J. Agric. Sci. Mansoura Univ., 34 (6): 6577 - 6588, 2009

EFFECT OF SOME ORGANIC AND BIO-FERTILIZATION TREATMENTS ON GLADIOLUS PLANTS
2- CORM PRODUCTION AND CHEMICAL CONSTITUENTS

Hassanein, Magda M.* and Soheir G. El – Sayed**
*** Hort. Res., Inst., Agric. Res. Center, Giza, Egypt.**
**** Antoniades garden, Alexandria, Egypt**

ABSTRACT

A field experiment was conducted during the two successive seasons of 2006 / 2007 and 2007 / 2008 at the Nursery of ornamental plants, Fac. Agric. Minia Univ. to investigate the effect of compost (0.0, 4, 8 and 12 t / fed.) and biofertilizers treatments (phosphorein and / or E.M.) on corm production and chemical constituents of *Gladiolus grandiflorus* cv. Eurovision.

The obtained results indicated that, corm diameter, number of cormels / plant, dry weight of corm and cormels as well as chemical constituents including total chlorophyll, percentages of N, P and K in the leaves, N, P, K and total sugars contents in corm were gradually increased by increasing the levels of compost.

All biofertilizer treatments significantly increased corm production and chemical constituents parameters in comparison to the control plant, Phosphorein + E.M. treatment was more effective in this concern.

The interaction between compost and biofertilization treatments was significant with the highest values for corm production and chemical constituents were obtained due to compost at 12 t / fed. in combination with phosphorein + E.M.

INTRODUCTION

Gladiolus grandiflorus, L. plant is belongs to Family iridaceae and considered as one of the most important flowering bulbs grown in Egypt. The superb and attractive cut flowers are greatly needed for exportation and for local market as well, during winter and spring seasons.

The effect of organic fertilization on increasing the corm production, number of cormels, fresh and dry weights of corms and cormels of gladiolus were reported by many investigators such as Liu *et al.,* (1998), Gangadharan and Gopinath (2000), Conti *et al.,* (2001), Zaghloul and Moghazy (2001), Zaghloul and Atta – Alla (2001) and Atta–Alla *et al.,* (2003). Also, Atta–Alla *et al.,* (2003) found that the organic fertilizers improved the chemical composition of Gladiolus.

Biofertilizersation treatments were found to have stimulating effect on bulb production as reported by Kathiresan *et al.,* (2002), Abdou *et al.,* (2004) and Taha and Hassan (2008) on gladiolus, and El–Naggar (1998) on tuberose. They found that bulb production and N, P and K % and content as well as pigments content and total carbohydrates were increased by using biofertilization treatments.

The aim of this work is to study the effect of application of compost and biofertilizer treatments on corm production, as well as, chemical constituents of *Gladiolus grandiflorus* cv. Eurovision plants.

MATERIALS AND METHODS

The present study was carried out at the Nursery of ornamental plants, Fac. Agric., Minia Univ. during two successive seasons of 2006 / 2007 and 2007 / 2008 on gladiolus plants.

Gladiolus grandiflorus cv. Eurovision corms were obtained from Holland by Basiony nurseries, Cairo, Egypt. Average corm diameter was 2.8 and 2.7 cm and corm weight was 9.3 and 9.1 g for the first and second seasons, respectively. Corms were planted on Nov. 3rd for both seasons in 1.8 × 2 m plots containg 3 ridges, 50 cm apart, corms were planted in hills, 20 cm apart (8 corms / ridge). Physical and chemical properties of the soil used are listed in Table (A). The split plot design with three replicates was followed in this experiments.

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

Soil properties	Value	Soil properties	Value
Sand %	15.56	Ex Ca mg / 100g soil	17.92
Silt %	39.98	Total N %	0.14
Clay %	44.46	Avail. P ppm.	19.12
Texture grade	Clay loame	Extr. k mg / 100 g soil	2.17
Organic matter %	1.51		
Ca Co_3 %	1.45	DTPA Fe	8.75
E. C. m mhos / cm	0.67	Ext. ppm Zn	2.99
pH (1 : 2.5)	8.02	Mn	25.65

The four levels of compost fertilization treatments were considered as main plots and the four biofertilization treatments were the sub plots. The four levels of compost treatments were 0.0, 4, 8 and 12 t / fed. The compost was added before planting during the soil preparation. Compost analysis is shown in Table (B).

