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Effect of GA_3 and Chemical Fertilization Treatments on Growth, Flowering, Corm Production and Chemical Composition of *Gladiolus grandiflorus* Plant

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ABSTRACT

This study was undertaken during two successive seasons (2012/2013 & 2013/2014) to evaluate the effect of GA_3 foliar sprays at (0.0, 50, 100 and 150 ppm.) and chemical fertilization NPK at aratio of 1:1:2 namely (0.0, 2, 4 and 6 g / plant) as well as their combination on the growth, flowering, corm production and chemical composition of *Gladiolus grandiflorus* cv. White Prosperity plant. Obtained results showed that all tested GA_3 concentrations and NPK chemical fertilizers treatments as well as their combination increased vegetative growth parameters i.e., leaf length, leaf area, number and fresh weight of leaves / plant as compared with control in the two seasons. Moreover, the longest spike and flowering portion as well as the highest number of florets / spike were scored by GA3 at 150 ppm combined with chemical fertilizer at 6 g / plant in the two seasons. The thickest spike and the heaviest fresh spike were recorded by GA3 at 100 ppm enriched with chemical fertilizer at 6 g / plant, while the thickest lower floret was gained by the combined treatment between GA3 at 50 ppm and chemical fertilizer at 6 g / plant in the two seasons. Moreover, GA3 at 50 ppm supported with chemical fertilizer at 6 g / plant produced the thickest corm and the heaviest fresh corm in the two seasons. Whereas, the highest number of cormels and the heaviest fresh cormels / plant were recorded by 100 ppm GA3-sprayed plants , fertilized with chemical fertilizer at 6 g / plant in the two seasons. Also, all tested combinations between GA3 and NPK chemical fertilizer significantly increased leaf N, P, K and total carbohydrates content, particularly using the combinations between GA_3 at 150 or 100 ppm and NPK chemical fertilizer at 4 or 6 g/plant in both seasons. Conclusively, treating *Gladiolus grandiflorus* cv. White Prosperity plants with GA3 at 150 or 100 ppm combined with NPK chemical fertilizer at 4 or 6 g/plant showed the best vegetative, corm production and flowering characteristics with high quality.

Keywords: *Gladiolus grandiflorus*, GA3, fertilization, vegetative growth, flowering, corms and chemical constituents.

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INTRODUCTION

Gladiolus grandiflorus belongs to family Iridaceae. It is one of the most important ornamental bulbous plants. It has decorative spike which carriers numerous florets. Its flowers are excellent attractive cut flowers, which are needed for local markets in winter and spring, as well as, for export to foreign ones. They are used especially in landscape, production of commercial cut-flowers and act as a source of glorious colors and perfumes. Moreover, Gladiolus plants are commonly used in border and beds of many gardens (Rees, 1992).

Gladiolus is derived from the native plants of south and central Africa, as well as, the Mediterranean region (De-Hertogh and Le Nard, 1995). Gladiolus is represented by 180 species and 10000 cultivars including almost all colors. Many cultivars varied in size, color, flowering date and other flowering aspects such as White Prosperity, Eurovision, Novolux, Rose Supreme, Peter Pears, Sancerre and others have been recently introduced to Egypt. Planted areas with such Gladiolus cultivars in Egypt in increasingly expanded in order to meet the increase demand for Gladiolus flowers for local market and exportation. In this study corms of Gladiolus cultivar White Prosperity were chosen for its popularity and adaptability to the Egyptian environmental conditions. Also, White Prosperity has some important characters such as its favorable height (80 to 100 cm), sturdiness of stem is good with large florets size which is showy florets (7.0 to 8.0 cm) (Hogan, 1990).

Bulbs plants in most cases need more than two applications of fertilizers during the growing season, but the most important point is that the greatest increment in size and weight of the new developing bulb takes place in the period during and mostly after flowering, as long as the leaves remains in good condition. So, fertilization must continue for good vegetative growth to produce a good flower and large new mature bulbs (Rees, 1992). In this respect, Shahin (1998) cleared that spraying *Hemerocallis aurantiaca* plants with greenzit (foliar fertilizer containing macro and micro elements) at the rates of 1, 3 or 5cm3 per liter caused a considerable increase in vegetative and flowering growth as well as leaf chemical composition determinations. Youssef and Abd El-Aal (2014) indicated that fertilizing *Hippeastrum vittatum* plants with chemical fertilizer (NPK) at 6 g/plant improved the tested vegetative and flowering growth parameters. Also, Ghatas (2015) pointed out that chemical fertilizer (NPK) at 5 g/plant improved the studied vegetative and flowering growth parameters of *Hemerocallis aurantiaca* plants.

Plant growth and development are greatly influenced by chemical growth regulators. The stimulatory effect of gibberellins application on growth and flowering of the different ornamental plants has been reported by several researchers. In this regard, Naglaa and Kandeel (2001) on iris, Youssef (2004) found that spraying *Strelitzia reginae* plants with GA3 at 100 or 200 ppm improved vegetative growth parameters (number of leaves and offsets, plant height, fresh and dry weights of leaves) as well as flowering growth parameters (number, length, fresh and dry weights of flowers/plant).In addition, Abou-EL-Ella (2007) showed that spraying *Acanthus mollis* plant with GA3 enhanced vegetative and flowering growth measurements. Besides, Hemud (2016) revealed that spraying *Hemerocallis aurantiaca* plant with GA3 at

300 ppm improved vegetative and flowering growth measurements.

Therefore, the present study was carried out to investigate the effect of GA3 foliar spry and chemical fertilization treatments on vegetative growth, flowering and corm production of *Gladiolus grandiflorus* cv. White Prosperity plants.

MATERIALS AND METHODS

A field experiment was carried out during the two successive seasons of 2012/2013 and 2013/2014 at the Nursery of Ornamental plants, Faculty of Agriculture, Benha University Egypt. The aim of this study was to figure out the effect of GA3 foliar spray and chemical fertilization, as well as, their interaction on some vegetative growth, flowering, corms and cormels production, as well as, chemical composition of *Gladiolus grandiflorus* cv. White Prosperity plants.

