EFFECT OF ORGANIC AND BIOFERTILIZER TREATMENTS ON GROWTH, FLOWERING, BULB PRODUCTION AND CHEMICAL CONSTITUENTS OF *IRIS TINGITANA* CV. WEDGEWOOD PLANTS

Journal

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ABSTRACT

This investigation was consummated throughout two successive seasons (2006/2007 and 2007/2008) at the nursery of Hort. Res. Inst., Giza, Egypt. The effect of actosol (at different concentrations and mode of applications), EM 5% and some combinations of both on morphological and chemical constituents of *Iris tingitana* cv. Wedgewood plant was investigated. The results emphasized that all organic and biofertilization treatments improved flowers and bulbs yield and quality as well as chemical constituents of the plant. Supplying the plant with actosol (Acto.) at the rate of 2.5 cm^3/L was the best treatment in increasing plant height, number of leaves/plant, flower stalk length, flower stalk diameter and fresh weight of cut spike. Whereas EM at the rate of 5% or Acto. at 20 cm^3/L as soil drench induced early flowering when compared with the other fertilizer treatments which were used or the control. Meanwhile, bulbs yield revealed an increment in response to actosol treatment at 10 cm^3/L or 20 cm^3/L as soil drench. Similarly, fresh weight of bulbs or bulb fresh weight were increased due to actosol at 2.5 cm^3/L. Whereas, applying actosol at 10 cm^3/L as soil drench revealed its superiority in increasing bulblets yield and fresh weight of bulblets. Meanwhile, the combination of acto. at 2.5 cm^3/L as foliar spray + acto. at 20 cm^3/L as soil drench + EM 5 % as soil drench revealed a great influence on increasing fresh weight of bulblet.

Applying the mixture of actosol at 2.5 cm^3/L as foliar spray + EM 5% as soil drench showed a clear increment on chlorophyll (A and B) and carotenoids content in leaves, with the superiority of using Actosol at 10 cm^3/L as soil drench in increasing chlorophyll (A) in leaves. Whereas, total carbohydrate contents revealed clear increment due to actosol at 5 cm^3/L as foliar spray + actosol at 20 cm^3/L as soil drench + EM 5% as soil drench treatment.

Also, great effect was detected on N and K % in leaves as a result of applying actosol at 2.5 cm^3/L as foliar spray. Whereas P% showed a clear increment resulting from using, the combination of EM 5% as soil drench and either acto. at 10 cm^3/L or 20 cm^3/L as soil drench.

It could be concluded from the above mentioned results that using the lowest rate of actosol (2.5 cm^3/L) as foliar spray was the most effective treatment in increasing plant quality and chemical constituents. Therefore, it could be recommended to use such treatment in application.

Key words: Actosol, Organic humic acid, EM 5%, biofertilizer, *Iris tingitana*

INTRODUCTION

Iris tingitana belongs to family Iridaceae. Iris species are planted for cut flowers as well as for landscape design. Iris flowers are very popular for local use and exportation. Organic or bio fertilizers are from paramount importance for their beneficial effects on the physical, chemical and biological properties of soil organic matter, cation exchange capacity, available of mineral nutrients plant and productivity (El-Naggar, 1996). However, the opportunities for organic agriculture to affect our plant and its occupants in the new century will increase obviously. There is some evidence of variation among organic and conventionally produced crops in their quality (Woese *et al.,* 1997, Zarb *et al.,* 1999 and El-Kholly, 2003).

Amendment of soil with EM solutions; which contains selected species of microorganisms including predominant population of lactic acid bacteria and yeasts, and smaller numbers of photosynthetic bacteria, actinomycetes and other types of microorganisms; significantly increase efficiency of all nutrients from all organic fertilizers low in C:N ratio (Piyadasa *et al.,* 1993; Millner and Kaufman, 1996; Obreza and Hampton, 2000).

Using actosol containing humic acid and EM biostimulant seems to be valuable in correcting the widespread occurrence of certain nutrient deficiency symptoms. This is attained through increasing the soil water holding capacity, promoting soil structure and enhance the metabolic activity of micro organisms. They also act as a source of nitrogen, phosphorus and sulfer for plants (Petrovic *et al.,* 1982 and Higa and Wididana, 1991). Moreover, Stevenson (1994) concluded that, humic substances isolated from different materials contained 45-65% carbon, 30-48% oxygen, 2-6% nitrogen and about 5% hydrogen. Humic substances (HS) are extremely important soil components because they constitute a stable fraction of carbon (C), thus regulating the carbon cycle and release of nutrients including nitrogen (N), phosphorus (P) and Sulphur (S). Additionally, the presence of HS improves pH buffering and thermal insulation.

Few information are available on the effect of Actosol or EM on ornamental bulbs or other ornamental plants. So, the literature on other plants species is indispensable in this concern.

Liu *et al.,* (1998) on creeping bentgrass (*Agrostis stolonifera*), reported that, HA at 400 mg/litre significantly increased net photosynthesis on all four observation dates. Chlorophyll content was unaffected by HA rate at each observation date. HA increased tissue content of Mg, Mn and S and decreased those of Ca, Cu and N. El-Sayed and El-Shal (2008), on Schefflera (*Brassaia actinophylla*), mentioned that humic acid treatments revealed significant effect on plant parameter, which reached its maximum due to use of (actosol ®) humic acid as foliage spray plus soil drench (5.0 cm^3/L foliage spray + 10.0 cm^3/L soil drench).

