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EFFECT OF COMPOST AND SOME NATURAL STIMULANT TREATMENTS ON: II. CORMS PRODUCTION AND CHEMICAL CONSTITUENTS OF (*GLADIOLUS GRANDIFLORUS* CV. PETER PEARS) PLANTS

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ABSTRACT: Two field experiments were conducted to investigate the effect of plant compost (0, 2.5, 5.0 and 7.5 ton/fed) and six natural stimulants (green tea extract at 5 g/l, moringa leaves extract at 300 mg/l, garlic extract at 300 mg/l, licorice roots extract at 5 g/l, active dry yeast at 5 g/l and seaweeds extract at 3 cm^3/l) on corms production and chemical constituents of *Gladiolus grandiflorus* cv. Peter Pears.

The obtained results indicated that corm diameter, number of cormels/plant, dry weight of cormels, 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 level of compost. Significant differences were detected among the four used treatments. So, the high level of compost resulted the highest values.

All six treatments of natural stimulants significantly increased corm and cormels production and their content of chemical constituents in comparison of the control plants. The highest values were obtained due to the treatments of seaweeds extract at 3 cm^3/l. or active dry yeast at 5 g/l.

The interaction between compost and natural stimulants was significant for all previous characters, except chlorophyll a in the first season.

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Key words: *Gladiolus grandiflorus*, compost, seaweeds extract, active dry yeast, moringa leaves extract, green tea extract, corms production, chemical constituents.

INTRODUCTION

Gladiolus grandiflorus, L. plant is considered one of the most important flowering bulbs grown in Egypt. It is known as "Queen" of the bulbous flowers. Its flowers are excellent attractive cut flowers as it lasts longer in flower vase and has magnificent inflorescence with variety of colors.

Organic fertilization and natural stimulants 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 cormels, as well as, chemical constituents of gladiolus plant were reported by many investigators, Zaghloul and Atta-Alla (2001), Ahmed (2013), Sönmez *et al.* (2013), Saeed *et al.* (2014), Khalil (2015), Sankari *et al.* (2015), Hassan (2016) and Khanam *et al.* (2017).

Active dry yeast treatments and seaweeds extract were found to have

stimulating effect on corm production and chemical constituents of gladiolus such as those raveled by Al-Rashedy (2010), Ahmed (2013); Abdou and Ibrahim (2015), Khattab *et al.* (2016), Hassan (2016) and Abdel-Mola (2017).

The aim of this work was to study the effect of application compost fertilization and spraying with some natural stimulants on corm and cormels production, as well as, chemical constituents of *Gladiolus grandiflorus* cv. Peter Pears.

MATERIALS AND METHODS

The present study was carried out at the Nursery of Ornamental Plants, Faculty of Agriculture, Minia University during two successive seasons of 2014/2015 and 2015/2016 on gladiolus plants.

Gladiolus grandiflorus cv. Peter Pears corms were obtained from Holland by Basiouny nurseries, Cairo, Egypt. Average corm diameter was 2.7-3.0 cm and corm weight was 9.7-10.2 g for the first and second seasons, respectively. Corms were planted on October 1st for both seasons in 1.5 × 2.2 m plots containing 3 ridges, 50 cm apart. Corms were planted in hills, 20 cm apart (10 corms/ridge) on the lower third of one side of each ridge in clay loam soil. The physical and chemical analysis of the used soil is shown in Table (1).

Split plot design with three replicates was used in this experiment. The four levels of compost fertilization treatments (0.0, 2.5, 5.0 and 7.5 ton/fed) were considered as main plots and the seven natural stimulant treatments (control, green tea extract at 5 g/l, moringa leaves extract at 300 mg/l, garlic extract at 300 mg/l, licorice roots extract at 5 g/l, active dry yeast at 5 g/l and seaweeds extract at 3 cm^3/l) were put in the sub-plots. The compost was added before planting during the soil preparation. Compost analysis is shown in Table (2).

Natural stimulants were applied, by hand sprayer, three times, one month and two months from planting date and after flowers cut for corm and cormels production. The plants were sprayed till run off. All agricultural practices were performed as usual in the region.