Plant material:

The corms of gladiolus devoted for this study were imported from Holland. Average corm diameter was 2.68 and 2.89 cm and average corm weight was 9.88 and 10.24 g for the two seasons, respectively, all corms were soaked in Topsin at the concentration of 1 g/l. for one minute.

Planting procedure:

Gladiolus Corms were planted in loamy soil "(the analyses of the used soil are presented in Tables (a,b)" on October 1st in beds 1x1m^2 as every bed contain 8 corms planted at 25x25 cm in between in both seasons.

Table (a): Mechanical analysis of the experimental soil.

Parameters	Unit	Season	
		2012/2013	2013/2014
Coarse sand	%	6.01	5.72
Fine sand	%	14.84	15.25
Silt	%	26.28	27.31
Clay	%	52.87	51.72
Textural class	------	Loamy	Loamy

Table (b): Chemical analysis of the Experimental Soil.

Parameters	Unit	Seasons	
		2012/2013	2013/2014
$CaCo_3$	%	1.07	1.16
Organic matter	%	1.84	1.79
Available nitrogen	%	0.91	0.87
Available phosphorus	%	0.36	0.39
Available potassium	%	0.87	0.91
E.C	ds/m	1.11	1.21
pH	----------	7.82	7.76

Fertilization treatments:

Gladiolus grandiflorus cv. White Prosperity plants received chemical fertilizer (using ammonium nitrate (33% N), calcium superphosphate (15.5% P_2O_5) and potassium sulfate (48% K_2O). A mixture of the three fertilizers, with a ratio of 1:1:2 (N: P_2O_5: K_2O), was prepared and applied to the plants at the rate of 2, 4 and 6g/plant (16, 32 and 48 g/ plot) as side dressing six times at two weeks interval, starting at mid February in the two seasons.Control plants were left without chemical fertilization as control treatment.

Gibberellin treatments:

Gladiolus grandiflorus cv. White Prosperity plants were subjected to GA3 foliar sprays at 0, 50, 100 and 150 ppm four times, each at two weeks interval, starting at February 1st in the two seasons. A surfactant (Tween 20) at a concentration of 0.01% was added to all tested solutions including the control (tap water).

Experiment layout:

The design of this experiment was a factorial experiment in a complete randomize block design with 16 treatments represented the combinations between GA_3 at the rates of 0, 50, 100 and 150 ppm and chemical fertilization at the rates of 0, 2, 4 and 6 g/ plants (4 chemical fertilization levels x 4 GA3 concentrations) replicated three times (each replicate consisted of five beds, with eight bulbs/bed). Common agricultural practices (irrigation, manual weed control,… etc.) were carried out when needed.

Data recorded:

1- Vegetative growth characters just before flowering were recorded:

1- Leaf length (cm), 2- Leaf area (cm2), 3- Number of leaves/plant, 4- Leaves fresh weight/plant (g).

2-Flowering parameters :

During the flowering period, for each season the following data were recorded.

1-Spike length (cm), 2- Flowering portion length of the spike, 3- Spike diameter (cm) "under the lower floret", 4- Spike fresh weight (g), 5- Florets number/spike, 6- Diameter of the lower floret (cm) .

3-Corms and cormels parameters :

After flowering diminished, under ground parts were lifted 2 months after cut spikes to determine the following data:

1- Corms diameter (cm), 2- Corms fresh weight (g), 3- Number of cormels/plant and 4- Fresh weight of cormels/plant (g)

4-Chemical composition determinations:

a-Total nitrogen percentage was determined in the dried leaves by using modified micro-kjeldahl method as described by Pregl (1945).

b-Phosphorus was determined colourimetrically in spectronic (20) spectrophotometer using the method described by Trouge and Meyer (1939).

c-Potassium content was determined by flame photometer according to Brown and Lilleland (1946).

d-Total carbohydrates content was determined in dry leaf powder according to Herbert et al. (1971). All samples of chemical analyses were taken at the flowering start.

Statistical analysis:

All obtained data in both seasons of study were subjected to analysis of variance as factorial experiments in a complete randomize block design. L.S.D. method was used to differentiate between means according to Snedecor and Cochran (1989).

RESULTS AND DISCUSSION

Effect of GA3 and chemical fertilization on:

I.Vegetative growth parameters:

- Leaf length and leaf area:

Table (1) shows that there was a positive correlation between leaf length , leaf area and GA_3 or chemical fertilizer treatments. So, as the levels of GA_3 or chemical fertilizer increased, the leaf length and leaf area increased until reach to the maximum increases at the high level. This trend was true in both seasons. Therefore, 150ppm GA3-sprayed plants and 6 g/plant-fertilized plants induced the highest values in this concern in the two seasons.

In addition, all interactions between GA_3 concentrations and chemical fertilizer levels increased the leaf length and leaf area in both seasons. However, the highest values of leaf length and leaf area were scored by the combined treatment between GA_3 at 150 ppm and chemical fertilizer at 6 g/plant in the two seasons.

- Leaves number and leaves fresh weight/plant:

Data outlined in Table (2) indicated that all concentrations of GA_3 significantly increased number of leaves and leaves fresh weight when compared with untreated plants (control) in the two seasons. Specifically, the medium concentration of GA_3 (100 ppm) induced the highest number of leaves and the heaviest fresh weight / plant in both seasons. On the other side, there was a positive relationship between the number of leaves , leaves fresh weight and chemical fertilizer levels, hence the number of leaves and leaves fresh weight were increased as the level of chemical fertilizer increased. In this concern, fertilizing the gladiolus plants with the highest level(6g/plant) statistically gave the highest values of No.of leaves and leaves fresh weight / plant in both seasons.

Table (1):Effect of GA3 and chemical fertilization treatments on leaf length and leaf area of *Gladiolus grandiflorus* plants during 2012/2013 and 2013/2014 seasons.