Concerning the effect of EM, Daly and Stewart (1999) used EM biostimulant on bean, pea and onion, reported that the EM improved the nutrient uptake efficiency, enhanced root growth, and increased yield. Furthermore, Abd El-Messeih *et al.,* (2005) indicated that EM enhanced vegetative growth, leaf chlorophylls, improved soil structure, yield and fruit quality of le Conte pear trees grown in calcareous soil. Also, El-Seginy (2006) on the same plant added that soil application of EM gave a significant increase in vegetative growth parameters of pears (trunk circumference, number of new shoots, shoot length, shoot diameter, leaf area and tree height) as well as leaf chlorophyll readings and total carbohydrates content.

Therefore, the experimental trials was conducted aiming to study the effect of actosol (an organic humic acid as liquid fertilizer) and EM 5% biostimulant on vegetative growth, flowering, bulbs and bulblets productivity and chemical constituents of *Iris tingitana* cv. "Wedgewood" plants.

MATERIALS AND METHODS

The experimental trial was conducted throughout two successive seasons (2007 and 2008) at the nursery of Horticulture Research Institute, Agriculture Research Center. It was intended to find out the effect of organic (actosol) and biofertilizer (EM 5%) or both (as a combined treatment) on growth, flowering, bulb productivity and chemical composition of Iris plant cv. "Wedgewood".

Plant materials:

Locally produced bulbs of 8-9 cm. circumference were selected after curing and storage at room temperature (27±3°C.)

Actosol: Is a commercial liquid organic fertilizer containing a minimum of 2.9% humic acid and 0.5% for each of Fe, Zn, Mn and Cu.

EM: Biostimulant contains more than 60 selected strains of effective micro organisms (Viz, phosphosynthetic and lactic acid bacteria, yeast, actinomycetes and various fungi).

Procedure:

In both seasons, the bulbs were planted on September 25th , at the open field condition in sandy clay soil.

Physical and chemical analysis, are exhibited in Table (a) They were planted on one side of each furrow 1.5 m and 50 cm wide at a depth of 7-8 cm and 15 cm apart in both seasons. On December 25th , the following treatments were carried out in every season.

- Untreated plants (control).
- Actosol at 2.5 cm^3/L as foliar spray.
- Actosol at 5 cm^3/L as foliar spray.
- Actosol at 10 cm^3/L as soil drench.
- Actosol at 20 cm^3/L as soil drench.
- Em 5% as soil drench.
- Actosol at 2.5 cm^3/L as foliar spray. + Em 5% as soil drench.
- Actosol at 5 cm^3/L as foliar spray. + Em 5% as soil drench.

- Actosol at 10 cm^3/L as soil drench. + Em 5% as soil drench.
- Actosol at 20 cm^3/L as soil drench. + Em 5% as soil drench.
- Actosol at 2.5 cm^3/L as foliar spray. + Actosol at 10 cm^3/L as soil drench. + Em 5% as soil drench.
- Actosol at 5 cm^3/L as foliar spray. + Actosol at 20 cm^3/L as soil drench. + Em 5% as soil drench.

Thus, 12 treatments were carried out in the two experimental seasons.

The plants were received the different types of organic or biofertilizer treatments (5 times) at 15 days intervals commencing from December 25th.

Table (A): Mechanical and chemical analysis of soil.

Mechanical analysis		**Chemical analysis**					
Sand %	51.39	**N**	480 ppm	**Cations Meq/L**		**Anions Meq/L**	
Silt %	31.63	**P**	380 ppm	**Na^+**	1.00	**HCO_3^-**	1.30
Clay %	17.98	**K**	564 ppm	**K^+**	0.25	**SO_4^-**	0.30
Soil texture	Sandy clay	**pH**	8.60	**Ca^{++}**	10.00	**Cl^-**	0.45
		E.C.	1.20 mmoh	**Mg^{++}**	8.02		
		Organic matter	0.23 %				

Every treatment contained 21 bulbs, arranged in randomized complete block design in three replicates (7 bulbs/experimental unite) (Mead *et al.,* 1993).

Regular agricultural practices such as weeding, watering ….. etc were carried out whenever necessary.

The recorded data included the following: Vegetative growth height (plant height) cm., number of leaves/plant at flowering phase, number of days from planting to flowering (flowering date) flower stalk length (cm.), flower stalk diameter (mm.), fresh weight of cut spike (gm.), number of bulbs/plot (experimental unit), fresh weight of

bulbs/plot (gm.) fresh weight of bulb (gm.), number of bulblets/plot, fresh weight of bulblets/plot gm. and fresh weight of bulblet.

Chemical analysis:

The effect of organic (actosol) and biofertilizer (EM 5%) or both (as a combined treatment) on the chemical constituents of the plant were estimated as follows in both seasons:

Chlorophyll a, b and carotenoids in the leaves: Determination of chlorophyll a and b as well as carotenoids content were determined in fresh leaves at flowering phase (mg/gm of fresh weight) according to Saric *et al.,* (1967).

Total carbohydrates percentage in leaves: were determined by using colorimetric method given by Smith *et al.,* (1956). Nitrogen content was determined by distillation in microkjeldahl apparatus (Black, 1956). Phosphorus content was colorimetrically determined in the acid digested using ascorbic acid method (John, 1970). Potassium content was determined using the flame photometer (Dewis and Freitas, 1970).

SAS program (1994) was used for statistical analysis and Duncan's Multiple Range Test (1955) was employed to verify the differences among the means of various treatments.

