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EFFECT OF COMPOST, BIOFERTILIZATION AND SOME VITAMINS Addition On *Gladiolus grandiflorus*

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ABSTRACT

A field experiment was carried out during the two successive seasons of 2011/2012 and 2012/2013 to study the effect of compost levels (zero, 5, 10, 15 ton/fed.) and biofertilizers (effective microorganisms and active yeast), as well as, some vitamins (vitamin E and vitamin B_1) and their interaction on *Gladiolus grandiflorus* cv. Eurovision plant.

Results showed that vegetative growth (leaf length, number of leaves/plant and dry weight of leaves/plant), flowering aspects (length of spike, number of florets/spike and lower floret diameter) and corm production (corm diameter, corm dry weight and number of cormels per plant) were gradually increased by increasing the level of compost fertilizer.All biofertilizers and vitamins treatments significantly increased all vegetative growth characters, flowering parameters and corm and cormels production in comparison with the control. Effective microorganisms and active yeast treatment seemed to be more effective than other treatments in this concern.

Their use of high level of compost (15 ton/fed.) in combination with combined biofertilizers treatment noticeably improved different vegetative growth characters, flowering parameters and corm production of gladiolus.

Keywords: Effective microorganisms, Compost, Cormels

INTRODUCTION

Gladiolus grandiflorus, L. plants considered one of the most important flowering bulbs grown in Egypt. *Gladiolus* belongs to Family Iridaceae and is propagated by corms. It has decorative spike which carries numerous florets. There are fast expands in areas planted with gladiolus in Egypt in order to meet the increase demand for gladiolus flowers for local market and export. Organic, biofertilizers and antioxidants (vitamins) are among the important agricultural treatments which have been proved to improve the vegetative growth and flowering aspects, as well as, corm production of gladiolus plants. Many investigators revealed the importance of organic fertilization on the growth, flowering quality and corm production of gladiolus. Gangadharan and Gopinath (2000), Conte *et al.* (2001), Zaghloul and Moghazy (2001), Khan *et al*. (2002), Atta-Alla *et al.* (2003), Dongardive *et al*. (2007), Hassanein and El-Sayed (2009a) and (2009b), Leonardo and Barbara (2011) and Chandar *et al.* (2012) reported that treated gladiolus plants with organic fertilization resulted in significant increase in plant height, number of leaves, leaf area, fresh and dry weights of whole plant, as well as, spike length, number of florets/spike and corm production in comparison with untreated plants.

Concerning the effect of biofertilizers, Kathiresan *et al.* (2002), Abdou *et al.* (2004), Badran *et al.* (2006), Taha and Hassan (2008a) and (2008b), Hassanein and El-Sayed (2009a) and (2009b) and Dalve *et al.* (2009) found

that biofertilization treatments improved vegetative growth, flower characters and corm production of gladiolus.
Abdel Aziz *et al.* (2009) and Alabdaly (2012) on gladiolus pointed out that application treatments of vitamins led to significant increase in a vegetative growth traits and flowering productivity.
The aim of the present study was to investigate the effect of compost as organic fertilizer, biofertilizers and vitamins addition on the vegetative growth, flowering and corm production of gladiolus cultivar, Eurovision.

MATERIALS AND METHODS

The corms of *Gladiolus* were obtained from Holland by Basiouny nurseries, Cairo, Egypt.

Effective microorganisms (E.M.) were obtained from the laboratory of biofertilizers, dept., of genetics, fac. of Agric., Minia Univ.
Thiamine (Vit. B1) was obtained from El-Gomhoria Company for chemicals, Egypt.
α-tocopherol (Vit. E) was obtained by Sigma Chemical Company, U.S.A.
Saccharomyces cerevisiae was obtained from the laboratory of biofertilizers, dept., of genetics, fac. of Agric., Minia Univ.

Preparation of biofertilizers:

a. Effective microorganisms (E.M.) as a biofertilizer containing photosynthetic bacteria, lactic acid bacteria and yeast. Each 1 ml contains 10^{7} cell.
b. *Saccharomyces cerevisiae* preparation: The dry matter of active dry yeast (*Saccharomyces cerevisia*), was 95 % and live cells were 11.6 $\times 10^{9}$ /g. The yeast suspension was prepared by dissolving dry yeast and sugar together (1:1 w/w) in warm water (38 C^{o}) and let it stand for two hours before spraying to enhance yeast activity (A.Y.) (**Skoog and Miller, 1957**). Chemical analysis of the dry yeast is presented in Table (c).