Parameters	Treatments	Leaf length (cm) GA3 0.0	50ppm	100 ppm	150 ppm	Mean	Leaf area (cm^2) GA3 0.0	50 ppm	100 ppm	150 ppm	Mean
		First season (2012/2013)									
fertilization	0.0	54.3	57.1	61.2	63.4	59.0	46.8	49.6	53.7	58.2	52.1
	2g/plant	56.4	59.2	63.9	66.4	61.5	48.3	51.4	56.1	63.1	54.7
	4g/plant	59.8	61.8	67.8	71.2	65.1	51.6	56.2	59.8	67.2	58.7
	6g/plant	61.2	63.1	69.2	73.1	66.7	52.4	58.1	61.0	68.6	60.0
Mean		57.9	60.3	65.5	68.5		49.8	53.8	57.7	64.3	
LSD at 5 % for											
GA3 treatments				2.01					2.12		
chemical fertilizer treatments				2.01					2.12		
Interaction (GA3 X fertilizer)				4.04					4.24		
		Second season(2013/2014)									
fertilization	0.0	56.7	59.8	64.2	68.1	62.2	49.3	51.9	54.0	57.9	53.3
	2g/plant	58.3	63.1	67.2	69.9	64.6	51.2	53.6	56.9	61.4	55.8
	4g/plant	64.2	68.2	73.6	76.8	70.7	54.1	58.2	61.2	66.5	60.0
	6g/plant	65.3	70.1	75.0	78.2	72.2	55.6	59.0	63.4	69.4	61.9
Mean		61.1	65.3	70.0	73.3		52.6	55.7	58.9	63.8	
LSD at 5 % for											
GA3 treatments				1.24					1.22		
Fertilization treatments				1.24					1.22		
Interaction (GA3 X fertilizer)				2.48					2.44		

Furthermore, data in Table (2) showed that all teted interactions between GA_3 concentrations and chemical fertilizer levels statistically increased number of leaves and leaves fresh weight / plant when compared with control in the two seasons. To elaborate, the combined treatment between GA_3 at 100 ppm and chemical fertilizer at 6g/plant, significantly gave the highest number of leaves and the heaviest fresh weight / plant when compared with the remained combinations or control in the two seasons.

The obtained results of GA_3 regarding vegetative growth parameters may be due to the fact that GA_3 causes cell elongation by the induction of enzymes that weaken the cell walls. Furthermore, the mechanism by which gibberellins might increase cell elongation is that the hydrolysis of starch resulting from the production of GA_3 induced α-amylase which might improve the

concentration of sugars, so raising the osmotic pressure in the cell sap so that water enters the cell and tends to stretch it (Macleod and Millar, 1962). The above-mentioned results of vegetative growth measurements as affected by GA_3 go on line with those of Singh *et al.*, (1994) on dahlia, Preeti *et al*., (1997) and Ved *et al.*, (1998) on tuberose Dantuluri *et al*., (2002) on *Lilium moculatum* and Goma (2003) who stated that GA_3 at 50, 100 and 150 ppm increased the plant height, stem diameter, number of branches and leaves fresh weight of *Dahlia pinnata*. While, the results of chemical fertilizer are coincide with those achieved by Manoly (1996) on Iris and Shahin (1998) on *Hemerocallis aurantiaca*, pointed out that spraying the plants with greenzit (foliar fertilizer containing macro and micro elements) at the levels of 1, 3 or 5cm^3 per liter increased the number of leaves and offshoots /plant and fresh and dry weights of leaves, Atta-Alla and Zaghloul (2002) on Iris, Youssef and Goma (2007) on *Iris tingitana* and Abou-El-Ella (2007) revealed that spraying *Acanthus mollis* plants with Kristalon at 2, 3 or 4 g/L and New-star fertilizer at 3, 4 or 5 g/L increased plant height, number of leaves and fresh and dry weights of the leaves. In addition, Hemud (2016) cleared that chemical fertilizer (NPK) at 6 g/plant increased plant height, the number of leaves and offshoots /plant and fresh and dry weights of leaves of *Hemerocallis aurantiaca* plants.

Table (2): Effect of GA3 and chemical fertilization treatments on leaves number and leaves fresh weight of *Gladiolus grandiflorus* plants during 2012/2013 and 2013/2014 seasons.

Parameters		Leaves number/plant					Leaves fresh weight / plant(g)				
		GA3				Mean	GA3				Mean
	Treatments	0.0	50ppm	100 ppm	150 ppm		0.0	50 ppm	100 ppm	150 ppm	
		First season(2012/2013)									
fertilization	0.0	8.13	8.34	8.73	8.59	8.45	17.3	18.3	19.7	19.1	18.6
	2g/plant	8.19	8.41	8.81	8.61	8.51	18.9	19.6	21.0	21.3	20.2
	4g/plant	8.26	8.56	8.92	8.71	8.61	20.4	22.8	26.4	25.2	23.7
	6g/plant	8.31	8.62	8.96	8.74	8.66	21.3	23.7	28.3	27.4	25.2
Mean		8.22	8.48	8.86	8.66		19.5	21.1	23.9	23.3	
LSD at 5 % for											
GA3 treatments				N.S					1.14		
chemical fertilizer treatments				N.S					1.14		
Interaction (GA3 X fertilizer)				N.S					2.28		
		Second season (2013/2014)									
fertilization	0.0	7.24	7.31	7.70	7.52	7.44	16.4	17.5	18.9	18.4	17.8
	2g/plant	7.29	7.36	7.78	7.61	7.51	18.1	19.1	19.8	19.4	19.1
	4g/plant	7.34	7.42	7.86	7.74	7.59	21.0	21.8	24.3	22.6	22.4
	6g/plant	7.36	7.46	7.92	7.78	7.63	21.7	22.1	26.0	23.4	23.3
Mean		7.31	7.37	7.82	7.66		19.3	20.1	22.3	21.0	
LSD at 5 % for											
GA3 treatments				N.S					1.34		
Fertilization treatments				N.S					1.34		
Interaction (GA3 X fertilizer)				N.S					2.68		

II.Flowering growth parameters:

- Length of spike and flowering portion (cm):

Data illustrated in Table (3) indicates that the spike length and flowering portion increased as the concentration of GA_3 increased in the two seasons. In all, 150 ppm GA_3-sprayed plants significantly induced the greatest values of spike and flowering portion length as compared with control plants in the two seasons. In addition, all tested chemical fertilizer treatments increased the values of these parameter, especially the high level (6g/plant) in the two seasons.