RESULTS AND DISCUSSION

Effect of fertilization on vegetative growth characters:

Vegetative growth height (plant height):

Data registered in Table (1) reveal the great influence of receiving the plants Acto. (2.5 cm^3/L) as foliar spray or Acto. (20 cm^3/L) as soil drench or the combination of Actosol (2.5 cm^3/L) as foliar spray + Acto. (10 cm^3/L) as soil drench + EM 5% as soil drench in increasing vegetative growth height (plant height) in both seasons. However the second category was occupied by plants treated with Acto. (5 cm^3/L) as foliar spray or Acto. (10 cm^3/L) as soil drench or the combinations of Acto. 2.5 cm^3/L as foliar spray + EM 5% as soil drench or Acto. 5 cm^3/L as foliar spray + EM 5% as soil drench.

In this connection, El-Sayed and El-Shal (2008) found that humic acid at 5 ml/L as foliar spray, 10 ml/L as soil drench and both of them in combination treatment improved plant height of *Brassaia actinophylla.*

Meanwhile, the increase in plant height due to micro organisms of biofertilizer can be attributed to the capability of those microorganisms in inducing beneficial effects on plant growth by contributing hormones such as cytokinins or auxins (Bouton *et al.,* 1979, 1985; Tein *et al*, 1979). However, the previous results are in line with those of Bonito *et al.,* (1995) on *Zinnia elegans* and *Gerbera jamsonii*, El-Naggar (1998) on tuberose, Dessouky (2002) on *Borago officinalis* plant, and Hussien (2004) on Iris.

Table (1). Effect of actosol and EM 5% treatments on vegetative growth parameters and flowering date of *Iris tingitana* cv. Wedgewood.

Treatments	Plant height (cm.)				No. of leaves/plant				No. of days from planting to flowering			
	2006/2007		2007/2008		2006/2007		2007/2008		2006/2007		2007/2008	
Control	57.00	DE	59.02	D	8.14	DE	8.19	D	128.30	A	127.89	A
Acto. 2.5	65.97	B	67.99	B	8.55	B	8.92	AB	126.40	AB	125.96	AB
Acto. 5.0	60.38	C	62.34	C	8.33	BCD	8.80	AB	127.30	AB	126.69	AB
Acto. 10.0	61.13	C	63.04	C	8.08	DE	8.12	D	125.90	AB	125.42	AB
Acto. 20.0	65.33	B	67.35	B	8.53	BC	8.69	B	125.90	AB	124.64	AB
EM 5%	55.40	E	57.42	D	8.20	DE	8.32	D	123.80	B	123.13	B
Acto.2.5+ EM 5%	61.60	C	63.68	C	8.27	CDE	8.35	D	126.40	AB	125.80	AB
Acto.5.0+ EM 5%	60.47	C	63.20	C	8.33	BCD	8.40	CD	125.60	AB	125.17	AB
Acto.10.0+ EM 5%	57.38	D	59.06	D	8.88	A	9.05	A	129.30	A	128.92	A
Acto.20.0+ EM 5%	55.23	E	57.60	D	8.58	B	8.67	BC	127.20	AB	126.75	AB
Acto.2.5+Acto.10.0+ EM 5%	69.07	A	70.18	A	8.60	B	8.73	B	125.70	AB	125.28	AB
Acto.5.0+Acto.20.0+ EM 5%	57.62	D	58.35	D	8.05	E	8.24	D	127.90	AB	126.13	AB

Acto.2.5= Actosol 2.5cm^3/L as foliar spray **Acto. 5.0**= Actosol 5cm^3/L as foliar spray
Acto. 10.0= Actosol 10cm^3/L as soil drench **Acto. 20.0**= Actosol 20cm^3/L as soil drench
EM 5% : as soil drench
* Means within column or row having the same letters are not significantly different according to Duncan's Multiple Range Test (DMRT) at 5% level

Number of leaves/plant:

Generally, it could be concluded from data of Table (1) that the different fertilization treatments caused an increment in number of leaves/plant in both experimental field. In this connection, the combination between Acto. 10 cm^3/L as soil drench + EM 5% as soil drench revealed clear increment on the obtained values comparing with the control, giving 8.88 and 9.05 compared with 8.14 and 8.19 produced from untreated plants in both seasons, respectively. Moreover, applying the lowest rate of Acto. (2.5 cm^3/L) as foliar spray showed also a favorable effect in this respect.

In this respect, the pronounced effects of fertilization with actosol and EM5% treatments may be related to the improving effect on soil structure, aeration, water retention and uptake of nutrients from the soil. Moreover they increased microbial activity in the soil and enhance plant cell biomass. The low molecular weight humics in Actosol have the cytokinnin/auxin like response and not only help in transport of trace elements, but also greatly stimulate root growth (Putti *et al.,* 1988). However, the great influence of Actosol on vegetative growth parameters was recorded by many authors on different plant species. Atef *et al.,* (2005) concluded that the use of actosol on lecton pear and camino apricot trees gave the highest vegetative growth parameters. The same trend was also recorded on Apple trees by Guo *et al.,* (2000).

Effect of fertilization on flowering:

Number of days from planting to flowering (flowering date):

Evidently, data in Table (1) reveal that, receiving the plants EM 5% as soil drench induced flowering earlier than the control and most of other fertilizers treatments in the two seasons. It induced flowering after only 123.80 and 123.13 days compared with 128.70 and 127.84 of the control in both seasons, respectively. However, applying Acto. 20 cm^3/L as soil drench induced also significantly early flowering when compared with the control in the two seasons.

