were recorded by the combination of foliar spraying at 5.0 ml/l plus soil drench at 10.0 ml/l. Similarly, were those results of Fe, Zn and Mn content (ppm) in the leaves and roots of treated plants, as they were increased with significant differences relative to control averages in most cases of both seasons (Tables, 6 and 7). The mastery, however was also due to the combined treatment between 5.0 ml/l foliar spray and 10.0 ml/l soil drench, which raised the content of these elements to the utmost high means in the two seasons.

Table 1. Effect of foliar spray or soil drench with humic acid on some vegetative growth parameters of *Ficus deltoidea* Jack. plant during 2012 and 2013 seasons.

Application method treatments (ml/l)	Plant height (cm)				No. of leaves/plant				No. of branches/plant				Root length (cm)			
	S.D. at 0.0	S.D. at 10.0	S.D. at 15.0	Mean	S.D. at 0.0	S.D. at 10.0	S.D. at 15.0	Mean	S.D. at 0.0	S.D. at 10.0	S.D. at 15.0	Mean	S.D. at 0.0	S.D. at 10.0	S.D. at 15.0	Mean
First season: 2012																
F.S. at 0.0	38.00e	41.33d	48.33c	42.55c	33.00e	38.63d	40.33d	37.32c	5.33f	9.10d	10.00c	8.14c	36.33e	46.50cd	59.67b	47.50b
F.S. at 2.5	38.67e	46.00dc	52.10b	45.59b	34.72ed	56.00c	64.10b	51.61b	8.00e	10.33c	11.70b	10.01b	37.10e	47.21c	48.96c	44.42c
F.S. at 5.0	56.33ab	58.79a	53.76b	56.29a	38.67d	72.33a	8.00c	56.33a	10.00c	15.67a	9.67cd	11.78a	39.76d	66.33a	46.78cd	50.96a
Mean	44.33b	48.71ba	51.40a		35.46b	55.65a	54.14a		7.78b	11.70a	10.46a		37.73b	53.35a	51.80ab	
Second season: 2013																
F.S. at 0.0	36.89f	40.17d	44.50dc	40.52c	31.76d	36.25	39.00c	35.67c	5.00e	8.71dc	9.58bc	7.76c	28.99f	36.67d	48.67b	38.11c
F.S. at 2.5	38.00e	45.09cd	51.33b	44.81b	38.33cd	48.00cb	51.51b	45.95b	7.33d	9.33cb	10.67b	9.11b	33.41e	47.00b	42.00c	40.80b
F.S. at 5.0	47.29c	57.63a	37.96e	47.63a	40.16c	68.33a	48.36cb	52.22a	9.00c	14.26a	10.00b	11.09a	36.50d	66.00a	46.71bc	49.74a
Mean	40.73c	47.63a	44.60b		36.75c	50.86a	46.29b		7.11b	10.77a	10.08a		32.97c	49.89a	45.79b	

*** F.S.: Foliar spray, and S.D.: soil drench**

**** Means within a column or row having the same letters are not significantly different according to Duncan's Multiple Range Test (DMRT) at 5% level.**

Table 2. Effect of foliar spray or soil drench with humic acid on fresh and dry weights of *Ficus deltoidea* Jack. Leaves, stem and roots during 2012 and 2013 seasons.