On the other side, all combinations of GA_3 concentrations and chemical fertilizer levels induced a remarkable increments in this parameter, especially the combinations of GA_3 at 150 ppm in both seasons. However, the highest values of spike and flowering portion length was recorded by the combined treatment between GA_3 at 150 ppm and chemical fertilizer at 6g/L in the two seasons.

- Diameter and fresh weight of spike:

Data presented in Table (4) indicated that all treatments of GA_3 statistically increased the diameter and fresh weight of spike as compared with control in the two seasons. In this concern, the highest values of diameter and fresh weight of spike were recorded by the medium concentration of GA_3 , followed in descending order by the low and high concentration in the two seasons.

Table (3): Effect of GA3 and chemical fertilization treatments on spike length and flowering portion length of *Gladiolus grandiflorus* plants during 2012/2013 and 2013/2014 seasons.

Parameters		Spike length (cm)					Flowering portion length (cm)				
		GA3				Mean	GA3				Mean
	Treatments	0.0	50ppm	100 ppm	150 ppm		0.0	50 ppm	100 ppm	150 ppm	
						First season (2012/2013)					
fertilization	0.0	51.8	54.6	62.3	64.9	58.4	30.2	32.8	34.2	35.6	33.2
	2g/plant	53.4	61.2	66.1	67.2	62.0	32.6	33.6	36.4	39.2	35.5
	4g/plant	59.2	68.3	69.8	71.3	67.2	36.1	39.4	41.2	43.0	39.9
	6g/plant	62.3	69.6	71.3	74.2	69.4	37.4	43.0	46.0	47.2	43.4
Mean		56.7	63.4	67.4	69.4		34.1	37.3	39.5	41.3	
LSD at 5 % for											
GA3 treatments				2.25					2.15		
chemical fertilizer treatments				2.25					2.15		
Interaction (GA3 X fertilizer)				4.50					4.30		
						Second season (2013/2014)					
fertilization	0.0	54.3	57.4	62.4	63.6	59.5	32.9	33.1	35.7	36.2	34.5
	2g/plant	56.1	61.0	64.3	65.4	61.7	34.6	34.8	37.8	39.1	36.6
	4g/plant	59.8	68.6	69.4	69.8	66.9	38.2	39.1	41.6	43.2	40.5
	6g/plant	62.7	69.4	71.3	72.0	68.9	39.1	41.2	42.8	44.6	41.9
Mean		58.2	64.1	66.9	67.8		36.2	37.1	39.5	40.8	
LSD at 5 % for											
GA3 treatments				1.82					1.84		
Fertilization treatments				1.82					1.84		
Interaction (GA3 X fertilizer)				3.64					3.68		

Table (4): Effect of GA3 and chemical fertilization treatments on spike diameter and spike fresh weight of *Gladiolus grandiflorus* plants during 2012/2013 and 2013/2014 seasons.

Parameters		Spike diameter (cm)					Spike fresh weight (g)				
		GA3				Mean	GA3				Mean
	Treatments	0.0	50ppm	100 ppm	150 ppm		0.0	50 ppm	100 ppm	150 ppm	
						First season (2012/2013)					
fertilization	0.0	8.36	8.49	8.81	8.41	8.52	15.3	16.8	19.4	16.1	16.9
	2g/plant	9.21	9.48	10.13	9.62	9.70	18.1	19.3	23.0	19.1	19.9
	4g/plant	10.14	10.62	11.62	10.43	10.70	24.4	26.4	29.4	25.7	26.5
	6g/plant	10.36	10.94	11.94	10.82	11.02	26.1	29.2	32.6	28.2	29.0
Mean		9.52	9.97	10.63	9.82		21.0	22.9	26.1	22.3	
LSD at 5 % for											
GA3 treatments				1.12					2.54		
chemical fertilizer treatments				1.12					2.54		
Interaction (GA3 X fertilizer)				2.24					5.08		
						Second season (2013/2014)					
fertilization	0.0	9.14	9.42	9.71	9.36	9.41	16.8	18.2	21.6	17.8	18.6
	2g/plant	9.83	10.36	10.92	10.26	10.34	19.4	19.8	26.0	19.5	21.2
	4g/plant	10.62	11.16	11.84	11.08	11.18	26.2	27.4	32.1	27.1	28.2
	6g/plant	11.21	11.28	12.14	11.15	11.45	28.4	31.2	35.0	29.8	31.1
Mean		10.20	10.56	11.15	10.46		22.7	24.2	28.7	23.4	
LSD at 5 % for											
GA3 treatments				1.27					2.22		
Fertilization treatments				1.27					2.22		
Interaction (GA3 X fertilizer)				2.54					4.44		

On the other hand, there was a positive relationship between the values of diameter and fresh weight of spike and chemical fertilizer levels, so the values of diameter and fresh weight of spike increased as the level of chemical fertilizer increased. Hence, 6g/plant chemical fertilizer-fertilized plants is being the most effective one for producing the highest values of diameter and fresh weight of spike in the two seasons.

In general, all combinations of GA_3 concentrations and chemical fertilizer levels increased the values of diameter and fresh weight of spike in both seasons. However, the highest values of diameter and fresh weight of spike were scored by the combined treatment between GA_3 at 100 ppm and chemical fertilizer at 6g/plant, followed in descending order by the combined treatment between GA_3 at 100 ppm and chemical fertilizer at 4g/plant in the two seasons.