Flower stalk length:

It is obvious from data presented in Table (2) that all fertilizer treatments (except the effect of Acto. 5 cm^3/L as foliar spray + EM 5% as soil drench) caused an increment on flower stalk length in both experimental seasons. In this respect, receiving the plants Acto. 2.5 cm^3/L as foliar spray or the combination of Acto. 2.5 cm^3/L as foliar spray + Acto. 10 cm^3/L as soil drench + EM 5% as soil drench or Acto. 10 cm^3/L as soil drench + EM 5% as soil drench were the best treatments in increasing the values, with significant effect, comparing with the control in the two seasons.

Table (2). Effect of actosol and EM 5% treatments on flowering of *Iris tingitana* cv. Wedgewood.

Treatments	Length of flower stalk (cm.)				Diameter of flower stalk (mm.)				Fresh weight of cut spikes (g.)			
	2006/2007		2007/2008		2006/2007		2007/2008		2006/2007		2007/2008	
Control	28.25	H	29.58	E	7.9	G	8.0	FG	23.60	E	24.70	G
Acto. 2.5	34.73	B	36.00	B	9.7	A	9.8	A	35.72	B	37.67	B
Acto. 5.0	33.42	C	34.64	C	8.2	EF	8.4	E	30.15	C	32.38	D
Acto. 10.0	30.85	FG	32.33	D	8.7	C	8.8	D	25.91	D	27.76	E
Acto. 20.0	31.69	EF	32.57	D	9.1	B	9.2	C	35.54	B	36.36	C
EM 5%	30.40	G	31.93	D	7.6	H	7.8	GH	21.48	F	23.48	H
Acto.2.5+ EM 5%	33.00	CD	34.20	C	8.4	DE	8.5	E	30.89	C	32.10	D
Acto.5.0+ EM 5%	26.80	I	28.13	F	8.0	FG	8.1	F	26.80	D	28.39	E
Acto.10.0+ EM 5%	33.75	BC	35.28	BC	8.5	CD	8.6	DE	23.89	E	25.49	FG
Acto.20.0+ EM 5%	32.38	DE	34.83	C	7.6	H	7.7	H	23.48	E	26.00	F
Acto.2.5+Acto.10.0+EM 5%	36.40	A	38.25	A	9.3	B	9.5	B	39.12	A	40.18	A
Acto.5.0+Acto.20.0+EM 5%	30.68	FG	31.75	D	8.5	CD	8.6	DE	24.47	E	26.41	F

Acto.2.5= Actosol 2.5cm^3/L as foliar spray **Acto. 5.0**= Actosol 5cm^3/L as foliar spray
Acto. 10.0= Actosol 10cm^3/L as soil drench **Acto. 20.0**= Actosol 20cm^3/L as soil drench
EM 5% : as soil drench
* Means within column or row having the same letters are not significantly different according to Duncan's Multiple Range Test (DMRT) at 5% level

Meanwhile, the other fertilizer treatments gave an intermediate effect in this regard. However, **Guo *et al.*, (2000)** reported that sprayed apple trees with different concentrations of Komix (an organic humic acid as liquid fertilizer) at different stages promoted shoot growth.

Also, it can be attributed the promotive action on stalk length due to biofertilizer treatment to plant hormones produced as a result of such treatment and partially to nitrogen fixations as well as availability of P by organisms. Similar results were obtained by Wange and Patil (1994), El-Naggar (1998) on tuberose, Kathiresan and Venkatesha (2002) on gladiolus and Hussien (2004) on Iris.

Flower stalk diameter:

Data registered in Table (2) indicate the superiority of receiving the plants Acto. 2.5 cm^3/L as foliar spray in increasing flower stalk diameter in the two seasons, followed by applying either the highest rate of Acto. (20 cm^3/L) as soil drench or the combination between Acto. 2.5 cm^3/L as foliar spray + Acto. 10 cm^3/L as soil drench + EM 5% as soil drench. Such treatments gave the utmost high means comparing with the control and all other fertilization treatments in the two seasons. The contrary action, was a result of receiving the plants

EM 5% as soil drench alone or the combination between Acto. 5 cm^3/L as foliar spray + EM 5% as soil drench or Acto. 20 cm^3/L as soil drench + EM 5% as soil drench . These treatments resulted in the lowest values in the two experimental trials. Whereas, the other treatments increased to some extent flower stalk diameter than the control with significant effects in most cases in both seasons.

Fresh weight of cut spike:

As shown in Table (2), fresh weight of cut spike significantly increased in most cases by using the various fertilizer treatments in both seasons. Receiving the plants the combination of Acto. 2.5 cm^3/L as foliar spray + Acto. 10 cm^3/L as soil drench + EM 5% as soil drench was the best treatments in increasing the values in both seasons (39.12 and 40.18 gm. against 23.60 and 24.70 gm. for the control plants in the two seasons, respectively). However, the same direction was also found on the same parameter, but with less effect by applying either Acto. 2.5 cm^3/L spray or Acto. 20 cm^3/L as soil drench in both seasons. Whereas, the contrary action was detected as a result of applying EM 5% as soil drench alone. Such treatments declined fresh weight of cut spike to only 21.48 and 23.48 gm. in the two seasons, respectively. In this connection the increment in fresh weight of cut spike as a result of bio or organic fertilization may be attributed to the increase in both the length and diameter of flower stalk as already discussed. However, these findings are in line with that of Misra (1997) on gladiolus plants and Hussien (2004) on Iris .