Preparation of the natural stimulants:

Garlic plant extract:

One kilogram fresh mature cloves were blended in the presence of distilled water (1 kg/l), then frozen (24 hours) and thawed two times then filtered. The filter extract (100 %) was used for preparation (300 ml/l = 30 %) according to El-Desouky *et al.* (1998).

Some chemical constituents of garlic according cloves to Arid Land Agricultural Research Unit are listed in Table (3).

Moringa leaves extract:

Aqueous extract of moringa at (300 ml/l) was prepared by mixing 30 g of plant leaf material with one liter of distilled water in a household blender for 15 min at 50 °C. The solution was filtered through filtered paper (Phiri and Mbewe, 2010). Nutrient information and amino acids of moringa leaves were shown in Table (4).

Table 1. Physical and chemical properties of the experimental soil.

Character	Value		Character		Value	
	2014/2015	2015/2016			2014/2015	2015/2016
Sand (%)	28.98	28.90	**Total N (%)**		0.08	0.06
Silt (%)	29.87	30.64	**Available P (%)**		15.67	15.58
Clay (%)	41.15	40.46	**Exch. K^+ (mg/100 g)**		2.85	2.64
Soil type	Clay loam	Clay loam	**Exch. Ca^{++} (mg/100 g)**		31.12	31.43
Organic matter (%)	1.54	1.59	**Exch. Na^+ (mg/100 g)**		2.51	2.50
CaCO3 (%)	2.11	2.10	**DPTA Ext. (ppm)**	**Fe**	8.23	8.11
pH	7.75	7.71		**Cu**	2.01	2.00
E.C. (mmhos /cm)	1.08	1.06		**Zn**	2.87	2.89
				Mn	8.11	8.15

Table 2. The chemical analysis of compost.

Content	Value	Content	Value
Organic carbon (%)	25.1	**Total P (%)**	0.5
Humidity (%)	25	**Total K (%)**	1.0
Organic matter	44	**Fe (ppm)**	1750
C/N ratio	16.7	**Zn (ppm)**	60
pH (1:2.5)	8.0	**Mn (ppm)**	125
E.C. (mmhos/cm)	5	**Cu (ppm)**	200
Total N (%)	2.2		

Table 3. Some chemical constituents of garlic according cloves to Arid Land Agricultural Research Unit:

Components	GA_3	IAA	ABA	Ca^{+2}	Mg^{+2}	SO_4^{-2}	Zn^{+2}	Mn^{+2}
Concentration	16.33 (mg/100 g f.w.)	Trace	Trace	1.363 %	1.230 %	0.181 %	66.5 ppm	94.4 ppm

Table 4. Nutrients information and amino acids of moringa leaves.

Nutrient information	Leaves	Nutrient information	Leaves	Amino acids	Leaves
Calories	92	**Sulfur (mg)**	137	**Arginine**	402
Protein (g)	6.7	**Selenium (mg)**	0	**Histidine**	141
Fat (g)	1.7	**Zinc (mg)**	0	**Isoleucine**	422
Carbohydrate (g)	13.4	**Oxalic Acid (mg)**	101	**Leucine**	623
Fiber (g)	0.9	**Vitamin A (mg)**	6.8	**Lysine**	288
Calcium (mg)	440	**Vitamin B (mg)**	423	**Methionine**	134
Copper (mg)	1.1	**Vitamin B_1 (mg)**	0.21	**Phenylalanine**	429
Iron (mg)	7	**Vitamin B_2 (mg)**	0.05	**Threonine**	328
Potassium (mg)	259	**Vitamin B_3 (mg)**	0.8	**Tryptophan**	127
Magnesium (mg)	24	**Vitamin C (mg)**	220		
Phosphorus (mg)	70	**Vitamin E (mg)**	0		

Green tea extract:

The aqueous extract is prepared in ratio 1:10 with the consideration of the absorption coefficient of green tea leaves. Technology of preparation – 5 g of tea leaves of diameter lower than 5 mm are poured with 60 ml of boiling water. Time is given for the extraction to cool down and the quality of these extracts has been evaluated after 10, 20 and 30 min according to Armoskaite *et al.* (2011).