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

pH	Humidity %	Organic matter %	N%	P%	K%	Fe ppm	Mn ppm	Cu ppm	Zn ppm	C/N
8.3	26	65	2.15	1.5	1.26	1025	115	180	28	1:16

The biofertilization treatments were as follow : 1- without biofertilization (control), 2- phosphorein, 3- effective microorganisms (E.M.), 4- phosphorein + E.M.

The biofertilizers were applied three ties to soil beside the plants at 6.4 kg / fed. of phosphorein and / or 50 cm^3 / plant of E.M. The soil applied was carried out three times, one month and two months after planting and after flower cut for corm and cormels production.

Effective microorganisms (E.M.) is a biofertilizer containing photosynthetic bacteria, lactic acid bacteria and yeasts. One ml contain 10^7 cells of bacteria). This biofertilizer was obtained from the Laboratory of Biofertilizers, Department of Genetics, Fac. Agric., Minia Univ.

Phosphorein a biofertilizer containing phosphate dissolving bacteria was obtained from Ministry of Agriculture.

The following data were recorded :

1- Under ground parts characters at harvesting after the foliage had dried (under ground parts were lifted two months after cut spikes) : corm diameter (cm), corm dry weight (g), number of new cormels / plant and dry weights of new cormels(g) / plant.
2- Determination of some chemical constituents : leaves samples were taken after 75 days from planting, but corms and cormels samples were taken after two months from flowering diminished.

Total chlorophyll (mg / g. F.W.) were determined in the fresh leaves samples using the method described by Moran (1982). The percentage of N, P and K in the dry leaves and dry corms were estimated according to Page *et al.,* (1982). Then the contents of the three elements in the dry corms were calculated. Recording sugars in the dry corms (mg / g) were determined according to Moore (1974).

All 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- Corm production :

Data in Tables (1 and 2) indicated that corm diameter, corm dry weight, number of cormels / plant and cormels dry weight / plant were significantly increased with increasing compost fertilizer levels, during the two growing seasons, in comparison with control. The high level of compost (12 t / fed.) resulted the highest values for all corm production. Similar results were revealed on gladiolus plants such as those of Liu *et al.,* (1998), Gangadharan and Gopinath (2000), Conti *et al.,* (2001), Zaghloul and Moghazy (2001), Zaghloul and Atta–Alla (2001) and Atta–Alla *et al.,* (2003).

The increase in the corm production was attributed to positive effect of organic fertilizers on improving the vegetative growth, as well as, stimulating chlorophyll (Table, 2) which reflected on increasing the underground organs or parts of gladiolus.

In relation to biofertilizer treatments, three tested ones suppressed, significantly at 5 % level, the control treatment in both first and second seasons in producing wider corm, higher new cormels / plant and heavier dry weights of corms and cormels as clearly indicated in Tables (1 and 2). Among the three biofertilizer treatments, the mixed biofertilizer gave the highest values for corm diameter and number of cormels / plant, as well as, dry weights of corm and cormels. E.M. treatment was effective than phosphorein treatment in this concern. Similar observations were pointed out on gladiolus plants by Kathirestan *et al.,* (2002), Abdou *et al.,* (2004) and Taha and Hassan (2008). Biofertilizers treatments were found to have stimulating effect on bulb production of some other plants such as *Narcassis* (El–Naggar and Mahmoud, 1994), tuberose (Wang and Patil, 1994 and Wang *et al.,* 1995).

The stimulatory effect of the treatments of biofertilizer on corm production may be due to the mode of action of biofertilizer on the soil, gibberellen, cytokinins, enzymes and vitamins which came from addition of biofertilizers, which gave better growth and better photosynthetic (Table, 2). Consequently increase in all corm production parameters.

The interaction between compost and biofertilizer treatments was significant for corm diameter, number of new cormels / plant and dry weights of corm and cormels / plant in the two seasons as shown in Tables (1 and 2). The highest values were obtained for all corm production parameters when gladiolus plants received compost at 12 t / fed. in combination with phosphorein + E.M.