Bulbs and bulblets production:

No. of bulbs/plot (bulbs yield):

It is evident from tabulated data that receiving the plants Acto. at either 10 cm^3/L or 20 cm^3/L as soil drench were the best treatments in increasing bulbs yield (No. of bulbs/plot) in both seasons. They increased the values to 15.00, 16.00 and 16.33, 16.67 against 8.00 and 9.00 of that produced from control plants in both seasons, respectively. However, applying either Acto. at 2.5 cm^3/L as foliar spray or the combination between Acto. at 20 cm^3/L as soil drench + EM 5% as soil drench caused also a favorable effect in this respect. The contrary action was a result of using either EM 5% as soil drench alone or the combination of Acto. at 2.5 cm^3/L as a foliarl spray + EM 5% as soil drench which declined the values comparing with the control or the other treatments used.

Fresh weight of bulbs/plot:

A clear increment on fresh weight of bulbs/plot was detected in most cases due to receiving the plants the different fertilizer treatments in both seasons, with the superiority of using Actosol at either 2.5 cm^3/L as foliar spray or at 20 cm^3/L as soil drench in the two seasons. Such treatments increased fresh weight of bulbs to 107.10, 110.10 and 117.70, 119.00 gm. against to only 35.00 and 36.99 gm. produced from control plants in both seasons, respectively. Whereas, undesirable effect on the other hand was observed as a result of receiving the plants EM 5% as soil drench alone. This treatment declined fresh weight of bulbs/plot than the control and other treatments used in both experimental trials.

Table (3). Effect of actosol and EM 5% treatments on fresh weight of bulbs and bulblets (g.) of *Iris tingitana* cv. Wedgewood.

Treatments	No. of bulbs/plot				F.W. of bulbs/plot				F.W. of bulb			
	2006/2007		2007/2008		2006/2007		2007/2008		2006/2007		2007/2008	
Control	8.00	E	9.33	F	35.00	G	36.99	G	4.38	H	3.96	G
Acto. 2.5	10.33	C	11.00	D	107.10	B	110.10	B	10.37	A	10.01	A
Acto. 5.0	8.00	E	9.00	F	67.34	C	68.34	C	8.42	B	7.59	B
Acto. 10.0	15.00	B	16.00	B	57.14	D	58.90	D	3.81	I	3.68	H
Acto. 20.0	16.33	A	17.67	A	117.70	A	119.00	A	7.21	D	6.73	C
EM 5%	7.00	F	9.00	F	28.92	H	30.88	H	4.13	H	3.43	I
Acto.2.5+ EM 5%	7.00	F	9.00	F	45.99	E	57.71	DE	6.57	E	6.41	D
Acto.5.0+ EM 5%	9.00	D	10.00	E	57.15	D	59.25	D	6.35	E	5.93	E
Acto.10.0+ EM 5%	8.00	E	9.00	F	41.25	F	43.35	F	5.16	G	4.82	F
Acto.20.0+ EM 5%	10.00	C	12.67	C	56.09	D	58.90	D	5.61	F	4.65	F
Acto.2.5+Acto.10.0+EM 5%	7.00	F	9.33	F	56.32	D	58.23	DE	8.05	C	6.24	D
Acto.5.0+Acto.20.0+EM 5%	7.00	F	9.00	F	54.88	D	56.08	E	7.84	C	6.23	D

Acto.2.5= Actosol 2.5cm^3/L as foliar spray **Acto. 5.0**= Actosol 5cm^3/L as foliar spray

Acto. 10.0= Actosol 10cm^3/L as soil drench **Acto. 20.0**= Actosol 20cm^3/L as soil drench

EM 5% : as soil drench

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

Fresh weight of bulb:

A promotive action on fresh weight of bulb was detected as a result of using the different types of fertilization treatments in both seasons. It is evident from the tabulated data, the great influence of applying Actosol at the lowest rate of 2.5 cm^3/L as foliar spray. It considerably increased bulb fresh weight to 10.37 and 10.01 gm. compared with 4.38 and 3.96 gm of the control in the two seasons,

respectively. Moreover, applying Acto. 5 cm^3/L as foliar spray or Actosol 20 cm^3/L as soil drench also showed a favorable effect in this concern. On the contrary using Actosol 10 cm^3/L as soil drench or EM 5% as soil drench revealed a reduction effect on the obtained values in both plantations.

Referring the effect of biofertilizer in increasing either fresh weight of bulbs/plot or fresh weight of bulb, these results are in agreement with those of El-Naggar and Mahmoud (1994) on Narcissus, Kshiragar *et al.,* (1994) on Onion, and Yassin *et al.,* (1994) on sweet potatos, Misra (1997) on gladiolus and Sheikh *et al.,* (2000) and Hussien (2004) on Iris. They concluded that applying the biofertilizers increased fresh and dry weights of bulbs compared to untreated plants.

Number of bulblets/plot (bulblets yield):

Data registrated in Table (4) show an increment on bulblets yield due to applying Acto. at either 10 or 20 cm^3/L as soil drench or using the combination between Acto. 2.5 cm^3/L as foliar spray + EM 5% as soil drench or Acto, 5 cm^3/L as foliar spray + EM 5% as soil drench. Such treatments significantly increased the values compared with the control in both seasons. The contrary action, was a result of receiving the plants the combination of Acto. 5 cm^3/L as foliar spray + Acto. 20 cm^3/L as soil drench + EM 5% as soil drench. Such treatment declined bulblets yield in both experimental trials.