Active dry yeast:

The dry matter of active dry yeast (*Saccharomyces cerevisiae*), was 95 % and live cells were 11.6×10^9/g. The yeast suspension was prepared by dissolving dry yeast and sugar together (1:1) w/w in warm water (38 ℃) and let it stand for two hours before spraying to enhance yeast activity (Skoog and Miller, 1957). Chemical analysis of the dry yeast is presented in Table (5).

Licorice roots extract:

Preparation of licorice extract soaked grinded dry licorice roots (5 g) in distilled water (1 liter) for 24 hours and then filtered using filter paper. The active components in licorice roots extract contains of volatile oils, tannins, carbohydrates, saponins, phenols, glycosides, flavonoids and fixed oils.

Table 5. Chemical composition of the used active dry yeast.

Component	Value	Component	Value	Component	Value
Cu (mg/g)	8.0	**Fe (mg/g)**	0.02	**Niacin**	300-500 mg/g
Se (mg/g)	0.1	**Mg (mg/g)**	1.65	**Pyrodoxin**	28.0 mg/g
Mn (mg/g)	0.02	**K (mg/g)**	21.0	**Pantathenate**	70.0 mg/g
Cr (mg/g)	2.2	**P (mg/g)**	13.50	**Bioton**	1.3 mg/g
Ni (mg/g)	3.0	**S (mg/g)**	3.90	**Cholin**	40.0 mg/g
Va (mg/g)	0.04	**Zn (mg/g)**	0.17	**Folic acid**	5.13 mg/g
Mo (mg/g)	0.4	**Si (mg/g)**	0.03	**Vit B12**	0.001 mg/g
Sn (mg/g)	3.0	**Proteins**	47%	**Thiamine**	60-100 ml/g
Li (mg/g)	0.17	**Carbohydrates**	33.0%	**Riboflavin**	35-50 ml/g
Na (mg/g)	0.12	**Minerals**	8.0%	**Lipids**	4.0%
Ca (mg/g)	0.75	**Nucleic acids**	8.0%		

The elements analysis in licorice roots extract contains of K, Ca, Fe, P, Mg, SO_4, N, Na, Mn, Zn and Co. Abd El-Azim *et al.* (2016). The elements of licorice analysis roots extract listed in Table (6).

Seaweeds extract:

Algeser product contains seaweed extract from (Shoura Chemicals Company, Cairo Alex Desert RD., Giza Governorate). The chemical properties of the seaweeds extract shown in Table (7).

Table 6. The elements of licorice analysis roots extract.

Elements	K^{+1}	Ca^{+2}	Fe^{+3}	P^{-3}	Mg^{+2}	$SO4^{-2}$	N^{-3}	Na^{+1}	Mn^{+2}	Zn^{+2}	Co^{+2}
ppm	1230	500	1400	520	5	900	16500	700	1700	35000	0.07

Table 7. The chemical properties of the seaweeds extract.

Character	Values	Character	Values	Character	Values
Moisture %	6.0	**K %**	1.0-1.2	**Cu ppm**	1.0-6.0
Organic matter %	45-60	**Mg %**	0.5-0.9	**Mn ppm**	5-12
Inorganic matter %	45-60	**P %**	0.02-0.09	**Zn ppm**	10-100
Protein %	6-8	**S %**	3-9	**Cytokinins %**	0.02
Carbohydrate %	35-50	**Ca %**	0.2-1.5	**IAA %**	0.03
Aliginic acid %	10-20	**B ppm**	20-100	**ABA %**	0.01
Mannitol %	4-7	**Mo ppm**	1-5		
Total N %	1.0-1.5	**Fe ppm**	50-200		

The following data were recorded:

1. Underground parts characters at harvesting after the foliage had dried (the underground parts were lifted 2 months after cut spikes): corm diameter (cm), number of new cormels/plant and dry weights of cormels (g).
2. Determination of 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 Moran (1982). The percentages of N, P and K in the dry corms (samples were taken after two months from flowering ending) were estimated according to the methods described by Wilde *et al.* (1985), Chapman and Pratt (1975) and Cottenie *et al.* (1982), respectively.