2- Chemical constituents :

2- A- Total chlorophyll :

The content of total chlorophyll in the fresh leaves of gladiolus was significantly promoted due to compost treatments, in the two seasons, in comparison with those of untreated plants as shown in Table (2). The high level of compost (12 t / fed.) gave the highest values for total chlorophyll pigments in both seasons, followed by medium level (8 t / fed.), then low level (4 t / fed.) with significant differences were detected between them. This result may be attributed to the increase in nutrient elements and / or positive role of organic compost on the physical and chemical properties of the soil, that reflected on the growth and the chlorophyll content.

In harmony with these results regarding organic fertilization treatments were those reported by Tawfik (2001) on potato plants.

In relation to the influence of different biofertilizer treatments, total chlorophyll content were promoted in the two seasons (Table, 2). Obtained data show that using both biofertilizer together (phosphorein + E.M) was effective than the use of either one. Also, the differences between biofertilizer treatments and control was statistically significant, with significant differences were detected between the three biofertilization treatments in both seasons. This result may be attributed not only to the increase in nutrient elements, but also to the production of growth promoting substances which gave a positive effect of plant growth and chlorophyll content (Bashan and Holguin, 1997 and Tawfik, 2001). Similar results were obtained by Abdou *et al.,* (2004) and Taha and Hassan (2008) on gladiolus plants.

The interaction between the two main factors (A × B) was significant in the first and second seasons with the highest values being obtained due to the use of compost at 12 t / fed. in combination with phosphorein plus E.M. or E.M. as shown in Table (2).

2- B- Leaves nitrogen, phosphorus and potassium percentages :

Data in Tables (2 and 3) indicated that N, P and K % were gradually increased by the gradual increase compost levels. The highest values in this concern were obtained from high level of compost fertilizer. This was in accordance with the previous results on gladiolus (Zaghloul and Atta–Alla, 2001, Zaghloul *and Moghazy,* 2001), *Ornithogalum thyrsoides* (Gomaa, 2000, Khalafalla *et al.,* 2000) and tuberose (Abd El–Karim, 2001).

The increase in percentages of the three elements in the leaves of gladiolus plants could be attributed mainly to the effect of compost on increased the amount of elements on the soil and consequently increased the amount of absorbed such elements by gladiolus plants (Tables, 2 and 3).

In regard to biofertilization treatments significant differences were obtained in N, P and K % in gladiolus leaves, due to such treatments over those of untreated plants (Tables, 2 and 3). Using both biofertilizers together (phosphorein + E.M.) was effective than the use of either one. Also, phosphorein treatment was more effective than E.M. regarding P %, while opposite effective were obtained regarding N and K %.

Similar results were obtained by Abdou *et al.,* (2004) and Taha and Hassan (2008) on gladiolus and El–Naggar (1998) on tuberose plants. This result may be reflected to the increment of N and P in the rhizosphere of plant uptake for inoculation by nitrogen fixed bacteria and / or phosphate – dissolving bacteria that improved the uptake of N and P (Hassan, 1997).

The interaction between compost and biofertilization treatments was significant in the two seasons for N and P %, while that of K % was not significant (Tables, 2 and 3). The highest percentages were obtained due to the high level of compost in combination with phosphorein plus E.M.

2- C- Corms nitrogen, phosphorus, potassium and total sugars content :

In both seasons, increasing the levels of compost linearly increased the contents of nitrogen, phosphorus, potassium and total sugars in the corms of gladiolus plants. In this concern, the treatment with high level of compost (12 t / fed.) gave the highest contents (Tables, 3 and 4). On the other hand, the lowest values of N, P, K and total sugars in the corms of gladiolus were recorded with the plants without organic fertilization. Moreover, significant differences were detected between biofertilizer treatments and control treatment, also between biofertilization treatments in most cases.

These results are in agreement with those obtained by Zaghloul *and moghazy* (2001) on gladiolus, Gomaa (2000) and Khalafalla *et al.,* (2000) on *Ornithogalum thyrsoides* and Nasr (2001) on tuberose plants.

In general, these results as mentioned above, could be attributed to application of organic materials improved soil properties, which it turn reflects on vigorous plant growth parameter, hence increase nutrients uptake and photosynthetic process which led to produce vigorous plants, finally which in turn reflects on the corm quality.

Corms contents of the three nutrients N, P and K, as well as, total sugars was significantly increased, in the two growing seasons, as a result of supplying gladiolus plants with biofertilizer treatments in comparison with corms contents of untreated plants (Tables, 3 and 4). The highest values were obtained when phosphorein and E.M. were used together.