Application method treatments (ml/l)	Fresh weight (g.)												Dry weight (g.)											
	Leaves				Stem				Roots				Leaves				Stem				Roots			
	S.D. at 0.0	S.D. at 10.0	S.D. at 15.0	Mean	S.D. at 0.0	S.D. at 10.0	S.D. at 15.0	Mean	S.D. at 0.0	S.D. at 10.0	S.D. at 15.0	Mean	S.D. at 0.0	S.D. at 10.0	S.D. at 15.0	Mean	S.D. at 0.0	S.D. at 10.0	S.D. at 15.0	Mean	S.D. at 0.0	S.D. at 10.0	S.D. at 15.0	Mean
First season: 2012																								
F.S. at 0.0	7.6 e	9.6d	12.1 c	9.8c	9.1f	10.2e	15.5c	11.6c	4.3d	6.8c	7.9b	6.3b	1.5d	2.1c	2.4cb	1.9b	2.7e	2.9e	4.5c	3.4c	2.1d	2.7c	3.3b	2.7b
F.S. at 2.5	8.4ed	12.7c	16.0b	12.4b	10.3e	13.6d	17.2b	13.7b	4.8d	7.1b	7.4b	6.4b	1.6d	3.2a	2.4b	2.4a	3.7d	4.3cd	5.4b	4.5b	2.3d	3.1bc	3.3b	2.9b
F.S. at 5.0	9.4d	18.6a	15.3b	14.4a	12.6e d	19.3a	18.0b	16.7a	6.5c	12.4a	7.0cb	8.6a	2.7b	3.5a	2.2c	2.8a	4.4c	6.1a	5.1b	5.2a	2.5cd	5.7a	3.2b	3.8a
Mean	8.5b	13.6a	14.5a		10.7c	14.4b	16.9a		5.2c	8.7b	7.4a		1.92c	2.9a	2.3b		3.61b	4.5a	4.9a		2.3c	3.8a	3.3b	
Second season: 2013																								
F.S. at 0.0	7.6f	11.7d c	12.0c d	10.4c	8.6f	12.6e d	15.1c	12.1c	4.3d	6.8c	7.5b	6.2b	1.4d	2.0c	2.6b	2.0a	2.5e	3.6c	4.5cb	3.5c	2.1d	2.8c	3.3b	2.7b
F.S. at 2.5	8.8e	13.0c	14.9b	12.2b	10.2e	13.4d	17.4b a	13.7b	4.8d	7.2b	7.3b	6.4b	1.6d	3.0a	2.3cb	2.3a	2.9d	4.5cb	5.2b	4.2b	2.3d	3.1b	3.3b	2.9b
F.S. at 5.0	9.8d	18.7a	15.8b	14.7a	10.9e	18.7a	16.8b	15.5a	6.2cd	11.1a	6.5c	7.9a	2.2cb	3.2a	1.9c	2.5a	3.4c	6.1a	5.0b	4.8a	2.5cd	5.5a	3.1bc	3.7a
Mean	8.7b	14.4a	14.2a		9.9c	14.9b	16.5a		5.10c	8.36a	7.1b		1.7c	2.7a	2.3b		2.9b	4.7a	4.9a		2.3c	3.8a	3.2b	

*** F.S.: Foliar spray, and S.D.: Soil drench**

**** Means within a column or row having the same letters are not significantly different according to Duncan's Multiple Range Test (DMRT) at 5% level.**

Table 3. Effect of foliar spray or soil drench with humic acid on chlorophyll a, b and carotenoids (mg/g f.w.) in the leaves of *Ficus deltoidea* Jack. plant during 2012 and 2013 seasons.

Application method treatments (ml/l)	Chlorophyll a				Chlorophyll b				Carotenoids			
	S.D. at 0.0	S.D. at 10.0	S.D. at 15.0	Mean	S.D. at 0.0	S.D. at 10.0	S.D. at 15.0	Mean	S.D. at 0.0	S.D. at 10.0	S.D. at 15.0	Mean
	First season: 2012											
F.S. at 0.0	1.97c	2.03ab	2.07ab	2.02b	1.57d	1.68c	1.73cb	1.66c	2.17e	3.67a	1.80g	2.55a
F.S. at 2.5	2.00b	2.03ab	2.00b	2.01b	1.70c	1.90b	1.86b	1.82b	2.08e	3.13b	2.50d	2.57a
F.S. at 5.0	2.03ab	2.10a	2.00b	2.07a	1.73cb	2.20a	1.80b	1.91a	2.97f	2.76c	2.57d	2.43b
Mean	1.00b	2.05a	2.02b		1.67c	1.93a	1.80b		2.07c	3.19a	2.29b	
	Second season: 2013											
F.S. at 0.0	2.00c	2.03b	2.07ab	2.03b	1.50e	1.73d	2.03ba	1.75b	2.13ef	3.73a	1.83g	2.56a
F.S. at 2.5	2.00c	2.05ba	2.03b	2.03b	1.83c	1.88c	1.96b	1.89a	1.98f	3.13b	2.50d	2.54a
F.S. at 5.0	2.10a	2.12a	2.00c	2.07a	1.82c	2.16a	1.87c	1.95a	1.83g	2.73c	2.30e	2.29b
Mean	2.03b	2.07a	2.03b		1.72b	1.62b	1.95a		1.98c	3.20a	2.21b	