- Florets number and lower floret diameter :

Data presented in Table (5) clear that all treatments of GA_3 increased the florets number and lower floret diameter in the two seasons, with superior for the low concentration, followed in descending order by the medium and high concentration in the two seasons. Moreover, all application of chemical fertilizer increased florets number and lower floret diameter as compared with the un-fertilized pants in the two seasons. In this respect, the increments in florets number and lower floret diameter were in parallel to the applied

level of chemical fertilizer, so the highest level of chemical fertilizer (6g/plant) significantly registered the highest values of florets number and lower floret diameter in the two seasons. Generally, all resulted combination between GA3 and fertilization increased the values of florets number and lower floret diameter, as compared with control plants in the two seasons. However, the greatest number of florets/spike was scored by the combined treatment between GA3 at 150 ppm and chemical fertilizer at 6 g / plant, whereas the thickest lower floret was recorded by those fertilized by 6 g / plant and received GA3 at 50 ppm in the two seasons.

The aforementioned results of flowering growth parameters are in parallel with those obtained by Dantuluri *et al.*, (2002) and Tiwari and Singh (2002) on *Lilium maculatum*, Wankhede *et al.*, (2002) on *Polianthes tuberosa* , Goma (2003) on *Dahlia pinnata* and Youssef (2004) they indicated that spraying *Strelitzia reginae* plants with GA_3 at 200 or 300 ppm increased number of flowers/plant, length and diameter of flower, diameter of flower (cm), fresh weight of flower/plant, duration of flower on plant and vase life of flower as well as producing early flowering . In addition, Hemud (2016) showed that GA3 at 200 and 300 ppm increased flower length as well as their fresh and dry weights of *Hemerocallis aurantiaca* plants.

The aforementioned results of chemical fertilizer are coincided with those obtained by Barman and Pal (1993) on *Polianthes tuberosa*, Mukherjee *et al.*, (1994) on gladiolus, Singh and Uma (1996) on *Polianthes tuberosa*, Shahin (1998) on *Hemerocallis aurantiaca*, showed that spraying the plants with greenzit (foliar fertilizer containing macro and micro elements) at the rates of 1, 3 or $5cm^3$ per liter improved flowering start, number of flowers, length and diameter of flower stalk, fresh and dry weights of flower and flower vase life Youssef (2004) stated that treating *Strelitzia reginae* plants with stimufol fertilizer at 4 or 6 g/L enhanced flowering growth parameters i.e., number of days to start flowering "flowering date", length of flowering stalk, diameter of flowering stalk fresh and dry weights of flowering stalk.

Youssef and Abd El-Aal (2014) indicated that fertilizing *Hippeastrum vittatum* plants with chemical fertilizer (NPK) at 6 g/plant increased the length and diameter of flower as well as their fresh weight. Also, Ghatas (2015) showed that NPK chemical fertilization at 5 g/plant increased flower length and diameter as well as their fresh weight of *Hemerocallis aurantiaca* plants.

Table (5): Effect of GA3 and chemical fertilization treatments on florets number/spike and lower floret number of *Gladiolus grandiflorus* plants during 2012/2013 and 2013/2014 seasons.

Parameters		Florets number/spike					Lower floret diameter (cm)				
		GA3				Mean	GA3				Mean
	Treatments	0.0	50ppm	100 ppm	150 ppm		0.0	50 ppm	100 ppm	150 ppm	
						First season (2012/2013)					
fertilization	0.0	9.26	9.73	9.86	10.02	9.72	5.37	6.34	6.14	5.62	5.88
	2g/plant	9.39	9.92	10.21	10.18	9.93	6.29	9.20	8.82	8.10	8.10
	4g/plant	9.62	10.30	10.43	10.64	10.25	8.16	11.36	10.94	10.82	10.32
	6g/plant	9.81	10.34	10.51	10.72	10.35	9.17	11.84	11.21	10.96	10.80
Mean		9.52	10.07	10.25	10.39		7.25	9.69	9.28	8.88	
LSD at 5 % for											
GA3 treatments				0.12					2.24		
chemical fertilizer treatments				0.12					2.24		
Interaction (GA3 X fertilizer)				0.24					4.48		
						Second season (2013/2014)					
fertilization	0.0	8.81	9.22	9.68	9.83	9.39	6.52	7.84	7.19	6.84	7.10
	2g/plant	8.96	9.38	10.20	10.36	9.73	7.18	8.63	8.53	8.26	8.15
	4g/plant	9.24	10.21	10.64	10.82	10.23	8.93	10.37	10.26	9.47	9.76
	6g/plant	9.35	10.29	10.92	11.11	10.42	9.26	10.92	10.64	9.38	10.05
Mean		9.09	9.78	10.36	10.53		7.97	9.44	9.16	8.49	
LSD at 5 % for											
GA3 treatments				0.13					1.14		
Fertilization treatments				0.13					1.14		
Interaction (GA3 X fertilizer)				0.26					2.28		

III. Corms parameters:

- Diameter and fresh weight of corm:

Data outlined in Table (6) revealed that all tested GA_3 concentration increased the diameter and fresh weight of corm in the two seasons, with superior for the low concentration, followed in descending order by the medium and high concentration in the two seasons. Moreover, all application of chemical fertilizer increased the diameter and fresh weight of corm as compared with the un-fertilized pants in the two seasons. In this concern, the increments in the diameter and fresh weight of corm were in parallel to the applied level of chemical fertilizer, hence the highest level of chemical fertilization (6g/plant) significantly registered the highest values of the diameter and fresh weight of corm in the two seasons. Briefly, all tested combinations of GA3 and fertilization increased the values of the diameter and fresh weight of corm as compared with control plants in the two seasons. Meanwhile, the thickest corm and the heaviest fresh corm were scored by those fertilized by 6 g / plant and received GA3 at 50 ppm in the two seasons.