Table (a): Chemical analysis of the used active dry yeast.

Protein %	Ash %	Glycogen %	Fats %	Cellulose %
34.87	**7.55**	**6.54**	**2.09**	**4.92**

The chemical analysis of composed used is presented in Table b.

Table (b): Chemical analysis of the compost (Average of the two seasons)

pH	Humidity %	Organic matter %	N %	P %	K %	Fe Ppm	Mn ppm	Cu Ppm	Zn ppm	C/N
8.0	26	44	1.5	0.5	1.0	1750	125	200	60	17.5

Physical and chemical analysis of the used soil were determined and listed in Table c.

Table (c): Physical and chemical properties of the experimental soil.

Soil properties	Value	Soil properties	Value
Sand (%)	28.20	Available P (%)	15.12
Silt (%)	30.70	Exch. K^+ (mg/100 g)	2.11
Clay (%)	41.10	Exch. Ca^{++} (mg/100 g)	31.74
Texture grade	Clay loam	Exch. Na^+ (mg/100 g)	2.40
Organic matter (%)	1.62		
Ca Co_3 (%)	2.09	Fe	8.54
E. C. (m mhos / cm)	1.04	DTPA Cu	2.06
pH (1 : 2.5)	7.82	Ext. ppm Zn	2.75
Total N (%)	0.08	Mn	8.26

Field experiments:

A field experiment was carried out during the two successive seasons of 2011/2012 and 2012/2013 at the Nursery of Ornamental plants, Fac. of Agric. Minia Univ. to figure out the response of *Gladiolus grandiflorus* cv. Eurovision to organic, biofertilizers and some vitamins addition.

Average corm diameter was 2.9 and 3.2 cm and corm weight was 9.8 and 10.3 g for the first season and second one, respectively. Corms were planted on October 15th for both seasons in 2×2.2 m plots containing 3 ridges, 50 cm apart, corms were planted in hills, 20 cm apart (10 corms/ridge). The split plot design with three replicates was followed in this experiment. The four levels of compost fertilization treatments were considered as main plots and the eight biofertilizers and vitamin treatments (Control, E.M., A.Y., vit. E, vit. B_1, E.M. + A.Y., E.M. + vit. E and E.M. + vit. B_1) were put in the sub-plots. The four levels of compost treatments were 0.0, 5, 10 and 15 ton/fed.

The sub-plot treatments were as follows:

1- Without any treatment (control)
2- Effective microorganisms (E.M.) at 50 ml/plant
3- Active yeast (A.Y.) at 5 g/l.
4- Alpha-tocopherol (vit. E) at 100 ppm.
5- Thiamine (vit. B_1) at 100 ppm.
6- E.M. + A.Y.
7- E.M. + vit. E
8- E.M. + vit. B_1

The compost was added before planting during the soil preparation. E.M. was applied three times to the soil around each plant. While each of alpha-tocopherol, thiamine and active yeast were applied by hand sprayer, 3 times on the plants one month and two months after planting and after flower cut. All agricultural practices were performed as usual, in the region. The following data were recorded.

1- Vegetative growth characters just before flowering leaf length (cm), number of leaves/plant and dry weight of leaves (g)/plant.
2- Flowering characters: spike length (cm), number of florets/spike and lower floret diameter (cm).

3- Under ground parts characters at harvesting after foliage had dried (under ground parts were lifted two months after cut spikes): Corm diameter (cm), corm dry weight (g) and number of new cormels/plant.

All of the obtained data were subjected to the statistical analysis of variance using MSTAT-C (1986). L.S.D. test at 0.05 was used to compare the average means of treatments.

RESULTS AND DISCUSSION

1- Vegetative growth characters :

Data in Table (1) show that leaf length, number of leaves/plant and leaves dry weight/plant of gladiolus were significantly increased in both seasons due to the use of compost at 5, 10 and 15 ton/fed. In comparison with those of untreated plants. The highest values were obtained from compost at high level (15 ton/fed.). The increase of vegetative growth resulting from using compost as organic fertilization treatments might be due to the fact that organic matter is considered as an important factor for improving physical, chemical and biological properties of the soil and consequently, increased plant growth (Maynard, 1991). Similar results were obtained by Gangadharan and Gopinath (2000), Conte *et al.* (2001), Atta-Alla *et al.* (2003), Hassanein and El-Sayed (2009a) and Chandar *et al.* (2012) on gladiolus.