*** F.S.: Foliar spray, and S.D.: Soil drench.**

**** Means within a column or row having the same letters are not significantly different according to Duncan's Multiple Range Test (DMRT) at 5% level.**

Table 4. Effect of foliar spray or soil drench with humic acid on N, P and K (%) in the leaves of *Ficus deltoidea* Jack. plant during 2012 and 2013 seasons.

Application method treatments (ml/l)	N				P				K			
	S.D. at 0.0	S.D. at 10.0	S.D. at 15.0	Mean	S.D. at 0.0	S.D. at 10.0	S.D. at 15.0	Mean	S.D. at 0.0	S.D. at 10.0	S.D. at 15.0	Mean
	First season: 2012											
F.S. at 0.0	2.38e	3.17c	2.65d	2.73c	0.473e	0.486e	0.540cd	0.500b	1.38c	1.42cb	1.55b	1.45b
F.S. at 2.5	2.62d	3.46b	2.64d	2.91b	0.630b	0.501de	0.560c	0.564a	1.42cb	1.56b	1.56b	1.51b
F.S. at 5.0	3.03cd	3.70a	3.38b	3.37a	0.690a	0.520d	0.503de	0.571a	1.53b	1.78a	1.53b	1.61a
Mean	2.68c	3.44a	2.89b		0.598a	0.502c	0.534b		1.44b	1.59a	1.55a	
	Second season: 2013											
F.S. at 0.0	2.26f	3.00b	2.63d	2.63c	0.436f	0.470ef	0.527c	0.478b	1.24d	1.26d	1.40c	1.30b
F.S. at 2.5	2.50e	3.10b	2.66d	2.75b	0.481e	0.500d	0.570a	0.517a	1.29d	1.43c	1.50b	1.41a
F.S. at 5.0	3.18ab	3.29a	2.81c	3.09a	0.546b	0.530c	0.513cd	0.530a	1.38cd	1.62a	1.40c	1.47a
Mean	2.65b	3.13a	2.70b		0.488c	0.500b	0.537a		1.30b	1.44a	1.43a	

*** F.S.: Foliar spray, and S.D.: Soil drench.**

**** Means within a column or row having the same letters are not significantly different according to Duncan's Multiple Range Test (DMRT) at 5% level.**

Table 5. Effect of foliar spray or soil drench with humic acid on N, P and K (%) in the roots of *Ficus deltoidea* Jack. plant during 2012 and 2013 seasons.

Application method treatments (ml/l)	N				P				K			
	S.D. at 0.0	S.D. at 10.0	S.D. at 15.0	Mean	S.D. at 0.0	S.D. at 10.0	S.D. at 15.0	Mean	S.D. at 0.0	S.D. at 10.0	S.D. at 15.0	Mean
	First season: 2012											
F.S. at 0.0	1.28g	2.11d	2.24c	1.88c	0.330g	0.413d	0.350f	0.364b	1.21d	1.29dc	1.30cd	1.27b
F.S. at 2.5	1.56f	2.17dc	2.76b	2.16b	0.450c	0.480b	0.393e	0.441a	1.19d	1.33c	1.39b	1.30a
F.S. at 5.0	1.83e	3.05a	2.33c	2.40a	0.473b	0.521a	0.418d	0.471a	1.28dc	1.46a	1.32c	1.35a
Mean	1.56b	2.44a	2.44a		0.418b	0.471a	0.387c		1.23b	1.36a	1.34a	
	Second season: 2013											
F.S. at 0.0	1.34g	1.96d	2.07c	1.79c	0.341e	0.443cd	0.350e	0.378c	1.30e	1.40d	1.41d	1.37b
F.S. at 2.5	1.50f	2.02cd	2.51b	2.01b	0.436d	0.485b	0.421d	0.447b	1.32e	1.45c	1.50b	1.42a
F.S. at 5.0	1.88e	2.84a	2.14c	2.29a	0.481b	0.561a	0.452c	0.498a	1.36ed	1.58a	1.43c	1.46a
Mean	1.57b	2.27a	2.24a		0.419b	0.496a	0.408c		1.33b	1.48a	1.45a	