These results are in harmony with those of Abdou *et al.,* (2004) and Taha and Hassan (2008) on gladiolus and El–Naggar (1998) on tuberose.

The stimulatory effect of biofertilizer on N and P contents may be due to the increment of these elements in the root zone from inoculation with biofertilizers either phosphorein or E.M. and their mixture, that improved the uptake of nutrients.

The interaction between compost and biofertilization treatments was significant, in both seasons, in regard to corm contents of N, P, K and total sugars (Tables, 3 and 4). The highest values for the four constituents were obtained due to phosphorein + E.M. with compost at high level.

It is clear from the above results that inoculation gladiolus plants with phosphorein plus E.M. led to increasing the efficiency use of added organic fertilizer and consequently improved plant growth which it turn reflects on corm production.

REFERENCES

Abd El – Karim, F.M. (2001) : Studies on some factors affecting growth, flowering and bulb productivity of *Polianthes tuberosa*, L. plant. Ph.D. Thesis, Fac. Agric., Kafr El – Sheikh, Tanta Univ.

Abdou, M.A.H.; Attia, F.A.; Aly, M.K. and Sayed, E.H. (2004) : Response of *Gladiolus* plants to some bio and chemical fertilization treatments. 2- Corm production and chemical constituents. The Fifth Arabian Hort. Conf. Ismalia, Egypt, 24–28 March, Vol. (1).

Atta – Alla, H.K.; Zaghloul, M.A. and Hashish, K.H. (2003) : Effect of organic manure and NPK fertilizers on vegetative growth, flowering and chemical composition of some *Gladiolus* cultivars. Annals Agric. Svi., Moshtohor, 41 (2) : 680 – 691.

Bashan, Y. and Holguin, G. (1997) : *Azospirillum* – plant relationship. Environmental and physiological advances (1990 – 1996). Con J. Microbiol., 43 : 103 – 121.

Conte, C.A.M.; Ruppenthal, V.; Zigiotto, D.C.; Bianchini, M.I.F. and Backes, C. (2001) : Organic fertilization in the culture of the *Gladiolus*. Scientia Agraria Paranaensis, 1 (1) : 33 – 41 (C.F. CAB Anst., ENAL).

El – Naggar, A.L. and Mahmoud, S.M. (1994) : Effect of inoculation with certain *Azospirillum* strains and nitrogen fertilization on *Narcissus tazetta*, L. under different soil textures, Assiut. J. Sci., 25 (4) : 135 – 151.

El – Naggar, A.L. (1998) : Investigation on the response of tuberose plants (*Polianthes tuberosa* L.) cv. Double to biofertilization with *Azospirillum* strains mixture and nitrogen fertilization under four different soil textures. J. Agric. Sci. Mansoura Univ, 23 (12) : 6177 – 6203.

Gangadharan, G.D. and Gopinath, G. (2000) : Effect of organic and inorganic fertilizers on growth, flowering and quality of *Gladiolus* cv. White Prosperity. Karnataka J. Agric. Sci., 13 (2) : 401 – 405 (C.F. www. Bids. Ac. UK).

Gomaa, S.A. (2000) : Physiological studies on *Polianthes tuberosa* and *Ornithogalum thyrsoides* bulbs. Ph.D. Thesis, Fac. Agric. Kafr El – Sheikh, Tanta Univ.

Hassan, M.E. (1997) : Biofertilizers, production and uses : Proceeding of the Training Course on Bio–organic Farming System for Sustainable Agriculture, Cairo, Egypt, July, 1997.

Kathiresan, C.; Venkatesha, J.; Misra, R.L. and Sauyat, M. (2002) : Effect of biofertilizers with levels of N and P on *Gladiolus*. Proc. National Symposium on Indian Floriculture in the New Millennium, Lai – Bagh. Bangolar, 25 – 27 Feb. 2002 P : 118 - 121 (C.F. www. bids. ac. UK).

Khalafalla, M.; Mahroak, E.; Nofal, E.; Nabih, A. and Goma, S. (2000) : Effect of growing medium and chemical fertilization on growth, flowering, bulbs productivity and chemical constituents of *Ornithogalum thyrsoides*, Jacq. J. Agric. Res. Tanta Univ., 26 (2) : 262 – 276.

Liu, W.C.; Wu, G.D.; Yao, T.P.; Chen, F.H. and Chen, W.H. (1998) : Effect of soil factors and management practices on soil fertility and *Gladiolus* growth in a slate alluvial soil Taiwan Sugat. 45 (3) : 20 – 25. (C.F. CAB Abst., ENAL).

Moore, T.C. (1974) : Research Experiences in plant physiology, A Laboratory Manual, Springer Verlag, Berlin, Heidelberge, New York, P 247 – 257.

Moran, R. (1982) : Formula for determination of chlorophylls pigment extracted with N.N. dimethyl formamide. Plant physiol., 69 : 1376 – 1381.

MSTAT–C (1986) : A microcomputer program for the design management and analysis of agronomic research experiments (Version 4.0), Michigan State Univ., USA.

Nasr, A.A. (2001) : Effect of some factors on growth, flowering and chemical composition of *Polianthes tuberosa*, L. plants. Ph.D. Thesis, Fac. Agric. Cairo Univ.

Page, A.L.; Miller, R.H. and Kenney, D.R. (1982) : Methods of Soil Analysis, part II. Amer. Soc. Agron. Inc, Madison, Wisconsin, U.S.A.

Taha, R.A. and Hassan, A.H. (2008) : Response of *Gladiolus* plants to mineral and biofertilization treatments. 2- Corm production and chemical constituents. Alex. J. Agric. Res. 53 Special Issue, 87 – 95.

Tawfik, A.S.E. (2001) : Effect of some organic and biofertilizers on growth, yield and quality of Potato. Ph.D. Thesis, Fac. Agric. Mansoura Univ.

Wang, S.S. and Patil, P.L. (1994): Response of tuberose to biofertilizers and nitrogen. J. Moharashra. Agric. Univ., 19 (3) 484 – 485 (C.F. El – Naggar 1998).

Wang, S.S.; Patil, P.L. and Patil, J.J. (1995) : Effect of biofertilizers alone and with nitrogen levels on tuberose cv. Sping petaled. J. Soil and Crops, 5 (2) : 97 – 99.

Zaghloul, M.A.R. and Moghazy, E.I. (2001) : Response of some *Gladiolus* cultivars to organic manure and NPK fertilizers in sandy soil under Sinai conditions. Annals Agric. Sci., Moshtohor, 39 (1) : 585 – 602.

Zaghloul, M.A.R. and Atta–Alla, H.K. (2001) : Effect of irrigation, sewage sludge and cement dust on the vegetative growth, flowering and chemical composition of *Gladiolus* grown in sandy soil. Annals. Agric. Sci., Moshtohor, 39 (1) : 565 – 583.

تأثير بعض معاملات التسميد العضوى والحيوى على نباتات الجلاديولس
٢- إنتاج الكورمات والمحتوى الكيماوى

ماجدة محمد حسانين* و سهير جمعة السيد**
*** معهد بحوث البساتين – مركز البحوث الزراعية – الجيزة**
**** حديقة الانطونيادس – الإسكندرية**

فـى تجربـة حقليـة فـى موسـمى ٢٠٠٦ / ٢٠٠٧ و ٢٠٠٧ / ٢٠٠٨ بمشـتل الزينـة بكليـة الزراعة جامعة المنيا بغرض دراسة تأثير معدلات مختلفة من سماد الكمبوست (صفر ، ٤ ، ٨ ، ١٢ م^{٣} / فدان) بالإضافة إلى التسميد الحيوى (الفوسفورين و / أو الكائنات الحية الدقيقة الفعالة .E.M أو هما معاً) على إنتاجية الكورمات والكريمات والمحتوى الكيماوى لنباتات الجلاديولس جراندفلورس صنف إيروفيشن .

أوضحت النتائج أن قطر الكورمة وعدد الكريمات والمحتوى الكيماوى متضمناً الكلوروفيل الكلى ونسب النتروجين والفوسفور والبوتاسيوم فى الأوراق والمحتوى من النتروجين والفوسفور والبوتاسيوم والسكريات الكلية فى الكورمات زاد تدريجياً مع زيادة مستويات سماد الكمبوست .

أوضحت النتائج أيضا أن كل معاملات التسميد الحيوى أدت إلى زيادة معنوية لكل صفات إنتاج الكورمات وكذلك المحتوى الكيماوى للكنترول مقارنة بمعاملة الكنترول .كما ظهر أن المعاملة الخليطة لكل من معاملة الفوسفورين والكائنات الحية الدقيقة الفعالة .E.M كانت أكثر تأثيراً فى هذا الشأن .

وأخيرا اتضح أن التداخل بين معاملات التسميد العضوى والحيوى كانت معنوية وتم الحصول على أعلى قيمةعند استخدام سماد الكمبوست بالمعدل المرتفع (١٢ م^{٣} / فدان) مع خليط من الفوسفورين والكائنات الحية الدقيقة الفعالة .E.M .

Table (1): Effect of some organic and biofertilization treatments on corm diameter, corm dry weight and number of cormels/ plant of gladiolus plants during 2006 / 2007 and 2007 /2008 seasons.

Biofertilizers	Level of compost									
	1st season					2nd season				
	0.0	4 t/fed.	8 t/fed.	12 t/fed.	Mean B	0.0	4 t/fed.	8 t/fed.	12 t/fed.	Mean B
Corm diameter (cm)										
Control	2.94	3.53	4.06	4.27	**3.70**	3.01	3.62	4.27	4.39	**3.82**
Phosphorein	3.15	3.81	4.19	4.42	**3.89**	3.23	3.79	4.45	4.61	**4.02**
E.M.	3.36	4.01	4.26	4.51	**4.04**	3.41	4.17	4.61	4.83	**4.26**
Phos.+ E.M.	3.49	4.23	4.45	4.73	**4.23**	3.54	4.36	4.72	4.96	**4.40**
Mean (A)	**3.24**	**3.90**	**4.24**	**4.48**		**3.30**	**3.99**	**4.51**	**4.70**	
L.S.D. 5 %	**A: 0.22**	**B: 0.13**	**AB: 0.26**			**A: 0.18**	**B: 0.12**	**AB: 0.24**		
Corm dry weight (g)										
Control	25.27	27.39	32.63	35.43	**30.18**	26.45	30.95	36.10	37.24	**32.69**
Phosphorein	28.55	30.92	34.87	37.81	**33.04**	29.80	33.78	38.03	40.09	**35.43**
E.M.	29.64	32.25	34.92	37.96	**33.69**	30.80	36.67	38.83	41.08	**36.85**
Phos.+ E.M.	29.88	32.85	35.19	38.22	**34.04**	31.01	36.88	38.95	41.22	**37.02**
Mean (A)	**28.34**	**30.85**	**34.40**	**37.36**		**29.52**	**34.57**	**37.98**	**39.91**	
L.S.D. 5 %	**A: 1.62**	**B: 0.39**	**AB: 0.78**			**A: 2.11**	**B: 0.81**	**AB: 1.62**		
Number of cormels / plant)										
Control	20.00	25.40	29.61	32.72	**26.93**	20.7	25.80	29.99	33.10	**27.40**
Phosphorein	26.11	32.80	36.93	39.99	**33.96**	27.18	33.29	38.41	42.53	**35.35**
E.M.	30.14	35.21	38.91	42.09	**36.59**	31.67	36.52	40.93	44.15	**38.32**
Phos.+ E.M.	33.26	37.31	41.15	45.10	**39.21**	34.01	39.18	43.10	47.26	**40.89**
Mean (A)	**27.38**	**32.68**	**36.65**	**39.98**		**28.39**	**33.70**	**38.11**	**41.76**	
L.S.D. 5 %	**A: 2.71**	**B: 1.11**	**AB: 2.22**			**A: 1.79**	**B: 0.86**	**AB: 1.72**		

Phos. = Phosphorein
E. M. = Effective microorganisms

Table (2): Effect of some organic and biofertilization treatments on cormels dry weight / plant, total chlorophyll and N % in the leaves of gladiolus plants during 2006 / 2007 and 2007 / 2008 seasons.

Biofertilizers	Level of compost									
	1st season					2nd season				
	0.0	4 t/fed.	8 t/fed.	12 t/fed.	Mean B	0.0	4 t/fed.	8 t/fed.	12 t/fed.	Mean B
Cormels dry weight / plant (g)										
Control	5.68	6.94	7.94	8.26	**7.21**	6.17	7.18	7.98	8.61	**7.49**
Phosphorein	6.22	7.58	8.49	9.31	**7.90**	6.85	7.98	8.83	9.74	**8.35**
E.M.	6.87	8.25	8.89	9.97	**8.50**	7.51	8.87	9.31	10.22	**8.98**
Phos.+ E.M.	7.26	8.94	9.53	10.40	**9.03**	8.26	9.43	9.99	10.95	**9.66**
Mean (A)	**6.51**	**7.93**	**8.71**	**9.49**		**7.20**	**8.36**	**9.03**	**9.88**	
L.S.D. 5 %	**A: 0.25**	**B: 0.21**	**AB: 0.42**			**A: 0.38**	**B: 0.26**	**AB: 0.52**		
Total chlorophyll (mg / g. F.W.)										
Control	2.563	2.953	3.261	3.473	**3.063**	2.634	3.022	3.311	3.333	**3.075**
Phosphorein	2.871	3.341	3.621	3.801	**3.409**	2.933	3.413	3.674	3.685	**3.426**
E.M.	2.952	3.456	3.736	3.918	**3.516**	3.025	3.521	3.781	3.810	**3.534**
Phos.+ E.M.	3.120	3.517	3.816	3.996	**3.612**	3.191	3.580	3.864	3.985	**3.655**
Mean (A)	**2.877**	**3.317**	**3.609**	**3.797**		**2.946**	**3.384**	**3.658**	**3.707**	
L.S.D. 5 %	**A: 0.185**	**B: 0.096**	**AB: 0.192**			**A: 0.044**	**B: 0.087**	**AB: 0.174**		
Leaves N %										
Control	1.56	1.84	2.17	2.21	**1.95**	1.57	1.85	1.87	1.91	**1.80**
Phosphorein	1.67	2.04	2.25	2.27	**2.06**	1.69	2.07	2.10	2.18	**2.01**
E.M.	1.88	2.21	2.31	2.33	**2.18**	1.91	2.25	2.27	2.34	**2.19**
Phos.+ E.M.	1.97	2.26	2.35	2.38	**2.24**	1.99	2.29	2.31	2.40	**2.25**
Mean (A)	**1.77**	**2.09**	**2.27**	**2.30**		**1.79**	**2.12**	**2.14**	**2.21**	
L.S.D. 5 %	**A: 0.05**	**B: 0.06**	**AB: 0.12**			**A: 0.04**	**B: 0.05**	**AB: 0.10**		

Phos. = Phosphorein

Table (3): Effect of some organic and biofertilization treatments on P and K % in the leaves and corm nitrogen content of gladiolus plants during 2006/2007 and 2007/2008 seasons.

Biofertilizers	Level of compost									
	1st season					2nd season				
	0.0	4 t/fed.	8 t/fed.	12 t/fed.	Mean B	0.0	4 t/fed.	8 t/fed.	12 t/fed.	Mean B
Leaves P %										
Control	0.201	0.275	0.304	0.319	**0.275**	0.210	0.281	0.310	0.310	**0.278**
Phosphorein	0.246	0.328	0.347	0.356	**0.319**	0.251	0.334	0.351	0.355	**0.323**
E.M.	0.221	0.298	0. 317	0. 329	**0.291**	0. 229	0.301	0.326	0.326	**0. 296**
Phos.+ E.M.	0.264	0.346	0.368	0.384	**0.341**	0.268	0.352	0.372	0.391	**0.346**
Mean (A)	**0.233**	**0.312**	**0.334**	**0.347**		**0.240**	**0.315**	**0.340**	**0.346**	
L.S.D. 5 %	**A: 0.013**	**B: 0.011**	**AB: 0.022**			**A: 0.012**	**B: 0.013**	**AB: 0.026**		
Leaves K %										
Control	1.631	1.721	1.830	1.895	**1.769**	1.643	1.735	1.839	1.841	**1.765**
Phosphorein	1.710	1.826	1.910	1.964	**1.853**	1.718	1.831	1.931	1.966	**1.862**
E.M.	1.731	1.740	1.962	2.030	**1.866**	1.741	1.748	1.982	2.010	**1.870**
Phos.+ E.M.	1.742	1.768	1.992	2.101	**1.901**	1.753	1.777	2.031	2.091	**1.913**
Mean (A)	**1.704**	**1.764**	**1.924**	**1.998**		**1.714**	**1.773**	**1.946**	**1.977**	
L.S.D. 5 %	**A: 0.074**	**B: 0.083**	**AB: N.S**			**A: 0.033**	**B: 0.095**	**AB: N.S**		
Corm nitrogen content (mg)										
Control	79.1	86.8	103.4	112.4	**95.4**	84.1	99.4	114.9	119.4	**104.5**
Phosphorein	90.5	98.0	110.5	119.9	**104.7**	94.8	109.4	127.9	130.1	**115.6**
E.M.	110.1	122.2	124.1	130.6	**121.8**	117.1	136.6	137.1	139.5	**132.6**
Phos.+ E.M.	120.4	124.4	131.6	151.1	**131.9**	118.9	138.9	139.7	143.6	**135.3**
Mean (A)	**100.0**	**107.9**	**117.4**	**128.5**		**103.7**	**121.1**	**129.9**	**133.2**	
L.S.D. 5 %	**A: 6.11**	**B: 5.22**	**AB: 10.44**			**A: 10.36**	**B: 9.12**	**AB: 18.24**		