Data in Table (1) indicated that, leaf length, number of leaves/plant and leaves dry weight were significantly increased, in both seasons, due to the use of the seven treatments of biofertilizers (E.M. and/or A.Y.), vitamins (vit. E and vit. B_1) and E.M. and/or vitamins (vit. E or vit. B_1) in comparison with untreated control. The combined treatment of E.M. + A.Y. seemed to be more effective than either biofertilizer alone or vitamins. Results are confirmed with those obtained by Kathiresan *et al.* (2002), Abdou *et al.* (2004), Taha and Hassan (2008a) and Hassanein and El-Sayed (2009a) on gladiolus.

The role of E.M. and active yeast as biofertilizers in promoting vegetative growth might be attributed to the increase in nutrient uptake and to their contents or synthesis of plant hormone. Consequently, increasing the formation of metabolites which encourage the vegetative growth and enhance meristematic activity of cells and tissues to improve leaf production (Sperenat, 1997, Hassan, 1997, Gabra, 2004 and Ismail, 2008).

The interaction between the two factors (A×B) was significant in the two seasons for leaf length, leaf number and leaves dry weight. The maximum leaf length, number of leaves/plant and leaves dry weight/plant, were obtained due to supplying the soil of gladiolus with 15 ton/fed. Compost in combination with E.M. + A.Y. followed by high level of compost (15 ton/fed.) with E.M.

2- Flowering parameters :

Data in Table (2) show that all compost level treatments caused significant increase in length of spike, number of florets/spike and lower floret

diameter, in the two seasons, in comparison with that of untreated plants. The flowering parameters were gradually increased according to the increase in the levels of compost fertilizer. However, unsignificant differences were detected between the high and medium levels for length of spike in both seasons. These results are in close agreement with those obtained by Zaghloul and Moghazy (2001), Pimpini and Zanin (2002), Atta-Alla *et al.* (2003), Dongardive *et al.* (2007) and Hassanein and El-Sayed (2009a) on gladiolus.

Table (1) : Effect of compost, bio-fertilizer and some vitamins addition on leaf length (cm), number of leaves/plant and leaves dry weight/plant (g) of *Gladiolus grandiflorus* cv. Eurovision, plants during 2011/2012 and 2012/2013 seasons.