*** F.S.: Foliar spray, and S.D.: Soil drench.**

**** Means within a column or row having the same letters are not significantly different according to Duncan's Multiple Range Test (DMRT) at 5% level.**

Table 6. Effect of foliar spray or soil drench with humic acid on Fe, Zn and Mn (ppm) in the leaves of *Ficus deltoidea* Jack. plant during 2012 and 2013 seasons.

Application method treatments (ml/l)	Fe				Zn				Mn			
	S.D. at 0.0	S.D. at 10.0	S.D. at 15.0	Mean	S.D. at 0.0	S.D. at 10.0	S.D. at 15.0	Mean	S.D. at 0.0	S.D. at 10.0	S.D. at 15.0	Mean
	First season: 2012											
F.S. at 0.0	23.27e	30.17b	24.10de	25.85b	7.98f	16.37c	18.75b	14.37b	9.70i	13.68g	18.24c	13.87c
F.S. at 2.5	25.61d	32.64a	27.82c	28.69a	11.10e	18.22b	19.33a	16.22a	11.46h	17.22d	19.31b	16.00b
F.S. at 5.0	28.52c	33.50a	25.33d	29.12a	12.03d	19.35a	15.76cd	15.71a	14.82f	21.50a	16.27e	17.53a
Mean	25.80b	32.10a	25.75b		10.37b	17.98a	17.95a		11.99b	17.47a	17.94a	
	Second season: 2013											
F.S. at 0.0	21.29e	29.33b	22.17e	24.26b	8.17f	14.27c	16.10b	12.85b	9.03g	12.76fe	16.10c	12.63c
F.S. at 2.5	24.87d	33.16a	25.96c	28.00a	10.21e	16.53b	17.36a	14.70a	10.68f	15.80cd	17.00b	14.49b
F.S. at 5.0	29.08b	33.00a	23.90d	28.66a	11.56d	17.55a	14.45c	14.52a	13.95e	19.56a	14.89d	16.13a
Mean	25.08b	31.83a	24.01c		9.98b	16.12a	15.97a		11.22b	16.04a	16.00a	

*** F.S.: Foliar spray, and S.D.: Soil drench.**

**** Means within a column or row having the same letters are not significantly different according to Duncan's Multiple Range Test (DMRT) at 5% level.**

Table 7. Effect of foliar spray or soil drench with humic acid on Fe, Zn and Mn (ppm) in the roots of *Ficus deltoidea* Jack. plant during 2012 and 2013 seasons.

Application method treatments (ml/l)	Fe				Zn				Mn			
	S.D. at 0.0	S.D. at 10.0	S.D. at 15.0	Mean	S.D. at 0.0	S.D. at 10.0	S.D. at 15.0	Mean	S.D. at 0.0	S.D. at 10.0	S.D. at 15.0	Mean
	First season: 2012											
F.S. at 0.0	95.08g	96.50fg	133.00d	108.19c	10.04g	16.22ef	17.34e	14.53c	33.01f	34.39e	34.56e	33.99c
F.S. at 2.5	100.40f	214.30a	155.10c	156.60b	25.56c	27.00b	22.61d	25.06b	34.99e	48.27c	39.78d	41.01b
F.S. at 5.0	112.80e	216.40a	179.40b	169.53a	27.60b	30.03a	22.85d	26.83a	35.62e	58.46a	52.20b	48.76a
Mean	10276c	175.73a	155.83b		21.07b	24.42a	20.93b		34.54c	47.04a	42.18b	
	Second season: 2013											
F.S. at 0.0	98.33g	99.16fg	123.36d	106.95c	9.26f	17.00e	17.66e	14.64c	30.69f	31.99e	32.16e	31.61c
F.S. at 2.5	103.51f	197.13a	142.60c	147.75b	23.41c	24.33b	21.80d	23.18b	32.56e	44.18c	36.38d	37.71b
F.S. at 5.0	115.00e	198.72a	164.68b	159.47a	25.32b	27.61a	21.03d	24.65a	33.10e	53.94a	46.10b	44.38a
Mean	105.61c	165.00a	143.55b		19.33c	22.98a	20.16b		32.12c	43.37a	38.21b	