Fresh weight of bulblets/plot:

Evidently, data in Table (4) show the superiority of using the combination of Acto. 5 cm^3/L as foliar spray + EM 5% as soil drench in increasing fresh weight of bulblets/plot comparing with the control or other treatments used. However, applying Acto. at 10 cm^3/L as soil drench or the combination of Acto. 2.5 cm^3/L as foliar spray + Acto. 10 cm^3/L as soil drench + EM 5% as soil drench revealed also a favorable effect in this concern. Whereas, undesirable effect was noticed as a result of using EM 5% as soil drench alone, as it declined the value to only 6.42 and 12.56 gm. against 13.67 and 15.99 gm. of the control in both seasons, respectively.

Table (4). Effect of actosol and EM 5% treatments on number of bulblets and bulbs/plot of *Iris tingitana* cv. Wedgewood.

Treatments	No. of bulblets		F.W. of bulblets		F.W. of bulblet	
	2006/2007	2007/2008	2006/2007	2007/2008	2006/2007	2007/2008
Control	10.67 C	13.00 D	13.67 I	15.99 J	1.28 J	1.23 I
Acto. 2.5	9.67 D	13.00 D	24.24 D	26.56 D	2.51 C	2.04 D
Acto. 5.0	11.33 B	14.67 B	18.94 G	20.19 H	1.67 G	1.38 H
Acto. 10.0	13.00 A	15.33 A	27.86 B	29.04 B	2.14 E	1.89 E
Acto. 20.0	13.00 A	14.00 C	22.76 E	24.76 E	1.75 F	1.77 F
EM 5%	10.67 C	13.00 D	9.42 J	12.56 K	0.88 K	0.97 J
Acto.2.5+ EM 5%	13.33 A	15.00 AB	18.26 G	20.37 GH	1.37 I	1.36 H
Acto.5.0+ EM 5%	13.00 A	15.33 A	31.37 A	33.52 A	2.41 D	2.19 C
Acto.10.0+ EM 5%	8.00 E	10.00 F	20.68 F	22.88 F	2.59 B	2.29 B
Acto.20.0+ EM 5%	9.67 D	12.33 E	15.36 H	17.99 I	1.59 H	1.46 G
Acto.2.5+Acto.10.0+EM 5%	10.67 C	13.00 D	25.89 C	28.10 C	2.43 D	2.16 C
Acto.5.0+Acto.20.0+EM 5%	6.33 F	9.00 G	18.53 G	21.12 G	2.93 A	2.35 A

Acto.2.5= Actosol 2.5cm^3/L as foliar spray **Acto. 5.0**= Actosol 5cm^3/L as foliar spray
Acto. 10.0= Actosol 10cm^3/L as soil drench **Acto. 20.0**= Actosol 20cm^3/L as soil drench
EM 5% : as soil drench
* Means within column or row having the same letters are not significantly different according to Duncan's Multiple Range Test (DMRT) at 5% level

Fresh weight of bulblet:

Generally, it could be mentioned from data presented in Table (4), that most of fertilizer treatments had a beneficial effect on fresh weight of bulblet in both seasons. However receiving the plants the combination of Actosol 2.5 cm^3/L as foliar spray + Acto. 20 cm^3/L as soil drench + EM 5% as soil drench was the best treatment used in this respect. Whereas, the contrary action, was a result of using EM 5% as soil drench alone. Such treatment decreased fresh weight of bulblet than control and other treatments in the two seasons.

In conclusion, the increment in bulblets formation due to using biofertilizer treatments or their combinations with organic fertilizer may be due to both plant hormones and nitrogen fixation produced from biofertilizer organisms. Similar results were obtained by Wang (1996) on garlic, El-Naggar (1998) on tuberose, Sheikh *et al.,* (2000) on Dutch iris, Kathiresan and Venkatesha (2002) on gladiolus and Hussien (2004) on Iris.

Effect of fertilization on pigment content:

Chlorophyll (a) content in leaves:

It is evident from data presented in Table (5) the increment of chlorophyll (a) accumulation in leaves associated with the different fertilizer treatments. However, the promotive action was more obvious

with applying Actosol 10 cm^3/L as soil drench and Actosol 5 cm^3/L as foliar spray + Actosol 20 cm^3/L as soil drench. Such treatments significantly increased the values to 0.635 and 0.652 mg/g. F.W. against 0.328 mg/g. F.W. of the control, respectively. However, receiving the plants Actosol 2.5 cm^3/L as foliar spray + EM 5% or Actosol 10 cm^3/L as soil drench revealed also a favourable effect in this concern. Whereas, using Actosol at 5 cm^3/L as foliar spray or Actosol at 20 cm^3/L as soil drench recorded the lowest values (0.340 and 0.398 mg/g F.W., respectively).

Table (5). Effect of actosol and EM 5% treatments on chemical constituents of *Iris tingitana* cv. Wedgewood.