- Number and fresh weight of cormels:

Data in Table (7) demonstrates that all concentration of GA_3 statistically increased the number and fresh weight of cormels as compared with control in

the two seasons. In this sphere, the highest values of number and fresh weight of cormels were recorded by the medium concentration of GA_3 , followed in descending order by the high and low concentration in the two seasons. On the other side, there was a positive relationship between the values of number and fresh weight of cormels and chemical fertilizer levels, hence the values of number and fresh weight of cormels increased as the level of chemical fertilizer increased. So, 6g/plant chemical fertilizer-fertilized plants produced the highest values of number and fresh weight of cormels in the two seasons.

Generally, all tested combinations of GA_3 concentrations and chemical fertilizer levels increased the values of number and fresh weight of cormels in both seasons. However, the highest values of number and fresh weight of cormels were scored by the combined treatment between GA_3 at 100 ppm and chemical fertilizer at 6g/plant in the two seasons.

Table (6): Effect of GA3 and chemical fertilization treatments on corm diameter and corm fresh weight of *Gladiolus grandiflorus* plants during 2012/2013 and 2013/2014 seasons.

Parameters		Corm diameter (cm)					Corm fresh weight/palnt (g)				
		GA3				Mean	GA3				Mean
	Treatments	0.0	50ppm	100 ppm	150 ppm		0.0	50 ppm	100 ppm	150 ppm	
						First season (2012/2013)					
fertilization	0.0	3.52	4.48	4.26	4.13	4.10	35.6	41.7	39.2	38.1	38.7
	2g/plant	3.78	5.32	5.17	4.82	4.77	39.4	48.6	42.7	41.0	42.9
	4g/plant	4.26	6.18	5.94	4.98	5.34	46.2	62.4	59.1	56.3	56.0
	6g/plant	4.35	6.27	6.18	5.43	5.56	49.4	66.2	62.5	59.7	59.5
Mean		3.98	5.56	5.39	4.84		42.7	54.7	50.9	48.8	
LSD at 5 % for											
GA3 treatments				0.25					3.15		
chemical fertilizer treatments				0.25					3.15		
Interaction (GA3 X fertilizer)				0.50					6.30		
						Second season (2013/2014)					
fertilization	0.0	3.81	4.69	4.37	4.12	4.25	39.4	46.2	43.1	41.7	42.6
	2g/plant	4.17	5.83	4.92	4.64	4.89	47.2	51.6	59.3	56.2	53.6
	4g/plant	5.06	6.29	5.86	5.43	5.66	54.3	64.1	61.6	58.3	59.5
	6g/plant	5.12	6.37	6.12	5.90	5.88	56.2	68.0	64.7	61.7	62.7
Mean		4.54	5.80	5.32	5.02		49.3	57.5	57.2	54.5	
LSD at 5 % for											
GA3 treatments				0.21					5.24		
Fertilization treatments				0.21					5.24		
Interaction (GA3 X fertilizer)				0.42					10.48		

Table (7): Effect of GA3 and chemical fertilization treatments on cormels number and cormels fresh weight of *Gladiolus grandiflorus* plants during 2012/2013 and 2013/2014 seasons.

Parameters		Cormels number / plant					Cormels fresh weight / plant (g)				
		GA3				Mean	GA3				Mean
	Treatments	0.0	50ppm	100 ppm	150 ppm		0.0	50 ppm	100 ppm	150 ppm	
						First season (2012/2013)					
fertilization	0.0	30.7	32.4	36.3	34.5	33.5	27.3	29.6	34.1	32.6	30.9
	2g/plant	34.2	36.9	41.9	38.4	37.9	29.6	31.4	36.4	34.7	33.0
	4g/plant	39.8	42.6	48.6	46.1	44.3	38.4	38.1	41.7	39.4	39.4
	6g/plant	42.3	44.4	53.4	48.2	47.1	40.1	41.6	45.2	43.6	42.6
Mean		36.8	39.1	45.1	41.8		33.9	35.2	39.4	37.6	
LSD at 5 % for											
GA3 treatments				1.28					2.33		
chemical fertilizer treatments				1.28					2.33		
Interaction (GA3 X fertilizer)				2.56					4.66		
						Second season (2013/2014)					
fertilization	0.0	32.7	34.3	38.1	37.2	35.6	29.8	32.4	36.4	35.1	33.4
	2g/plant	36.4	39.6	46.7	42.6	41.3	34.0	36.2	42.7	39.2	38.0
	4g/plant	42.1	46.2	51.3	49.3	47.2	39.2	41.8	51.2	43.7	44.0
	6g/plant	45.6	48.4	54.2	51.0	49.8	46.2	43.7	54.6	47.6	48.0
Mean		39.2	42.1	47.6	45.0		37.3	38.5	46.2	41.4	
LSD at 5 % for											
GA3 treatments				2.84					2.27		
Fertilization treatments				2.84					2.27		
Interaction (GA3 X fertilizer)				5.68					5.06		

IIII.Chemical determinations:

Data illustrated in Tables (8) and (9) showed that all tested GA_3 concentrations increased leaf N, P, K and total carbohydrates contents with significant differences in most cases. Regarding chemical fertilization treatments, data showed that leaf N, P, K and total carbohydrates contents of Gladiolus plants increased with increasing chemical fertilization level. Since, 6g/L chemical fertilizer-fertilized plants induced the highest values in this concern. Moreover, all combinations between GA_3 concentrations and chemical fertilizer levels statistically increased leaf N, P, K and total

carbohydrates contents in the two seasons. However, the highest values of these parameters were recorded by the combinations of chemical fertilizer at the highest level in the two seasons.

Table (8): Effect of GA3 and chemical fertilization treatments on leaf N and P content of *Gladiolus grandiflorus* plants during 2012/2013 and 2013/2014 seasons.