Phos. = Phosphorein
E. M. = Effective microorganisms

Table (4): Effect of some organic and biofertilization treatments on content of phosphorus, potassium and total sugars in the corm of gladiolus plants during 2006/2007 and 2007/2008 seasons.

Biofertilizers	Level of compost									
	1st season					2nd season				
	0.0	4 t/fed.	8 t/fed.	12 t/fed.	Mean B	0.0	4 t/fed.	8 t/fed.	12 t/fed.	Mean B
Corm phosphorus content (mg)										
Control	42.9	47.9	58.7	65.6	**53.8**	44.9	54.2	65.1	68.9	**58.3**
Phosphorein	57.1	64.9	73.3	83.2	**69.6**	59.8	70.9	81.9	88.2	**75.2**
E.M.	53.4	59.7	66.4	74.0	**63.4**	55.5	67.9	73.8	80.4	**69.4**
Phos.+ E.M.	58.3	67.1	74.1	86.9	**71.6**	58.8	71.9	77.9	96.9	**76.4**
Mean (A)	**52.9**	**59.9**	**68.1**	**77.4**		**54.8**	**66.2**	**74.7**	**83.6**	
L.S.D. 5 %	**A: 6.1**	**B: 2.5**	**AB: 5.0**			**A: 5.1**	**B: 1.7**	**AB: 3.4**		
Corm potassium (mg)										
Control	28.8	32.5	40.2	45.3	**36.7**	31.1	37.6	45.3	48.6	**40.7**
Phosphorein	35.3	39.7	46.3	52.1	**43.4**	37.8	44.2	51.4	56.1	**47.4**
E.M.	39.5	44.6	49.9	56.1	**47.5**	42.1	51.5	56.6	61.7	**53.0**
Phos.+ E.M.	42.9	48.7	53.9	60.3	**51.5**	45.5	55.6	60.6	65.9	**56.9**
Mean (A)	**36.6**	**41.4**	**47.6**	**53.5**		**39.1**	**47.2**	**53.5**	**58.1**	
L.S.D. 5 %	**A: 3.8**	**B: 2.3**	**AB: 4.6**			**A: 4.1**	**B: 2.1**	**AB: 4.2**		
Corm total sugars content (mg / g. D.W.)										
Control	41.95	47.10	49.31	51.83	**47.55**	43.16	48.21	50.11	51.91	**48.35**
Phosphorein	46.15	53.21	55.45	57.95	**53.19**	47.38	53.81	56.4	58.18	**53.94**
E.M.	48.16	54.95	57.01	59.18	**54.83**	49.17	55.81	58.91	60.91	**56.20**
Phos.+ E.M.	51.28	56.81	58.95	61.01	**57.01**	52.00	56.98	60.00	62.31	**58.07**
Mean (A)	**46.89**	**53.02**	**55.18**	**57.49**		**47.93**	**53.70**	**56.36**	**58.33**	
L.S.D. 5 %	**A: 2.1**	**B: 0.81**	**AB: 1.62**			**A: 1.98**	**B: 0.53**	**AB: 1.06**		

Phos. = Phosphorein
E. M. = Effective microorganisms