Treatments	Carbohyd (%)	CH a (mg/g F.W)	CH b (mg/g F.W)	Caroten (mg/g F.W)	N (%)	P (%)	K (%)
Control	31.53 J	0.328 D	0.133 B	0.170 AB	1.301 C	0.150 I	1.500 E
Acto. 2.5	34.37 H	0.588 A-C	0.194 AB	0.222 AB	3.742 A	0.250 D	2.073 AB
Acto. 5.0	45.83 D	0.340 D	0.181 AB	0.190 AB	2.813 A-C	0.226 E	1.750 C-E
Acto. 10.0	42.33 F	0.635 A	0.221 AB	0.216 AB	2.967 AB	0.198 F	2.013 A-C
Acto. 20.0	34.95 H	0.398 CD	0.161 AB	0.173 AB	2.394 A-C	0.306 C	2.153 A
EM 5%	32.82 I	0.433 B-D	0.138 B	0.180 AB	2.107 BC	0.230 E	1.717 DE
Acto.2.5+ EM 5%	45.39 DE	0.611 AB	0.236 A	0.234 AB	2.745 A-C	0.187 G	1.843 B-D
Acto.5.0+ EM 5%	44.95 E	0.421 B-D	0.208 AB	0.159 B	2.966 AB	0.250 D	1.870 B-D
Acto.10.0+ EM 5%	47.57 C	0.431 B-D	0.140 B	0.179 AB	3.132 AB	0.458 B	1.883 A-D
Acto.20.0+ EM 5%	37.78 G	0.408 CD	0.148 AB	0.171 AB	2.569 A-C	0.499 A	1.933 A-D
Acto.2.5+Acto.10.0+EM 5%	50.34 B	0.412 CD	0.148 AB	0.180 AB	2.252 A-C	0.168 H	1.560 E
Acto.5.0+Acto.20.0+EM 5%	60.05 A	0.652 A	0.216 AB	0.246 A	3.251 AB	0.241 D	1.833 B-D

Acto.2.5= Actosol 2.5cm^3/L as foliar spray **Acto. 5.0**= Actosol 5cm^3/L as foliar spray
Acto. 10.0= Actosol 10cm^3/L as soil drench **Acto. 20.0**= Actosol 20cm^3/L as soil drench
EM 5% : as soil drench
* Means within column or row having the same letters are not significantly different according to Duncan's Multiple Range Test (DMRT) at 5% level

Chlorophyll (b) content in leaves:

As chlorophyll (a) content in leaves was increased in response to the different fertilizer treatments compared with the control, the same direction was also noticed in chlorophyll (b) accumulation in leaves as a result of the same treatments. However, great influence was detected due to supplying the plants Actosol 2.5 cm^3/L as foliar spray + EM 5% as soil drench. On the contrary, receiving the plants EM 5% as soil

drench or Actosol 10 cm^3/L as soil drench recorded the lowest values in this concern.

In this connection, Guo *et al.,* (2000) reported that sprayed apple trees with different concentrations of Komix (an organic humic acid as liquid fertilizer) at different types promoted shoot growth, increased chlorophyll content and enhance photosynthesis.

Carotenoids content in leaves:

Clear increment on carotenoids accumulation in leaves was detected due to receiving the plants Actosol 5 cm^3/L as soil drench + EM 5% as soil drench (0.246 mg/g F.W.). However, supplying the plants Actosol at 2.5 cm^3/L as foliar spray or Actosol 2.5 cm^3/L as foliar spray + EM 5% as soil drench showed also an increment on carotenoids accumulation in leaves (0.22 and 0.234 mg/g. F.W., respectively). Whereas, supplying the plants Actosol 5 cm^3/L as foliar spray + EM 5% as soil drench behaved the contrary action. Such treatment declined the value to only 0.159 mg/g F.W. The other treatments gave an intermediate effect in this concern, with best effect when the plants treated with Acto. 10 cm^3/L as soil drench (0.126 mg/g. F.W.).

Total carbohydrates content in leaves:

As showen in Table (5), plants received Actosol 5 cm^3/L as foliar spray + Actosol 20 cm^3/L as soil drench + EM 5% as soil drench considerably increased total carbohydrate content in leaves comparing with control and most of other fertilizer treatments (60.048 mg/g. D.W.). Also, great influence was observed on the obtained value as a result of supplying the plants Actosol 2.5 cm^3/L as foliar spray + Actosol 10 cm^3/L as soil drench + EM 5% as soil drench followed by Acto. 10 cm^3/L as soil drench + EM 5% as soil drench (50.344 and 47.57 mg/g. D.W., respectively). The other fertilizer treatments revealed also an increment but with less effect on total carbohydrate content, with the exception of the effect Actosol 2.5 cm^3/L as foliar spray + EM 5% as soil drench, which showed negligible effect in this concern.

Referring to the increment on total carbohydrate content in leaves due to Actosol and EM 5% treatments, El-Seginy (2006) attributed the increase in leaf carbohydrate content of Le Conte pear and Canion Apricot to the increase of leaf chlorophyll readings due to Actosol and EM treatments.

Mineral content in leaves:

Nitrogen content in leaves:

Apparently, nitrogen accumulation in leaves revealed a clear increment in response to the different fertilizer treatments, especially with applying Actosol 2.5 cm^3/L as foliar spray followed by using Actosol 5 cm^3/L as foliar spray + Actosol 20 cm^3/L as soil drench + EM 5% as soil drench or Actosol 20 cm^3/L as soil drench + EM 5% as soil drench. Whereas, receiving the plants EM 5% as soil drench recorded the lowest value in this concern (2.107%).

Phosphorus content in leaves:

As shown in Table (5), all fertilizer treatments caused an increment in phosphorus accumulation in leaves in most cases. However applying the combination of EM 5% as soil drench and either Actosol at 10.0 or 20 cm^3/L as soil drench revealed their superiority in increasing phosphorus content in leaves (0.458 and 0.494%, respectively). Whereas, slight increment on the obtained values was detected due to receiving the plants the combination of Actosol 5 cm^3/L as foliar spray+ Actosol 10.0 cm^3/L as soil drench + EM 5% as soil drench (0.168%).

Potassium content in leaves:

Generally, it could be concluded from data presented in Table (5), that K% in leaves was increased in response to the different fertilizer treatments in most cases. In this connection, great influence was detected on the accumulation rate of K% in leaves due to receiving the plants Actosol 2.5 cm^3/L as foliar spray, Actosol 10 cm^3/L as soil drench and Actosol 20 cm^3/L as soil drench. The values were increased to 2.073, 2.013 and 2.153% compared with 1.500% of the control, respectively. Whereas, using Actosol 2.5 cm^3/L as foliar spray + Actosol 10 cm^3/L as soil drench + EM 5% as soil drench registred the lowest value in this respect.

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تأثير التسميد العضوي و الحيوي على نمو و ازهار و انتاج الأبصال و المحتوى الكيماوي لنبات الأيرس (صنف Wedgewood)

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أجرى هذا البحث خلال موسمين زراعيين متتاليين (٢٠٠٦/٢٠٠٧ ، ٢٠٠٧/٢٠٠٨) بمشتل معهد بحوث البساتين بالجيزة لدراسة تأثير كل من الأكتوسول (Actosol) بتركيزات و بأنماط متباينة من الاستخدام و كذا الـ EM 5% هذا بالاضافة الى دراسة تأثير بعض التأثيرات المتجمعة من كلٍ على الصفات المورفولوجية و المحتوى الكيماوي لنبات الأيرس.

و قد أوضحت النتائج فاعلية استخدام التسميد الحيوي و العضوي في تحسين المنتج من الأزهار و الأبصال الناتجة.

كذلك أوضحت النتائج تفوق معاملة النباتات بالأكتوسول بتركيز ٢,٥سم٣/لتر عن طريق الرش حيث أدت الى زيادة ارتفاع النمو الخضري و عدد الأوراق للنبات و طول الساق الزهرية و سمكها و الوزن الطازج لها بينما كان لإستخدام الـ EM 5% أو الأكتوسول بتركيز ٢٠ سم٣/لتر عن طريق الاضافة الى التربة أثراً في تبكير موعد الازهار بالمقارنة بالكنترول أو معاملات التسميد الأخرى المستخدمة، هذا و قد أظهرت معاملة الأكتوسول بتركيز ١٠سم٣/لتر أو ٢٠ سم٣/لتر عن طريق الاضافة للتربة زيادة في محصول الأبصال الناتج، كذلك ازداد وزن الأبصال الناتجة بالنسبة للوحدة التجريبية و كذلك الوزن الطازج لكل بصلة كنتيجة لاستخدام الأكتوسول بتركيز ٢,٥سم٣/لتر عن طريق الرش، بينما كان لاضافة الأكتوسول بتركيز ١٠سم٣/لتر عن طريق الاضافة للتربة أثراً ممتازاً في زيادة محصول البصيلات الناتجة و كذلك وزن البصيلات بالنسبة للوحدة التجريبية بينما كان لاستخدام الخليط من الأكتوسول بتركيز ٢,٥سم٣/لتر عن طريق الرش و الأكتوسول بتركيز ٢٠ سم٣/لتر و الـ EM 5% عن طريق الاضافة للتربة أثراً واضحاً في زيادة الوزن الطازج للبصيلة.

أظهرت كذلك معاملات التسميد المختلفة أثراً ملحوظاً بالنسبة للمحتوى الكيماوي للنبات حيث أدت معاملة النباتات بخليط من الأكتوسول بتركيز ٢,٥سم٣/لتر عن طريق الرش و الـ EM 5% عن طريق الاضافة للتربة الى زيادة محتوى الأوراق من الكلوروفيل (A) و الكلوروفيل (B) و الكاروتينويدات هذا و قد أظهرت النتائج كذلك تفوق واضح باستخدام الأكتوسول بتركيز ١٠سم٣/لتر عن طريق الاضافة للتربة في زيادة محتوى الأوراق من الكلوروفيل (A).

أما بالنسبة لمحتوى الأوراق من الكربوهيدرات الكلية فقد أظهرت معاملة النباتات بخليط من الأكتوسول بتركيز ٥سم٣/ لتر عن طريق الرش و الأكتوسول بتركيز ٢٠ سم٣/لتر و الـ EM 5% عن طريق الاضافة للتربة الى زيادة واضحة في محتوى الأوراق.

بالاضافة الى ذلك فقد ازداد محتوى الأوراق الناتجة من النيتروجين و البوتاسيوم كنتيجة لاستخدام الأكتوسول بتركيز ٢,٥سم٣/لتر عن طريق الرش بينما ازداد محتواها من الفوسفور نتيجة لاستخدام خليط من الـ EM 5% عن طريق الاضافة للتربة و الأكتوسول بتركيزات ١٠ أو ٢٠ سم٣/لتر عن طريق الاضافة للتربة كذلك.

من النتائج السابقة يمكن الذكر أن هذا البحث قد أظهر أن استخدام التركيز المنخفض من الأكتوسول (٢,٥سم٣/لتر) عن طريق الرش كان له تأثيرات مفيدة على معظم الصفات المورفولوجية و بعض المحتويات الكيميائية للنبات مما يدعو أن نوصي باستخدام هذه المعاملة لإنتاج أزهار جيدة من الأيرس.