Parameters		N (%)					P (%)				
		GA3				Mean	GA3				Mean
	Treatments	0.0	50ppm	100 ppm	150 ppm		0.0	50 ppm	100 ppm	150 ppm	
						First season (2012/2013)					
fertilization	0.0	2.37	2.41	2.53	2.61	2.48	0.234	0.239	0.246	0.249	0.242
	2g/plant	2.49	2.62	2.68	2.71	2.63	0.241	0.246	0.249	0.253	0.247
	4g/plant	2.61	2.91	2.96	2.98	2.87	0.253	0.259	0.266	0.272	0.263
	6g/plant	2.68	2.98	3.14	3.17	2.99	0.256	0.264	0.271	0.279	0.268
Mean		2.54	2.73	2.83	2.87		0.246	0.252	0.258	0.263	
LSD at 5 % for											
GA3 treatments				0.14					0.012		
chemical fertilizer treatments				0.14					0.012		
Interaction (GA3 X fertilizer)				0.28					0.024		
						Second season (2013/2014)					
fertilization	0.0	2.21	2.34	2.47	2.52	2.39	0.241	0.248	0.253	0.259	0.250
	2g/plant	2.38	2.46	2.53	2.61	2.50	0.249	0.253	0.258	0.261	0.255
	4g/plant	2.54	2.52	2.68	2.74	2.62	0.258	0.260	0.264	0.269	0.263
	6g/plant	2.59	2.61	2.70	2.79	2.67	0.264	0.262	0.268	0.271	0.266
Mean		2.43	2.48	2.60	2.67		0.253	0.256	0.261	0.265	
LSD at 5 % for											
GA3 treatments				0.15					0.013		
Fertilization treatments				0.15					0.013		
Interaction (GA3 X fertilizer)				0.30					0.026		

Table (9): Effect of GA3 and chemical fertilization treatments on leaf K and total carbohydrates content of *Gladiolus grandiflorus* plants during 2012/2013 and 2013/2014 seasons.

Parameters		K(%)					Total carbohydrates (%)				
		GA3				Mean	GA3				Mean
	Treatments	0.0	50ppm	100 ppm	150 ppm		0.0	50 ppm	100 ppm	150 ppm	
						First season (2012/2013)					
fertilization	0.0	1.39	1.46	1.54	1.61	1.50	10.64	11.26	12.17	13.26	11.83
	2g/plant	1.46	1.52	1.61	1.67	1.57	11.21	12.42	13.24	13.82	12.67
	4g/plant	1.52	1.68	1.78	1.82	1.70	12.91	14.14	14.68	14.92	14.16
	6g/plant	1.58	1.71	1.81	1.86	1.74	13.20	14.96	15.17	15.26	14.64
Mean		1.49	1.59	1.69	1.74		11.99	13.18	13.82	14.32	
LSD at 5 % for											
GA3 treatments				0.11					1.02		
chemical fertilizer treatments				0.11					1.02		
Interaction (GA3 X fertilizer)				0.22					2.04		
						Second season (2013/2014)					
fertilization	0.0	1.43	1.52	1.61	1.68	1.56	11.17	12.39	13.64	14.21	12.85
	2g/plant	1.56	1.67	1.70	1.75	1.67	11.84	13.14	13.92	14.31	13.30
	4g/plant	1.65	1.70	1.79	1.82	1.74	13.21	14.62	14.86	15.17	14.47
	6g/plant	1.72	1.79	1.83	1.89	1.81	13.94	15.11	15.26	15.60	14.98
Mean		1.59	1.67	1.73	1.79		12.54	13.82	14.42	14.82	
LSD at 5 % for											
GA3 treatments				0.13					0.82		
Fertilization treatments				0.13					0.82		
Interaction (GA3 X fertilizer)				0.26					1.64		

The stimulated effect of chemical fertilizer may be due to the role of chemical fertilizer on supplying the plants with carbohydrates and proteins production which are necessary for vegetative, flowering, bulbs growth and chemical constituents of gladiolus (Marschner, 1997). The aforementioned results of GA_3 were in harmony with those reported by Tawila (2000) on *Polianthes tuberose*, Dantuluri *et al.*, (2002) on Lilium maculatum, Wankhede et al., (2002) on *Polianthes tuberosa* Tiwari and Singh (2002) on *Lilium maculatum*, Goma (2003) on *Dahlia pinnata*, Salama (2003) on *Strelitzia reginae* , Youssef and Goma (2007) on *Iris tingitana* and Abou El-Ella (2007) they stated that spraying *Acanthus mollis* plants with GA_3 at 100 or 200 ppm enhanced leaf N,P.K and total chlorophyll contents. Besides, Hemud (2016) demonstrated that GA3 at 200 and 300 ppm increased leaf N, P, K and total carbohydrates content of *Hemerocallis aurantiaca* plants.

The aforementioned results of chemical constituents concerning NPK fertilization are in conformity with those obtained by Shahin (1998) on

Hemerocallis, indicated that spraying the plants with greenzit (foliar fertilizer containing macro and micro elements) at the rates of 1, 3 or 5cm^3 per liter increased leaf N, P, K and total carbohydrates content, Naglaa and Kandeel (2001), Atta-Alla and Zaghloul (2002) on *Iris tingitana*, Youssef (2004) on *Strelitzia reginae*, El-Sayed (2004) on *Iris tingitana* ,Abou-El-Ella (2007) on *Acanthus mollis* and Youssef and Goma (2007) stated that treating *Iris tingitana* plants with stimufol fertilizer at 4 or 6 g/L significantly increased leaf(N, P, K) and total carbohydrates content. Also, Ghatas (2015) demonstrated that NPK chemical fertilizer at 5 g/plant increased leaf (N, P, K) and total carbohydrates content of *Hemerocallis aurantiaca* plant.

Conclusively, in order to produce good quality *Gladiolus grandiflorus* plants, it is preferable to spray the plants with GA_3 at 100 or 150 ppm supplemented with chemical fertilization at 4 or 6g/plant.

REFERENCES

Abou El-Ella, E.M. (2007): Physiological studies on *Acanthus mollis* plant. M.Sc., Thesis, Hort. Dept. Fac. Agric., Benha Univ.