*** F.S.: Foliar spray, and S.D.: Soil drench.**

**** Means within a column or row having the same letters are not significantly different according to Duncan's Multiple Range Test (DMRT) at 5% level.**

This may indicate the role of actosol (a humic acid NPK organic fertilizer) on increasing the release of nutrients (Dorer and Peacock, 1997), with increasing the permeability of plant membranes, and consequently increasing nutrients uptake (Russo and Berlyn, 1990). In addition, Türkmen *et al.* (2004) stated that humic acid elevated the content of macro-and micro-elements in the tissues of tomato plant. These findings, however are in accordance with those of Hunter and Butler (2005) of *Agrostis stolonifera* and El-Sayed *et al.* (2008) on Tifway grass.

From the aforementioned results, it could be concluded that spraying the humic acid NPK liquid fertilizer (actosol) at 5.0 ml/l on the foliage to run-off plus drenching it in the soil at 10.0 ml/l is the best way for improving growth and quality of *Ficus deltoidea* plant and also for avoiding environments pollution with chemicals used in agriculture.

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استجابة نبات الفيكس دلتا بطئ النمو للمعاملة بالتسميد ومنشط النمو
٢ـ السماد السائل لحمض الهيوميك

أمل صلاح الفولى ، عزة محمد عبد المنعم وحنان عز الدين إبراهيم
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أجريت سلسلة من تجارب الأصص بإحدى الصوبات البلاستيك بمشتل معهد بحوث البساتين، مركز البحوث الزراعية، الجيزة، مصر خلال موسمي ٢٠١٢ ، ٢٠١٣ و ذلك لدراسة التأثيرات المنفردة أو المشتركة للأكتوسول (سماد عضوي سائل غني بحمض الهيوميك) عند إضافته شهرياً رشاً على الأوراق بمعدلات: صفر، ٢،٥ ، ٥ مم/لتر أو محلول للتربة بتركيزات صفر، ١٠، ١٥ مم/لتر على النمو و التركيب الكيميائي لشتلات الفيكس دلتا (*Ficus deltoidea* Jack.) عمر ستة أشهر و المنزرعة في أصص بلاستيك قطرها ٢٠سم وملئت بحوالي ٢،٥ كجم من مخلوط متساوي (بالحجم) من الرمل، الطين و البيتموس.تم أيضاً دراسة تأثير التفاعلات بين التركيزات المختلفة للإضافة الأرضية والرش على الأوراق.

أوضحت النتائج المتحصل عليها أن جميع قياسات النمو الخضري و الجذري، محتوى الأوراق من الصبغات (كلوروفيللي أ، ب و الكاروتينويدات)، و كذلك تركيز العناصر المعدنية في الأوراق و الجذور من النيتروجين، الفوسفور، البوتاسيوم، الحديد، الزنك و المنجنيز قد تحسنت بشكل واضح نتيجة للرش الورقي أو الإضافة الأرضية لمحلول حمض الهيوميك السائل بالتركيزات المختلفة، مع تفوق المعاملة المشتركة التي اشتملت على رش الأوراق بمعدل ٥مم/لتر مع الإضافة الأرضية بمعدل ١٠ مم/لتر و التي أعطت أعلى المتوسطات في جميع القياسات سالفة الذكر بكلا الموسمين.

و عليه ... يمكن التوصية بإضافة الأكتوسول (السماد العضوي السائل لحمض الهيوميك) شهرياً خلال فترة النمو النشط بمعدل ٥ مم/لتر رشاً على الأوراق مع اضافته للتربة بمعدل ١٠ مم/لتر للحصول على نباتات جيدة النمو صحية من شتلات الفيكس دلتا عمر ستة أشهر تصلح للتسويق التجاري.