All of the 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

Corms and cormels production:

Data in Table (8) indicated that corm diameter, number of cormels/plant and dry weight of cormels/plant during both seasons were significantly increased with increasing compost level in comparison with untreated control plants. Among the three compost treatments, the high level treatment (7.5 ton/fed) resulted the highest values for all corm and cormels production over both low and medium compost treatments in the two seasons. Similar results were also revealed on gladiolus plants by Ruppenthal and Castro (2005), Chandar *et al.* (2012), Pradeep *et al.* (2014) Sankari *et al.* (2015), Hassan (2016) and Khanam *et al.* (2017).

The increase in the corms and cormels production was attributed to the positive effect of organic fertilizers on improving the vegetative growth, as well as, stimulating the photosynthetic pigments (Table, 9) which reflected on increasing the underground parts of gladiolus.

Concerning natural stimulant treatments, the used six treatments significantly increased corm and cormels production. The highest values were obtained due to the treatments of seaweeds extract at 3cm^3/l. followed by active dry yeast at 5 g/l. then licorice roots extract at 5 g/l. in both seasons. Similar observations were pointed out on gladiolus plants such as Al-Rashedy (2010), Ahmed (2013), Abdou and Ibrahim (2015), Khattab *et al.* (2016) and Hassan (2016).

The stimulatory effect of the treatments of natural stimulants on corms productivity may due to their mode of action, on the soil or plant, plant hormone, enzymes, amino acids, nutrients and vitamins which came from addition of natural stimulants, and gave better growth consequently increased all corm productivity parameters. (Mady, 2009; Nagodawithana, 1991; Chapman and Chapman, 1980)

The interaction between the main and sub plot treatments was significant, in both seasons, in regard to corm diameter, cormels dry weight and cormels number/plant. The highest values were obtained for all corm productivity parameters when gladiolus plants received compost at 7.5 ton/fed in combination with seaweeds extract (3 cm^3/l) followed by active dry yeast (5 g/l) without significant differences between them in some cases.

Chemical constituents:

1. Photosynthetic pigments:

The contents of chlorophyll a, b and carotenoids in the fresh leaves of *Gladiolus* cv. Peter Pears were significantly promoted due to compost treatments, in the two growing seasons, in comparison with those of untreated plants as shown in Table (9). The high level of compost (7.5 ton/fed) gave the highest values for the three photosynthetic pigments in both seasons. 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 pigments content. In harmony with these results regarding organic fertilization treatments were those reported by Abdou *et al.* (2013), Ahmed *et al.* (2013), Sankari *et al.* (2015), Khalil (2015) and Hassan (2016) on gladiolus.

Concerning the influence of natural stimulants treatments, each of chl. a, b and carotenoids contents were significant promoted, in the two experimental seasons, in comparison with control. The highest contents of chl. a, b and carotenoids were obtained with plants received seaweeds extract at 3 cm^3/l followed by active dry yeast at 5 g/l without significant difference between such two superior treatments, except chlorophyll a during the first season. The stimulatory effect of natural stimulant treatments on photosynthetic pigments may be attributed those seaweeds act as plant

Table 8. Effect of compost and natural stimulants, as well as, their combination treatments on corms and cormels production [corm diameter, number of leaves/plant & cormels dry weight (g)] of *Gladiolus grandiflorus* cv. Peter Pears plants during 2014/2015 and 2015/2016 seasons.