Atta-Alla, H.K. and M. Zaghloul (2002): Effect of cold storage, GA_3 and fertilization on the growth, flowering and chemical composition of *Iris tingitana* cv. Wedgwood. J. Agric. Sci. Mansoura Univ., 27 (9): 6267-6285.

Barman, D. and P. Pal (1993): A note on effects of micronutrients on growth and yield of tuberose (*Polianthes tuberosa* L.) cv. Single. Hort. J., 6 (1): 69-70.

Brown, J.D. and O. Lilleland (1946): Rapid determination of potassium and sodium in plant material and soil extract by flame photometry. Proc. Amer. Soc., Hort., Sci., 48:341-346.

Dantuluri, V.S.R.; R.L. Misra and S.Misra (2002): Effect of growth regulating chemicals on Asiatic hybrid lily. Proceedings-of-the-national-symposium-on-Indian-floriculture-in-the-new-millenium,-Lal-Bagh,-Bangalore,-25-27-February,-2002., 147-149; 8 ref.

De-Hertogh, A. andM. Le Nard. (1995) : Botanical aspects of flower bulbs. In the Physiology of Flower Bulbs, El-Sevier Amsterdam, London, New York, Tokyo, p 7-33.

El-Sayed, M.A. (2004): Physiological studies on Iris. M.Sci., Thesis, Hort. Dept. Fac. Agric., Moshtohor, Zagazig Univ.

Ghatas, Y. A.A.(2015): Response of *Hemerocallis aurantiaca* Plants to Kinetin and Chemical Fertilization Treatments. Middle East J. Agric. Res., 4(4): 650-659,

Goma, A. O. (2003): Effect of foliar spraying with Gibberellic acid and calcium on growth and flowering of Dahlia pinnata plant. The 2nd Conference of Agric.& Biological Research Division (Prospects of the Recent Agricultural Research, April, 21-23).

Hemud,M.A.(2016):Physiological studies on *Hemerocallis aurantiaca* plants.M.SC.Fac.of Agri.Benha Uni. Egypt.

Herbert, D.; P.J. Phipps and R.E. Strange (1971): Determination of total carbohydrates, Methods in Microbiology, 5 (8): 290-344.

Hogan, L. (1990) : Bulbs for all seasons. Sunset Western Garden Book, Menlo Park, CA: Lane Publishing, California, pp: 185-198.

Macleod, A.M. and A.S. Millar (1962): Effect of gibberellic acid on barley endosperm. Jour. Inst. Brewing, 68: 322-332.

Manoly, N.D. (1996): Effect of soil type, fertilization, bulb size and growth regulators on growth, flowering and chemical composition of Iris plants. Ph.D. Thesis, Hort. Dept. Fac. of Agric., Minia Univ.

Marschner, H. (1997): Mineral Nutrition of Higher Plants. Second Printing, Academic press INC. San Diego, pp: 889.

Mukherjee, S.; S.C. Jana and T.K. Chartterjee (1994): Effect of nitrogen and phosphorus doses on production of flowers and corms of gladiolus (*G. grandiflorum* L.). Ind. Agric., 38 (3): 211-213.

Naglaa, S.A.T. and A.M. Kandeel (2001): Effect of fertilization level and GA_3 application on growth, flowering, bulb productivity and chemical composition of *Iris tingitana* cv. Wedgewood. Arab Univ. J. Agric. Sci., Ain Shams Univ., Cairo, 9 (2): 803-824.

Preeti, H.; S.Gogoi; A. Mazumder and P. Hatibarua (1997): Effect of pre-plant chemical treatment of bulbs on growth and flowering of tuberose (*Polianthes tuberosa* L.) cv. Single. Annals-of-Biology-Ludhiana. 1997, 13: 1, 145-149; 8 ref.

Pregl, F. (1945): Quantitative organic micro analysis. 4th ED. J. & Achurnil, London. Regul., 4: 111-122.

Rees, A.R. (1992): Ornamental Bulbs, Corms and Tubers. C.A.B. Inter., Wallingford, UK. 61-65.

Salama, W.A. (2003): Physiological studies on *Strelitzia reginae*. M.Sc. Thesis Hort., Dept., Fac. of Agric. Moshtohor, Zagazig Univ., Egypt.

Shahin, S.M.E. (1998): Physiological studies on Crinum and Hemerocallis bulbs. Ph.D. Thesis, Fac. Agric., Tanta Univ.

Singh, J.N.; D.K. Singh and K.K. Sharma (1994): Effect of GA_3 and Alar on growth, flowering and seed production of dahlia (*Dahlia variabilis L.*). Orissa-Journal-of-Horticulture. 1994, 22: 1-2, 10-12; 4 ref.

Singh, K.P. and A. Uma (1996): Response of graded levels of nitrogen on growth and flowering in "Shringar" tuberose (*Plianthes tuberosa* L.). Ind. J. of Agric. Sci., 66 (!1): 655-657.

Snedecor, G.W. and W.G. Cochran (1989): Statistical methods. 7th Ed. Iowa State Univ. Press. Ames Iowa, USA.

Tawila, A.S.I. (2000): Physiological studies on tuberose plant (*Polianthes tuberosa* L.). M.Sci. Thesis, Fac. Agric., Moshtohor, Zagazig Univ.

Tiwari, J.K. and R.P. Singh (2002): Effect of pre-planting GA_3 treatment on tuberose. Journal-of-Ornamental-Horticulture-New-Series. 2002, 5: 2, 44-45; 1 ref.

Trouge, E. and A.H. Meyer (1939): Improvement in deiness calorimetric for phosphorus and arsenic. Ind. Eng. Chem. Anal. Ed., 1; 136-139.

Ved, P.; K.K. Jha and V. Prakash (1998): Effect of GA_3 on the floral parameters of gladiolus cultivars. Journal-of-Applied-Biology. 1998, 8: 2, 24-28; 12 ref.

Wankhede, S.G.; P.V.Belorkar; A.D.Mohariya; M.W.Alurwar; K.G. Rathod and P.P. Gawande (2002): