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INFLUENCE OF ORGANIC MANURE, BIOFERTILIZER AND/OR SOME VITAMIN TREATMENTS ON: B. CORM AND CORMELS PRODUCTIVITY AND SOME CHEMICAL CONSTITUENTS OF *GLADIOLUS GRANDIFLORUS* VAR. GOLD FIELD PLANTS

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ABSTRACT: A field experiment was conducted to investigate the effect of plant farmyard manure (FYM) as an organic fertilizer (0, 10, 15 and 20 m^3/fed) and Minia Azotein (M.A.) at 50 ml/plant and/or some vitamins (E and C) each at 50 ppm on corm and cormels productivity and chemical constituents of *Gladiolus grandiflorus* var. Gold Field plants. The obtained results indicated that corm diameter (cm), number of cormels/plant, dry weight of corm and cormels (g), as well as, chemical constituents including chlorophyll a, b, carotenoids and percentages of N, P and K in the corms were gradually increased by increasing the levels of FYM. Significant differences were detected among the four used treatments. So, the high level of FYM resulted the highest values. All six treatments of Minia Azotein (M.A.) and/or some vitamins (E and C) significantly increased corm and cormels productivity and their content of chemical constituents in comparison to the control plants. The treatments of Minia Azotein (M.A.) plus vit. E plus vit. C was more effective than other treatments for corm and cormels productivity, as well as, photosynthetic pigments content (mg/g. F.W.) and the percentages of nitrogen, phosphorus and potassium, in most cases. The interactions between farmyard manure (FYM), Minia Azotein (M.A.) and/or some vitamins (E and C) treatments were significant for all previous characters, except for K %. In most cases, the highest values of corm and cormels productivity were achieved by FYM (20 m^3/fed) in combination with Minia Azotein (M.A.) plus vit. E plus vit. C followed by 20 m^3/fed FYM with M.A. + vit. C then 15 m^3/fed FYM with M.A. + vit. E + vit. C which recorded the highest contents of pigments and elements of N and P%.

Key words: *Gladiolus grandifloras*, farmyard manure, biofertilizers, vitamins, corm, cormels, chemical constituents.

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INTRODUCTION

Gladiolus grandiflorus var. Gold Field plant is considered one of the most important flowering bulbs grown in Egypt. 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 exporting, Gladiolus plants are propagated by corms and cormels.

Farmyard manure as organic fertilizer, Minia Azotein (M.A.), vit. E and vit. C are among the important agricultural treatments which have been proved to improve corm production of gladiolus plants.

The effect of organic fertilization on increasing corm diameter, number of cormels and dry weight of corm and cormels of gladiolus were reported by many investigators, such as Abdou and Ibrahim (2015) and Karagöz *et al.* (2019) on gladiolus, Abd El-Karim (2001), Abdel-Sattar *et al.* (2010), Srivastava *et al.* (2014) and Pattnaik (2016) on tuberose, El-Naggar and El-Nasharty (2009) on *Hippeastrum vittatum*, El-Sayed *et al.* (2012) on Freesia and Prasad et al. (2017) on lily plant who stated that improved the chemical composition of gladiolus plants as well.

Minia Azotein (M.A.) biofertilizer treatment were found to have stimulatory effects on corm and cormels productivity and chemical composition of gladiolus such as those summarized by Abdou *et al.* (2004), Hassanein and El-Sayed (2009), Mazhar and Eid (2016), Sathyanarayana *et al.* (2018) and Chakradhar *et al.* (2019) on gladiolus and Khan *et al.* (2009) on tulip plant

With regard to corm and cormels productivity, as well as, chemical constituents of gladiolus, some vitamins (E and C) treatments were found to increase corm diameter, number of cormels, dry weight of corm and cormels and pigments (chlorophyll a, b and carotenoids contents), as well as, NPK % (Ramraj *et al.* (1997), Abdel Aziz *et al*., 2009 and Abo Leila and Eid, 2011).

The aim of this work was to study the effect of application farmyard manure (FYM) fertilization, Minia Azotein (M.A.) and/or spraying with some vitamins (E and C) on corm and cormels productivity, as well as, chemical constituents of Gladiolus grandiflorus var. Gold Field plants.

MATERIALS AND METHODS

The present study was carried out at the Nursery and Laboratory of Ornamental Plants, Faculty of Agriculture, Minia University during two successive seasons of 2016/2017 and 2017/2018 on gladiolus plants.

Gladiolus grandiflorus var. Gold Field corms were obtained from Holland by Basiony nurseries, Cairo, Egypt. Average corm diameter was 2.7 and 3.3 cm and corms weight were 9.4 and 10.2 g for the first and second seasons, respectively. Corms were planted on October 1st for both seasons in 1.5 × 2.0 m plots containing 3 ridges, 50 cm apart. Corms were planted in hills, 20 cm apart (10 corms/ridge) at a depth of 5 cm under ground surface in clay loam soil. The physical and chemical analysis of the used soil in both seasons were determined according to Jackson (1973) and shown in Table (a)

The split plot design with three replicates was followed in this experiment. The four levels of FYM fertilization treatments (0, 10, 15 and 20 m^3/fed) were considered as main plots and the seven Minia Azotein (M.A.) and/or some vitamin (E and C) treatments (control, alpha tocopherols (vit. E) at 50 ppm, ascorbic acid (vit. C) at 50 ppm, Minia Azotein (M.A.) at 50 ml/plant, M.A. + vit. E, M.A. + vit. C and M.A. + vit. E + vit. C) were put in the sub-plots.

The chemical analysis of FYM was done according to Black *et al.* (1965) and is shown in Table (b).

Gladiolus plants were inoculated by Minia Azotein (M.A.) biofertilizer at the rate of 50 ml/hill, as well as, some vitamin (E and C) treatments each at the concentration of 50 ppm were applied, by hand sprayer, 3 times, one month and two months from planting date and after flowers cut for corm and cormels productivity. The plants were sprayed till run off. All agricultural practices were performed as usual in the region. The following data were recorded:

1. Under ground parts characters at harvesting after the foliage had dried (the under ground parts were lifted 2 months after cut spikes): corm diameter (cm), number of new cormels/plant and dry weights of corm and cormels (g).

Table a. Physical and chemical properties of the experimental soil.

Soil character	Values		Soil character		Values	
	2016/2017	2017/2018			2016/2017	2017/2018
Sand %	28.20	28.98	**Available P %**		15.15	15.64
Silt %	30.70	29.87	**Exchangeable K^+**		2.09	2.82
Clay %	41.10	41.15	**Exch. Ca^{++} mg/100 g soil**		31.71	31.10
Soil texture	Clay loam	Clay loam	**Exch. Na^+ mg/100 g soil**		2.42	2.53
Organic matter %	1.59	1.56				
$CaCO_3$ %	2.08	2.10		**Fe**	8.52	8.22
pH 1:2.5	7.80	7.77	**DTPA**	**Cu**	2.05	2.02
E.C. m mhose/cm	1.06	1.07	**Ext. ppm**	**Zn**	2.74	2.85
Total N %	0.07	0.08		**Mn**	8.24	8.09

Table b. Chemical analysis of FYM applied in the present study.

Properties	1st season	2nd season	Properties	1st season	2nd season
Organic matter %	28.0	27.5	**K %**	1.18	1.22
Carbon %	15.80	16.65	**Fe ppm**	239.0	237.5
Total N %	0.92	0.95	**Zn ppm**	271.2	273.1
C/N ratio	17.17	17.53	**Mn ppm**	233.5	235.8
Humidity %	8.00	7.91	**pH**	7.31	7.21
P %	0.23	0.25	**E.C. (mhose/cm)**	1.07	1.08

2. Determination of some chemical constituents: leaf samples were taken after 75 days from planting to determine chlorophyll a, b and carotenoids as mg/g f.w. using the method described by Fadl and Sari El–Deen (1978). The percentages of N, P and K in the dry corms (samples were taken after two months from flowering end) were estimated according to the methods described by Wilde *et al.* (1985), Champan and Pratt (1975) and Cottenie *et al.* (1982), respectively.

All obtained data were tabulated and statistically analyzed according to MSTAT-C (1986) and the L.S.D. test at 5 % was followed to compare between the means.

RESULTS AND DISCUSSION

1. Corm and cormels productivity:

Data listed in Tables (1 and 2) during both seasons indicated that corm diameter (cm), corm dry weight (g), number of cormels/plant and dry weight of cormels/plant (g) were significantly increased with increasing FYM level in comparison with untreated control plants. Among the three FYM treatments, the high level treatment (20 m^3/fed) resulted the highest values for all corm and cormels productivity over both media (15 m^3/fed) and low (10 m^3/fed) FYM treatments in the two seasons. Similar results were also revealed on gladiolus plants Ahmed (2013), Abdou and Ibrahim (2015) and Karagöz *et al.* (2019) on gladiolus, Abd El-Karim (2001), Abdel-Sattar *et al.* (2010), Srivastava *et al.* (2014) and Pattnaik (2016) on tuberose, El-Naggar and El-Nasharty (2009) on *Hippeastrum vittatum,* El-Sayed *et al.* (2012) on Freesia and Prasad *et al.* (2017) on lily plant.

The increase in the corm and cormels productivity was attributed to the positive effect of organic fertilizers on improving the vegetative growth, as well as, stimulating the photosynthetic pigments (Table, 3) which reflected on increasing the under ground parts of gladiolus.

Table 1. Effect of farmyard manure (FYM), biofertilizer and/or some vitamin treatments, as well as, their combination treatments on corm diameter (cm) and corm dry weight (g) of *Gladiolus grandiflorus* var. Gold Field during the first and second seasons.

Biofertilization and some vitamin treatments (B)	FYM levels (m^3/fed) (A)									
	1st season (2016/2017)					2nd season (2017/2018)				
	0	10	15	20	Mean (B)	0	10	15	20	Mean (B)
Corm diameter (cm)										
Control	3.34	3.74	4.19	4.32	3.90	3.42	3.82	4.25	4.59	4.02
Alpha tocopherol (vit. E)	3.63	3.90	4.30	4.65	4.12	3.71	4.07	4.52	4.82	4.28
Ascorbic acid (vit. C)	3.81	4.26	4.60	4.98	4.41	3.92	4.47	4.81	5.33	4.63
Minia Azotein (M.A.)	4.23	4.53	4.93	5.18	4.72	4.36	4.78	5.12	5.43	4.92
M.A. + vit. E	4.25	4.85	5.15	5.27	4.88	4.39	4.99	5.42	5.52	5.08
M.A. + vit. C	4.52	5.07	5.25	5.35	5.04	4.68	5.38	5.45	5.62	5.28
M.A. + vit. E + vit. C	4.82	5.20	5.32	5.47	5.20	4.90	5.44	5.59	5.91	5.46
Mean (A)	4.08	4.51	4.82	5.03		4.20	4.71	5.02	5.32	
L.S.D. at 5 %	A: 0.19		B: 0.07		AB: 0.14	A: 0.24		B: 0.16		AB: 0.32
Corm dry weight (g)										
Control	29.0	31.3	34.7	38.7	33.4	40.3	44.3	48.3	50.3	45.8
Alpha tocopherol (vit. E)	31.0	34.3	38.0	42.9	36.6	44.0	46.2	50.0	54.0	48.6
Ascorbic acid (vit. C)	31.4	37.7	42.7	46.0	39.4	45.0	49.7	53.7	57.0	51.3
Minia Azotein (M.A.)	34.8	41.3	45.3	49.7	42.8	48.5	53.0	56.8	59.1	54.4
M.A. + vit. E	35.0	44.7	49.4	54.7	45.9	48.8	55.3	57.9	61.7	55.9
M.A. + vit. C	41.0	46.9	53.0	55.3	49.1	51.7	57.3	61.0	63.0	58.3
M.A. + vit. E + vit. C	44.0	50.0	55.0	58.3	51.8	54.4	59.7	62.7	66.3	60.8
Mean (A)	35.2	40.9	45.4	49.4		47.5	52.2	55.8	58.8	
L.S.D. at 5 %	A: 3.8		B: 1.7		AB: 3.4	A: 3.0		B: 1.9		AB: 3.8

In relation to Minia Azotein (M.A.) and/or some vitamin (E and C) treatments, the six treatments significantly suppressed, 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 shown in Tables (1 and 2). Among the six treatments, the combined Minia Azotein (M.A.) with vitamin E plus vitamin C gave the highest values for corm and cormels productivity. Similar observations about the role of biofertilizer were pointed out on gladiolus plants such as Abdou *et al*. (2004), Hassanein and El-Sayed (2009), Mazhar and Eid (2016), Sathyanarayana *et al.* (2018) and Chakradhar *et al.* (2019) on gladiolus and Khan *et al.* (2009) on tulip plant. The role of vitamin E in promoting corm and cormels productivity was mentioned by Ramraj *et al.* (1997) on potato plant. Also, the role of vitamin C was found by Abdel Aziz *et al.* (2009) and Abo Leila and Eid (2011) on gladiolus, El-Morsy *et al.* (2010) and Shalaby and El-Ramady (2014) on garlic and Abo-Hinna and Merza (2012) on potato.

The stimulatory effect of Minia Azotein (M.A.) on corm and cormels production may be due to their mode of action, nutrient uptake and regulation of photosynthesis and

Table 2. Effect of farmyard manure (FYM), biofertilizer and/or some vitamin treatments, as well as, their combination treatments number of cormels and cormels dry weight (g) on of *Gladiolus grandiflorus* var. Gold Field during the first and second seasons.

Biofertilization and some vitamin treatments (B)	FYM levels (m^3/fed) (A)									
	1st season (2016/2017)					2nd season (2017/2018)				
	0	10	15	20	Mean (B)	0	10	15	20	Mean (B)
Number of cormels										
Control	22.8	26.7	29.4	31.9	27.7	24.6	29.2	30.7	34.0	29.6
Alpha tocopherol (vit. E)	25.2	28.1	31.4	34.2	29.7	27.6	30.2	33.1	36.5	31.9
Ascorbic acid (vit. C)	27.0	31.1	33.2	36.1	31.9	29.5	32.4	35.8	39.3	34.2
Minia Azotein (M.A.)	30.1	32.6	36.1	38.6	34.3	31.6	35.6	38.6	40.7	36.6
M.A. + vit. E	30.3	35.8	37.5	39.1	35.7	31.9	37.5	40.3	44.9	38.6
M.A. + vit. C	32.5	36.6	39.0	42.2	37.6	35.1	39.9	44.5	47.3	41.7
M.A. + vit. E + vit. C	34.9	38.7	41.5	42.6	39.4	37.0	42.9	46.4	48.0	43.5
Mean (A)	29.0	32.8	35.4	37.8		31.0	35.4	38.5	41.5	
L.S.D. at 5 %	A: 1.8		B: 0.9		AB: 1.8	A: 2.8		B: 1.2		AB: 2.4
Cormels dry weight (g)										
Control	10.97	12.56	13.73	14.90	13.04	12.06	14.12	15.16	16.42	14.44
Alpha tocopherol (vit. E)	11.80	13.22	14.67	16.01	13.93	13.34	14.82	16.26	17.77	15.55
Ascorbic acid (vit. C)	12.98	14.60	15.97	17.01	15.14	14.50	15.67	17.56	19.05	16.70
Minia Azotein (M.A.)	14.13	15.31	16.91	18.00	16.09	15.18	17.31	18.96	19.62	17.77
M.A. + vit. E	14.48	16.72	17.59	18.39	16.79	15.31	18.21	19.60	22.01	18.78
M.A. + vit. C	15.23	17.15	18.32	19.73	17.61	17.16	19.36	21.48	22.99	20.25
M.A. + vit. E + vit. C	16.23	18.08	19.36	20.01	18.42	17.80	20.75	22.24	23.37	21.04
Mean (A)	13.69	15.38	16.65	17.72		15.05	17.18	18.75	20.18	
L.S.D. at 5 %	A: 0.95		B: 0.75		AB: 1.50	A: 1.25		B: 0.66		AB: 1.32

growth. Consequently increase in all corm production (Dadarwall *et al.*, 1997, Hauwaka, 2000 and Gadagi *et al.*, 2004).

In plants, α-tocopherol an ascorbic acid are believed to promote the corm and cormels productivity (Munne-Bosch and Algere, 2002 and Eid *et al.*, 2010).

The interaction between FYM, Minia Azotein (M.A.) and/or some vitamin (E and C) treatments was significant for corm diameter, number of cormels/plant and dry weights of corm and cormels per plant in the two seasons (Tables 1 and 2). In most cases, the highest values were obtained for all corm and cormels productivity parameters when gladiolus plants received farmyard manure (FYM) at 20 m^3/fed in combination with Minia Azotein (M.A.) plus vit. E plus vit. C followed by 20 m^3/fed with M.A. + vit. C then 15 m^3/fed with M.A. + vit. E + vit. C.

2. Chemical constituents:

a. Photosynthetic pigments:

The contents of chlorophyll a, b and carotenoids in the fresh leaves of *Gladiolus grandiflorus* var. Gold Field were significantly promoted due to FYM treatments, in the two growing seasons, in comparison with those of untreated plants as

Table 3. Effect of farmyard manure (FYM), biofertilizer and/or some vitamin treatments, as well as, their combination treatments photosynthetic pigments content (mg/g F.W.) on of *Gladiolus grandiflorus* var. Gold Field during the first and second seasons.

Biofertilization and some vitamin treatments (B)	FYM levels (m^3/fed) (A)									
	1st season (2016/2017)					2nd season (2017/2018)				
	0	10	15	20	Mean (B)	0	10	15	20	Mean (B)
Chlorophyll a content (mg/g F.W.)										
Control	2.281	2.322	2.360	2.410	2.343	2.290	2.330	2.371	2.419	2.352
Alpha tocopherol (vit. E)	2.318	2.358	2.398	2.439	2.378	2.327	2.367	2.415	2.449	2.389
Ascorbic acid (vit. C)	2.348	2.396	2.438	2.475	2.414	2.357	2.407	2.447	2.489	2.425
Minia Azotein (M.A.)	2.379	2.425	2.458	2.487	2.437	2.388	2.431	2.470	2.502	2.448
M.A. + vit. E	2.388	2.450	2.485	2.516	2.460	2.399	2.465	2.500	2.528	2.473
M.A. + vit. C	2.420	2.478	2.514	2.546	2.489	2.430	2.490	2.527	2.561	2.502
M.A. + vit. E + vit. C	2.449	2.507	2.534	2.564	2.513	2.460	2.522	2.549	2.583	2.528
Mean (A)	2.369	2.419	2.455	2.491		2.379	2.430	2.468	2.504	
L.S.D. at 5 %	A: 0.032		B: 0.023		AB: 0.046	A: 0.035		B: 0.026		AB: 0.052
Chlorophyll b content (mg/g F.W.)										
Control	0.741	0.753	0.766	0.780	0.760	0.744	0.758	0.771	0.787	0.765
Alpha tocopherol (vit. E)	0.746	0.763	0.777	0.793	0.770	0.757	0.770	0.785	0.793	0.776
Ascorbic acid (vit. C)	0.754	0.776	0.793	0.806	0.782	0.766	0.783	0.792	0.811	0.788
Minia Azotein (M.A.)	0.767	0.787	0.800	0.809	0.791	0.775	0.792	0.805	0.816	0.797
M.A. + vit. E	0.772	0.797	0.809	0.819	0.799	0.779	0.804	0.815	0.828	0.807
M.A. + vit. C	0.783	0.807	0.818	0.830	0.809	0.791	0.813	0.826	0.839	0.817
M.A. + vit. E + vit. C	0.794	0.816	0.825	0.835	0.818	0.798	0.822	0.837	0.850	0.827
Mean (A)	0.765	0.786	0.798	0.810		0.773	0.792	0.804	0.818	
L.S.D. at 5 %	A: 0.011		B: 0.007		AB: 0.014	A: 0.013		B: 0.009		AB: 0.018
Carotenoids content (mg/g F.W.)										
Control	0.782	0.793	0.812	0.822	0.802	0.786	0.801	0.814	0.832	0.808
Alpha tocopherol (vit. E)	0.792	0.807	0.818	0.831	0.812	0.799	0.813	0.826	0.841	0.820
Ascorbic acid (vit. C)	0.802	0.817	0.828	0.846	0.823	0.810	0.824	0.839	0.852	0.831
Minia Azotein (M.A.)	0.815	0.826	0.842	0.850	0.833	0.821	0.837	0.846	0.861	0.841
M.A. + vit. E	0.816	0.840	0.850	0.860	0.842	0.822	0.845	0.857	0.868	0.848
M.A. + vit. C	0.823	0.848	0.858	0.871	0.850	0.834	0.854	0.867	0.880	0.859
M.A. + vit. E + vit. C	0.836	0.857	0.865	0.876	0.858	0.843	0.864	0.878	0.891	0.869
Mean (A)	0.809	0.827	0.839	0.851		0.816	0.834	0.847	0.861	
L.S.D. at 5 %	A: 0.010		B: 0.006		AB: 0.012	A: 0.012		B: 0.007		AB: 0.014