Natural stimulants treatments (B)	Compost levels (ton/fed) (A)									
	1st season (2014/2015)					2nd season (2015/2016)				
	0.0	2.5	5.0	7.5	Mean (B)	0.0	2.5	5.0	7.5	Mean (B)
Corm diameter (cm)										
Control	5.33	5.62	6.28	6.64	5.97	5.44	5.82	6.47	6.85	6.15
Green tea extr. 5 g/l	5.73	5.85	6.37	6.73	6.17	5.75	6.12	6.52	7.01	6.35
Moringa extr. 300 mg/l	5.64	6.00	6.36	6.70	6.18	5.84	6.14	6.57	7.11	6.42
Garlic extr. 300 mg/l	5.94	5.97	6.41	6.51	6.21	6.08	6.17	6.61	7.12	6.50
Licorice extr. 5 g/l	6.31	6.45	6.56	6.84	6.54	6.37	6.57	6.72	7.40	6.77
Active yeast 5 g/l	6.32	6.47	6.56	6.86	6.55	6.52	6.79	6.84	7.41	6.89
Seaweeds extr. 3 cm^3/l	6.34	6.48	6.58	7.13	6.63	6.58	6.80	6.84	7.43	6.91
Mean (A)	5.94	6.12	6.45	6.77		6.08	6.34	6.65	7.19	
L.S.D. at 5 %	A: 0.17		B: 0.21		AB: 0.42	A: 0.23		B: 0.15		AB: 0.30
Number of cormels/plant										
Control	27.67	32.67	34.67	36.67	32.92	28.33	31.33	33.67	35.00	32.08
Green tea extr. 5 g/l	29.00	33.33	36.67	37.67	34.17	30.33	33.33	35.00	37.67	34.08
Moringa extr. 300 mg/l	32.33	35.00	37.33	38.00	35.67	33.00	35.67	37.33	39.33	36.33
Garlic extr. 300 mg/l	33.00	35.67	38.33	39.00	36.50	34.67	37.33	38.67	40.67	37.84
Licorice extr. 5 g/l	35.33	37.67	38.67	39.67	37.84	36.33	38.33	40.67	43.00	39.58
Active yeast 5 g/l	36.33	38.67	40.00	41.33	39.08	36.67	40.67	42.00	43.33	40.67
Seaweeds extr. 3 cm^3/l	37.33	39.00	40.00	42.00	39.58	38.00	42.00	43.00	45.00	42.00
Mean (A)	33.00	36.00	37.95	39.19		33.90	36.95	38.62	40.57	
L.S.D. at 5 %	A: 2.24		B: 1.22		AB: 2.44	A: 2.55		B: 1.94		AB: 3.88
Cormels dry weight (g)										
Control	5.49	6.84	7.47	7.68	6.87	6.60	7.81	7.99	9.18	7.90
Green tea extr. 5 g/l	6.05	7.20	7.94	8.11	7.33	7.29	7.98	8.29	10.15	8.43
Moringa extr. 300 mg/l	6.15	7.25	8.02	8.15	7.39	7.32	8.36	8.64	10.18	8.63
Garlic extr. 300 mg/l	7.91	8.00	8.14	8.32	8.09	8.57	8.61	8.71	10.55	9.11
Licorice extr. 5 g/l	7.94	8.09	8.17	8.55	8.19	8.60	8.67	8.75	10.93	9.24
Active yeast 5 g/l	8.11	8.29	8.34	8.73	8.37	8.69	8.73	8.81	11.49	9.43
Seaweeds extr. 3 cm^3/l	8.22	8.34	8.77	9.65	8.75	8.73	8.87	8.96	11.82	9.60
Mean (A)	7.12	7.72	8.12	8.46		7.97	8.43	8.59	10.61	
L.S.D. at 5 %	A: 0.54		B: 0.42		AB: 0.84	A: 0.43		B: 0.50		AB: 1.00

Table 9. Effect of compost and natural stimulants, as well as, their combination treatments on three Photosynthetic pigments (chlorophyll a, b and carotenoids) of *Gladiolus grandiflorus* cv. Peter Pears plants during 2014/2015 and 2015/2016 seasons.

Natural stimulants treatments (B)	Compost levels (ton/fed) (A)									
	1st season (2014/2015)					2nd season (2015/2016)				
	0.0	2.5	5.0	7.5	Mean (B)	0.0	2.5	5.0	7.5	Mean (B)
Chlorophyll a (mg/g f.w.)										
Control	2.432	2.483	2.534	2.605	2.514	2.491	2.541	2.586	2.641	2.565
Green tea extr. 5 g/l	2.472	2.502	2.542	2.592	2.527	2.531	2.576	2.631	2.696	2.609
Moringa extr. 300 mg/l	2.493	2.534	2.574	2.625	2.557	2.550	2.595	2.650	2.715	2.628
Garlic extr. 300 mg/l	2.522	2.563	2.604	2.655	2.586	2.581	2.626	2.681	2.746	2.659
Licorice extr. 5 g/l	2.548	2.569	2.630	2.681	2.607	2.606	2.646	2.691	2.752	2.674
Active yeast 5 g/l	2.579	2.620	2.661	2.712	2.643	2.635	2.665	2.704	2.764	2.692
Seaweeds extr. 3 cm^3/l	2.597	2.641	2.692	2.752	2.671	2.656	2.686	2.735	2.795	2.718
Mean (A)	2.520	2.559	2.605	2.660		2.579	2.619	2.668	2.730	
L.S.D. at 5 %	A :0.038		B :0.011		AB :N.S.	A :0.031		B :0.041		AB :0.082
Chlorophyll b (mg/g f.w.)										
Control	0.858	0.875	0.893	0.916	0.886	0.878	0.895	0.910	0.928	0.903
Green tea extr. 5 g/l	0.882	0.892	0.905	0.922	0.900	0.893	0.906	0.925	0.946	0.918
Moringa extr. 300 mg/l	0.890	0.903	0.917	0.932	0.911	0.898	0.913	0.930	0.954	0.924
Garlic extr. 300 mg/l	0.898	0.911	0.925	0.941	0.919	0.908	0.924	0.938	0.960	0.933
Licorice extr. 5 g/l	0.907	0.921	0.933	0.951	0.928	0.917	0.930	0.955	0.962	0.941
Active yeast 5 g/l	0.918	0.930	0.942	0.958	0.937	0.926	0.936	0.956	0.969	0.947
Seaweeds extr. 3 cm^3/l	0.925	0.937	0.953	0.972	0.947	0.933	0.943	0.960	0.978	0.954
Mean (A)	0.897	0.910	0.924	0.942		0.908	0.921	0.939	0.957	
L.S.D. at 5 %	A :0.012		B :0.012		AB :0.024	A :0.012		B :0.013		AB :0.026
Carotenoids (mg/g f.w.)										
Control	0.938	0.955	0.973	0.997	0.966	0.998	1.015	1.030	1.048	1.023
Green tea extr. 5 g/l	0.982	0.992	1.006	1.022	1.001	1.012	1.026	1.044	1.066	1.037
Moringa extr. 300 mg/l	0.993	1.002	1.015	1.034	1.011	1.018	1.033	1.051	1.073	1.044
Garlic extr. 300 mg/l	0.999	1.013	1.026	1.045	1.021	1.029	1.045	1.063	1.082	1.055
Licorice extr. 5 g/l	1.008	1.022	1.035	1.054	1.030	1.038	1.052	1.065	1.087	1.061
Active yeast 5 g/l	1.021	1.033	1.046	1.065	1.041	1.047	1.056	1.067	1.090	1.065
Seaweeds extr. 3 cm^3/l	1.026	1.043	1.056	1.077	1.051	1.054	1.064	1.080	1.100	1.075
Mean (A)	0.995	1.009	1.022	1.042		1.028	1.042	1.057	1.078	
L.S.D. at 5 %	A :0.012		B :0.032		AB :0.064	A :0.012		B :0.012		AB :0.024

growth regulators stimulants in peolonged chlorophyll production and photosynthesis (Aitken and Senn, 1965). Also, yeast is considered as a natural source of cytokinns that stimulate the synthesis of proteins, nucleic acid and chlorophyll (Fathy and Farid, 1996). Our results are in some direction with Ahmed (2013), Hassan (2016) and Khattab *et al.* (2016) on gladiolus.

The interaction between main and sub plots (A×B) was significant for chlorophyll a, b and carotenoids, except, chlorophyll a in the first season. The highest values being obtained due to fertilizing plants with compost at 7.5 ton/fed. and spraying plants with seaweeds extract at 3cm^3/l.

3. Corms content of nitrogen, phosphorus and potassium as percentages:

In both seasons, increasing the level of compost linearly increased the percentages of N, P and K in the corms. In this concern, the treatment with high level of compost (7.5 ton/fed) gave the highest percentages (Table, 10). On the other hand, the lowest values of N, P and K in the corms of gladiolus were recorded by the plants treated without organic fertilization.

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

These results are in agreement with those obtained by Zaghloul and Atta-Alla (2001), Sönmez *et al.* (2013), Saeed *et al.* (2014) and Hassan (2016) on gladiolus.

In regard with natural stimulant treatments, significant differences were obtained due to the used of any one, in comparison with control treatment. Most effective treatment among these six treatments, for the three nutrients percentage was treatment of seaweeds extract followed by dry yeast without significant differences between them in the two growing seasons.

Seaweeds liquid contained macronutrients, trace elements, organic substances like amino acids and plant growth regulators such as auxins, cytokinins and gibberellins, as well as, vitamins and fatty acids (Chapman and Chapman 1980). Also, yeast can play a very significant role in making available nutrient elements for plant (Khalil and Ismael, 2010). These positive effects of the used treatments led to promoted nutrient uptake and finally reflexes on the corms percentages of N, P and K.

Hassan (2016) and Abdel-Mola (2017) on gladiolus found that seaweeds extract treatment increased NPK % in corms. Moreover, Ahmed (2013) and Abdel-Mola (2017) concluded that active dry yeast treatment increased N, P and K % in corms of gladiolus.

Effect of the interaction treatments was significant, in both seasons, for NPK % in corms. The highest values for N, P and K% in corms were obtained due to fertilizing plants with high level of compost (7.5 ton/fed.) plus treating plants with seaweeds extract (3 cm^3/l) followed by active dry yeast (5 g/l) without significant differences between them except in K% in the two growing seasons.

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Table 10. Effect of compost and natural stimulants, as well as, their combination treatments on NPK percentages in dry corms of *Gladiolus grandiflorus* cv. Peter Pears plants during 2014/2015 and 2015/2016 seasons.

Natural stimulants treatments (B)	Compost levels (ton/fed) (A)									
	1st season (2014/2015)					2nd season (2015/2016)				
	0.0	2.5	5.0	7.5	Mean (B)	0.0	2.5	5.0	7.5	Mean (B)
N % in corms										
Control	0.415	0.436	0.466	0.506	0.456	0.422	0.438	0.469	0.515	0.461
Green tea extr. 5 g/l	0.474	0.515	0.546	0.585	0.530	0.487	0.518	0.550	0.596	0.538
Moringa extr. 300 mg/l	0.495	0.534	0.569	0.609	0.552	0.498	0.560	0.595	0.640	0.573
Garlic extr. 300 mg/l	0.526	0.589	0.624	0.665	0.601	0.528	0.596	0.632	0.676	0.608
Licorice extr. 5 g/l	0.545	0.610	0.660	0.676	0.623	0.550	0.621	0.650	0.690	0.628
Active yeast 5 g/l	0.574	0.651	0.673	0.720	0.655	0.587	0.658	0.680	0.718	0.661
Seaweeds extr. 3 cm^3/l	0.576	0.652	0.675	0.721	0.656	0.588	0.659	0.682	0.720	0.662
Mean (A)	0.515	0.570	0.602	0.640		0.523	0.579	0.608	0.651	
L.S.D. at 5 %	A :0.031		B :0.072		AB :0.144	A :0.025		B :0.074		AB :0.148
P % in corms										
Control	0.302	0.359	0.380	0.388	0.357	0.311	0.367	0.390	0.390	0.365
Green tea extr. 5 g/l	0.328	0.378	0.393	0.408	0.377	0.334	0.385	0.402	0.417	0.385
Moringa extr. 300 mg/l	0.335	0.389	0.402	0.412	0.385	0.334	0.390	0.407	0.417	0.387
Garlic extr. 300 mg/l	0.338	0.392	0.408	0.422	0.390	0.342	0.397	0.414	0.429	0.396
Licorice extr. 5 g/l	0.339	0.396	0.411	0.426	0.393	0.344	0.402	0.418	0.434	0.400
Active yeast 5 g/l	0.345	0.405	0.433	0.443	0.407	0.349	0.412	0.440	0.443	0.411
Seaweeds extr. 3 cm^3/l	0.345	0.405	0.433	0.444	0.407	0.350	0.410	0.440	0.444	0.411
Mean (A)	0.333	0.389	0.409	0.420		0.338	0.395	0.416	0.425	
L.S.D. at 5 %	A :0.010		B :0.012		AB :0.024	A :0.007		B :0.016		AB :0.032
K % in corms										
Control	1.203	1.415	1.499	1.548	1.416	1.224	1.416	1.499	1.548	1.422
Green tea extr. 5 g/l	1.235	1.448	1.529	1.579	1.448	1.250	1.453	1.529	1.583	1.454
Moringa extr. 300 mg/l	1.246	1.459	1.539	1.589	1.458	1.261	1.462	1.538	1.590	1.463
Garlic extr. 300 mg/l	1.254	1.467	1.547	1.609	1.469	1.270	1.462	1.538	1.590	1.465
Licorice extr. 5 g/l	1.265	1.478	1.559	1.617	1.480	1.280	1.471	1.547	1.599	1.474
Active yeast 5 g/l	1.274	1.496	1.570	1.626	1.492	1.291	1.487	1.562	1.616	1.489
Seaweeds extr. 3 cm^3/l	1.282	1.488	1.577	1.628	1.494	1.294	1.489	1.565	1.618	1.492
Mean (A)	1.251	1.464	1.546	1.599		1.267	1.463	1.540	1.592	
L.S.D. at 5 %	A :0.049		B :0.029		AB :0.058	A :0.045		B :0.031		AB :0.062