Bio-fertilizer and some vitamins treatments	Compost levels (ton/fed.) (A)									
	1st season					2nd season				
	0	5	10	15	Mean (B)	0	5	10	15	Mean (B)
Leaf length (cm)										
Control	26.2	32.3	36.5	38.7	**33.43**	27.6	33.9	38.3	40.9	**35.18**
E.M.	29.3	36.2	41.2	44.3	**37.75**	31.0	38.2	43.5	47.0	**39.93**
A.Y.	28.4	35.0	39.8	42.7	**36.48**	30.2	37.2	42.3	45.6	**38.83**
Vit. E	27.1	33.4	37.8	40.3	**34.65**	28.8	35.4	40.1	43.0	**36.83**
Vit B_1	27.0	33.3	37.7	40.2	**34.55**	28.7	35.3	40.0	42.8	**36.70**
E.M. + A.Y.	30.5	37.7	43.0	46.4	**39.40**	32.2	39.7	45.3	49.1	**41.58**
E.M. + Vit. E	28.0	34.6	39.3	42.1	**36.00**	29.7	36.5	41.4	44.5	**38.03**
E.M. + Vit. B_1	27.8	34.3	38.9	41.6	**35.65**	29.5	36.2	41.1	44.2	**37.75**
Mean (A)	**28.04**	**34.60**	**39.28**	**42.04**		**29.71**	**36.55**	**41.50**	**44.64**	
L.S.D. at 5 %	**A: 2.21**	**B: 0.91**	**AB: 1.82**			**A: 2.52**	**B: 1.21**	**AB: 2.42**		
Number of leaves/plant										
Control	7.00	8.11	8.36	8.47	**7.99**	7.62	8.69	8.91	9.08	**8.58**
E.M.	7.85	9.03	9.29	9.42	**8.90**	8.45	9.66	9.94	10.09	**9.54**
A.Y.	7.75	8.91	9.17	9.29	**8.78**	8.35	9.53	9.79	9.92	**9.40**
Vit. E	7.65	8.79	9.04	9.15	**8.66**	8.25	9.41	9.67	9.79	**9.28**
Vit B_1	7.55	8.68	8.92	9.03	**8.55**	8.13	9.27	9.52	9.63	**9.14**
E.M. + A.Y.	7.95	9.15	9.45	9.60	**9.04**	8.56	9.81	10.16	10.36	**9.72**
E.M. + Vit. E	7.78	8.94	9.21	9.34	**8.82**	8.32	9.45	9.70	9.82	**9.32**
E.M. + Vit. B_1	7.68	8.83	9.09	9.21	**8.70**	8.25	9.37	9.61	9.72	**9.24**
Mean (A)	**7.65**	**8.81**	**9.07**	**9.19**		**8.24**	**9.40**	**9.66**	**9.80**	
L.S.D. at 5 %	**A: 0.21**	**B: 0.12**	**AB: 0.24**			**A: 0.24**	**B: 0.14**	**AB: 0.28**		
Leaves dry weight/plant (g)										
Control	2.86	3.40	3.69	3.77	**3.43**	3.05	3.62	3.95	4.09	**3.68**
E.M.	3.50	4.26	4.65	4.76	**4.29**	3.85	4.62	5.01	5.14	**4.66**
A.Y.	3.37	4.15	4.49	4.67	**4.17**	3.52	4.29	4.63	4.82	**4.32**
Vit. E	3.21	3.78	4.09	4.18	**3.82**	3.44	4.02	4.36	4.51	**4.08**
Vit B_1	3.15	3.72	4.02	4.08	**3.74**	3.34	3.94	4.26	4.47	**4.00**
E.M. + A.Y.	4.01	4.64	4.99	5.27	**4.73**	4.10	4.91	5.26	5.73	**5.00**
E.M. + Vit. E	3.23	3.94	4.26	4.39	**4.00**	3.58	4.14	4.48	4.63	**4.21**
E.M. + Vit. B_1	3.20	3.85	4.17	4.25	**3.87**	3.42	4.03	4.37	4.60	**4.11**
Mean (A)	**3.32**	**3.97**	**4.30**	**4.42**		**3.54**	**4.20**	**4.54**	**4.75**	
L.S.D. at 5 %	**A: 0.11**	**B: 0.18**	**AB: 0.36**			**A: 0.14**	**B: 0.21**	**AB: 0.42**		

E.M. :- Effective microorganisms A.Y. :- Active yeast

2

3

A possible explanation to the positive effect of compost fertilizer treatments might be attributed to its stimulative effect on different vegetative growth (Table 1). Better vegetative growth should be directly reflected on various flowering aspects.

Regarding to biofertilization (E.M. and/or A.Y.), vitamins (vit. E and vit. B_1) and their combined data in Table (2) revealed that all seven used treatments significantly increased length of spikes, number of florets/spike and lower florets diameter compared with untreated plants. The highest values were obtained due to the treatments of E.M. + A.Y. or E.M. for spike length and E.M. + A.Y. or used each of biofertilizers alone for number of florets/spike and E.M. + A.Y. followed by A.Y. for lower floret diameter. These findings were similar to those obtained by Abdou *et al.* (2004), Taha and Hassan (2008a) and Hassanein and El-Sayed (2009a) on gladiolus and Romuald and Tomasz (2010) on rose and gerbera.

These results might be attributed to the direct and/or indirect role of substances (nutrients, amino acids, vitamins, auxin, cytokinin and gibberellins) (Nagodawithana, 1991 and Spernat, 1997), all those have better effects on the plant growth, consequently improving enzymatic system that reflected on the flowering of gladiolus.

The interaction between factor (A) and factor (B) was significant in the two seasons for the three studied flowering characters. The best overall results were obtained due to the use of compost at the high level in combination with E.M. + A.Y. followed by the high level of compost with E.M. biofertilizers.