shown in Table (3). The high level of FYM (20 m^3/fed) gave the highest values for the three photosynthetic pigments in both seasons. These results may be attributed to the increase in nutrient elements and/or positive role of organic farmyard manure (FYM) on the physical and chemical properties of the soil, that reflected on the growth and the pigments content. In harmony with these results regarding organic fertilization treatments were those reported by Khalil (2015) and Abdou *et al.* (2018) on gladiolus, El-Naggar and El-Nasharty (2009) on *Hippeastrum vittatum,* Mathivanan *et al.* (2012) on ground nut, Dalawai and Naif (2017) on *Dianthus caryophyllus,*

In relation to the influence of Minia Azotein (M.A.) and/or some vitamin (E and C) treatments on chlorophyll a, b and carotenoids contents were promoted, in the two seasons (Table, 3). Using both Minia Azotein (M.A.) and some vitamins (E and C) together was more effective than the used treatments. Also, the differences between any treatment and control was statistically significant, among the six treatments, Minia Azotein (M.A.) plus some vitamin E plus vitamin C resulted the highest values over all other treatments. These results may be attributed not only to the increase in nutrient elements, but also to the role of Minia Azotein (M.A.) treatment on stomatal regulation and photosynthesis and growth as separately Taha and Hassan (2008) on gladiolus and Attia *et al.* (2018) on tuberose, Also, vitamin E increased pigments as reported by Hassan (2013) on roselle, Ibrahim (2014) on khella and Mohamed (2016) on *Antirrhinum majus* plant. Vitamin C gave similar results obtained by Kasim and Adil (2014) on freesia, Mohammed *et al.* (2016) on dahlia and Gaber (2019) on *Pelargonium zonale* plant.

Effects of the interaction between FYM, Minia Azotein (M.A.) and/or some vitamin (E and C) treatments were significant in both seasons, for corm diameter, number of cormels/plant and dry weights of corm and cormels with the highest values being obtained due to the use of FYM at 20 m^3/fed in combination Minia Azotein (M.A.) plus vitamin E plus vitamin C followed by 20 m^3/fed with M.A. + vit. C then 15 m^3/fed with M.A. + vit. E + vit. C, in most cases as shown in Table (3).

b. Nitrogen, phosphorus and potassium percentages:

In both seasons, increasing the level of FYM linearly increased the percentages of N, P and K in the corms. In this concern, the treatment with high level of FYM (20 m^3/fed) gave the highest percentages (Table, 4). On the other hand, the lowest values of N, P and K% in the corms were recorded by the plants treated with organic fertilization. Moreover, significant differences were detected between FYM treatments and control one, also between FYM treatments in all cases.

The results mentioned above, could be attributed to that application of FYM improved soil properties, increased nutrients in area of roots, which increased nutrients uptake, in turn reflects on the corm quality.

These results are in agreement with those obtained by Sönmez *et al.* (2013), Khalil (2015), Abdou *et al.* (2018) on gladiolus, Abd El-Karim (2001) and Suseela *et al*. (2016) on tuberose, Eliwa *et al.* (2009) on Iris, El-Sayed *et al.* (2012) on freesia and Dalawai and Naif (2017) on *Dianthus caryophyllus.*

The percentages of N, P and K were significantly increased, in both seasons, as a result of inoculating gladiolus with Minia Azotein (M.A.) and spraying gladiolus with some vitamin (E and C) treatments in comparison with the control (Table, 4). The treatment of M.A. + vit. E + vit. C recorded the significantly highest values for N, P and K % in both seasons. N- fixing bacteria enhance the uptake of different nutrients (Jagnow *et al*., 1991). Also, alpha tocopherol is involved in a wide range of important functions as antioxidant defense and regulation of photosynthesis and growth (Zhang *et al.* 2000). Ascorbic acid promoted

Table 4. Effect of farmyard manure (FYM), biofertilizer and/or some vitamin treatments, as well as, their combination treatments on nitrogen, phosphorus & potassium percentages of *Gladiolus grandiflorus* var. Gold Field during the first and second seasons.

Biofertilization and some vitamin treatments (B)	FYM levels (m^3/fed) (A)									
	1st season (2016/2017)					2nd season (2017/2018)				
	0	10	15	20	Mean (B)	0	10	15	20	Mean (B)
					N %					
Control	1.675	1.780	1.855	2.087	1.849	1.751	1.862	1.922	2.165	1.925
Alpha tocopherol (vit. E)	1.748	1.843	2.035	2.175	1.950	1.817	1.910	2.125	2.221	2.018
Ascorbic acid (vit. C)	1.808	1.993	2.154	2.293	2.062	1.886	2.074	2.216	2.366	2.136
Minia Azotein (M.A.)	1.876	2.146	2.264	2.340	2.156	1.937	2.211	2.335	2.405	2.222
M.A. + vit. E	1.931	2.260	2.328	2.412	2.233	2.005	2.327	2.403	2.563	2.325
M.A. + vit. C	2.132	2.321	2.364	2.441	2.314	2.200	2.394	2.529	2.588	2.428
M.A. + vit. E + vit. C	2.207	2.360	2.438	2.461	2.367	2.289	2.420	2.585	2.611	2.476
Mean (A)	1.911	2.100	2.205	2.316		1.984	2.171	2.302	2.417	
L.S.D. at 5 %	A: 0.081		B: 0.011		AB: 0.022	A: 0.101		B: 0.012		AB: 0.024
					P %					
Control	0.223	0.254	0.296	0.325	0.275	0.228	0.260	0.307	0.337	0.283
Alpha tocopherol (vit. E)	0.236	0.293	0.323	0.353	0.301	0.240	0.304	0.330	0.360	0.309
Ascorbic acid (vit. C)	0.269	0.307	0.345	0.368	0.322	0.274	0.315	0.351	0.376	0.329
Minia Azotein (M.A.)	0.298	0.342	0.367	0.378	0.346	0.309	0.348	0.374	0.389	0.355
M.A. + vit. E	0.304	0.363	0.377	0.401	0.361	0.312	0.371	0.387	0.413	0.371
M.A. + vit. C	0.335	0.372	0.394	0.404	0.376	0.345	0.381	0.403	0.418	0.387
M.A. + vit. E + vit. C	0.361	0.389	0.403	0.414	0.392	0.369	0.398	0.416	0.431	0.404
Mean (A)	0.289	0.331	0.358	0.378		0.297	0.340	0.367	0.389	
L.S.D. at 5 %	A: 0.015		B: 0.004		AB: 0.008	A: 0.019		B: 0.006		AB: 0.012
					K %					
Control	1.573	1.591	1.608	1.628	1.600	1.598	1.621	1.639	1.663	1.630
Alpha tocopherol (vit. E)	1.582	1.600	1.619	1.640	1.610	1.610	1.632	1.658	1.677	1.644
Ascorbic acid (vit. C)	1.593	1.617	1.639	1.664	1.628	1.622	1.653	1.676	1.697	1.662
Minia Azotein (M.A.)	1.612	1.635	1.659	1.673	1.644	1.644	1.675	1.694	1.711	1.681
M.A. + vit. E	1.614	1.644	1.670	1.689	1.654	1.650	1.688	1.709	1.729	1.694
M.A. + vit. C	1.632	1.669	1.685	1.696	1.671	1.665	1.703	1.722	1.736	1.706
M.A. + vit. E + vit. C	1.642	1.680	1.691	1.700	1.678	1.681	1.716	1.730	1.743	1.717
Mean (A)	1.607	1.634	1.653	1.670		1.639	1.670	1.690	1.708	
L.S.D. at 5 %	A: 0.015		B: 0.007		AB: N.S.	A: 0.017		B: 0.010		AB: N.S.

nutrient elements uptake (Dewick, 2000). These positive effects of the used treatments led to promote nutrients uptake and finally reflect on the percentages of N, P and K.