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تأثير معاملات الكمبوست وبعض المنشطات الطبيعية على: ٢. انتاج الكورمات وبعض المكونات الكيماوية لنباتات الجلاديولس جراندفلورس صنف بيتر بيرس

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تم إجراء تجربة حقلية خلال موسمين متعاقبين هما ٢٠١٥/٢٠١٤ و٢٠١٦/٢٠١٥ في مشتل ومعمل نباتات الزينة بكلية الزراعة جامعة المنيا وذلك لدراسة تأثير التسميد العضوي بالكمبوست وبعض المنشطات الطبيعية بالإضافة إلى معاملات التداخل على انتاجية الكورمات والمكونات الكيماوية لنبات الجلاديولس جراندفلورس صنف بيتر بيرس.

أظهرت النتائج أن صفات انتاج الكورمات والكريمات (قطر الكورمة وعدد الكريمات والوزن الجاف للكريمات) والمكونات الكيماوية (صبغات البناء الضوئي الثلاث "كلوروفيل أ ، ب والكاروتينويدات" والنسبة المئوية من النتروجين والفسفور والبوتاسيوم فى الكورمات) ازداد تدريجياً بزيادة مستوي التسميد بالكمبوست. أيضا أظهرت النتائج ان كل المعاملات الخاصة بالمنشطات الطبيعية ادت الى فى انتاج الكورمات وصبغات البناء الضوئى وكذا محتوى الكورمات من النيتروجين والفوسفور والبوتاسيوم مقارنة بمعاملة الكنترول. ووجد أن استخدام مستخلص الأعشاب البحرية عند تركيز ٣ سم^{٣}/لتر أواستخدام الخميرة النشطة بتركيز ٥ جرام/لتر تكون أكثر فاعلية بالمقارنة بباقي الصفات.

وعليه يمكن التوصية بإضافة ٧,٥ طن/فدان كمبوست مع رش النباتات بمستخلص الأعشاب البحرية عند تركيز ٣ سم^{٣}/لتر أو استخدام الخميرة النشطة بتركيز ٥ جرام/لتر للحصول على أفضل محصول للكورمات والكريمات لنبات الجلاديولس جراندفلورس صنف بيتر بيرس.