3- Corm and cormels production :

Data in Table (3) indicated that corm diameter, corm dry weight and number of cormels/plant were significantly increased with increasing compost fertilizer levels, during the two growing seasons, in comparison with control. The high level of compost (15 ton/fed.) resulted in the highest values for all corm and cormels production traits. Similar results were revealed on gladiolus by Liu *et al.* (1998), Gangadharan and Gopinath (2000), Conte *et al.* (2001), Zaghloul and Moghazy (2001), Zaghloul and Atta-Alla (2001), Atta-Alla *et al.* (2003), Taha and Hassan (2009b) and Hassanein and El-Sayed (2009b).

The increase in the corm production was attributed to the positive effect of organic fertilizers in improving the vegetative growth, as well as, stimulating chlorophyll (Hassanein and El-Sayed (2009b) which reflect on increasing the underground organs of gladiolus.

In relation to the sub-plot treatments, the seven tested ones surpassed, significantly at 5 % level, the control treatment in both seasons in producing wider corms, higher number of new cormels/plant and heavier dry weights of corms. Biofertilizers were more effective than vitamin treatments. Also, the use of the two biofertilizers together was more effective than each one alone. Therefore, the treatment of E.M. + A.Y. followed by E.M. treatment resulted in the highest value in this concern. Similar observation was pointed out on gladiolus by Kathiresan *et al.* (2002), Abdou *et al.* (2004), Taha and Hassan (2008b) and Hassanein and El-Sayed (2009b).

The stimulatory effect of the treatments of biofertilizers on corm production may be due to the mode of action of biofertilizers on the soil or

plant, plant hormone, enzymes and vitamins which came from addition of biofertilizers, and gave better growth, consequently increase in all corm production parameters. Moreover, vitamin treatments were found to have stimulating effect on growth, flowering and bulb production on gladiolus, (Abdel Aziz *et al.,* 2009 and Alabdaly, 2012).

The interaction between the main and sub-plot treatments was significant, in both seasons, in regard to corm diameter, corm dry weight and cormels number/plant. The highest values were obtained for all corm production parameters when gladiolus plants received compost at 15 ton/fed. in combination with E.M. + A.Y.

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تأثير إضافة الكمبوست والتسميد الحيوي وبعض الفيتامينات على الجلاديولس

محمود عبد الهادي حسن عبده، محمد كمال علي وأية سمير أحمد أحمد
قسم البساتين – كلية الزراعة – جامعة المنيا

تم إجراء تجربة حقلية خلال موسمين متتاليين ٢٠١٢/٢٠١١ و٢٠١٣/٢٠١٢ بمشتل كلية الزراعة جامعة المنيا وذلك بهدف دراسة تأثير بعض معاملات التسميد بالكمبوست بمعدل صفر ، ٥ ،١٠، ١٥ طن/فدان والتسميد الحيوي (الكائنات الحية الدقيقة الفعالة .E.M والخميرة) والفيتامينات (فيتامين هـ وفيتامين ب١) أو هما معاً وكذلك تأثير التداخل بين الكمبوست والتسميد الحيوي والفيتامينات على نبات الجلاديولس جراندفلورس صنف إيروفيجن.

وقد أظهرت النتائج أن صفات النمو الخضري (طول الورقة وعدد الأوراق/نبات والوزن الجاف للأوراق/نبات) وكذلك صفات التزهير (طول الشمراخ وعدد الزهيرات للشمراخ وقطر الزهيرة السفلى) وإنتاجية الكورمات والكريمات (قطر الكورمة ووزنها جاف وعدد الكريمات/نبات) ازداد تدريجياً بزيادة مستوى التسميد بالكمبوست.

أدت كل معاملات التسميد الحيوي والفيتامينات إلى زيادة معنوية لكل صفات النمو الخضري وقياسات الأزهار وكذلك إنتاجية الكورمات مقارنة بمعاملة الكنترول وبدت معاملة E.M + الخميرة النشطة أكثر تأثيراً في ذلك من المعاملات الأخرى.

وجد أن استعمال المعدل المرتفع من الكمبوست (١٥ طن/فدان) مع خليط التسميد الحيوي (الخميرة + E.M) قد أدى إلى تحسن في مختلف صفات النمو الخضري والزهري وإنتاجية الكورمات لنباتات الجلاديولس.

قام بتحكيم البحث

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