The role of biofertilizer in improving N, P and K %, which is in harmony with the obtained results was revealed by Mazhar and Eid (2016) and Sathyanarayana *et al.* (2018) on gladiolus, Fawzy *et al.* (2012) on onion, Parmar *et al*. (2017) on golden rod, Attia *et al.* (2018) on tuberose. Also, vitamin E increased N, P and K % as reported by Abdou *et al*. (2012, 2013a and 2013b) on mint, caraway and guar plants, respectively, and Mohamed (2016) on *Antirrhinum majus* plant. Vitamin C made a similar trend to increase these characters as reported by Abdel Aziz *et al.* (2009) and Abo Leila and Eid (2011) on gladiolus, Abdou and Mohamed (2014) on mint and Mohammed *et al.* (2016) on dahlia plant.

Effect of the interaction treatments was significant, in both seasons, for N and P % only. The highest values were obtained with the interaction treatments of 20 m^3/fed FYM × M.A. + vit. E + vit. C as shown in Table (4).

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تأثير معاملات سماد المزرعة والتسميد الحيوي و/أو بعض الفيتامينات على ب- انتاج الكورمات والكريمات وبعض الصفات الكيميائية لنباتات الجلاديولس صنف Gold Field

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أجريت تجربة حقلية خلال موسمي ٢٠١٧/٢٠١٦ و٢٠١٨/٢٠١٧ لدراسة تأثير سماد المزرعة (FYM) بمستويات (صفر، ١٠، ١٥ و ٢٠ م^{٣}/فدان) مع إضافة السماد الحيوي المنيا أزوتين (M.A.) بمعدل ٥٠ مل/الجورة و/أو الرش بفيتاميني هـ و ج كل بتركيز ٥٠ جزء/ المليون على إنتاجية الكورمات والكريمات والمحتوى الكيماوي لنباتات الجلاديولس صنف Gold Field. أوضحت النتائج أن قطر الكورمة وعدد الكريمات/نبات والوزن الجاف للكورمة والكريمات والمحتوى الكيماوي متضمناً كلوروفيل أ، ب والكاروتينويدات والنسبة المئوية للنتروجين والفوسفور والبوتاسيوم في الكورمات الجافة زاد تدريجياً بزيادة مستوى سماد المزرعة (FYM). وكان يوجد فرق معنوي بين المعاملات الأربعة والمستوى العالي من سماد المزرعة (FYM) أعطى أعلى القيم. كل معاملات سماد المنيا أزوتين و/أو بعض الفيتامينات (فيتامين هـ + فيتامين ج) منفردين أو مجتمعين أحدثت زيادة معنوية في إنتاجية الكورمات والكريمات والتقديرات الكيماوية مقارنة بمعاملة الكنترول. معاملات خليط من السماد الحيوي (المنيا أزوتين) + فيتامين هـ + فيتامين ج كانت أكثر فاعلية من المعاملات الأخرى فيما يخص إنتاجية الكورمة والكريمات وصبغات البناء الضوئي والنسبة المئوية للنتروجين والفوسفور والبوتاسيوم. تأثير التفاعل كان معنوياً لكل الصفات المدروسة عدا النسبة المئوية للبوتاسيوم. أعلى القيم لإنتاجية الكورمة والكريمات نتجت في معظم الحالات عن سماد المزرعة (FYM) بمعدل ٢٠ م^{٣}/فدان مع إضافة خليط من السماد الحيوي (المنيا أزوتين) + فيتامين هـ + فيتامين ج تليها استعمال سماد المزرعة بمعدل ١٥ م^{٣}/فدان مع خليط من السماد الحيوي (المنيا أزوتين) + فيتامين هـ + فيتامين ج وأعطت أعلى محتوى أيضاً من الصبغات وعنصري النتروجين والفوسفور%.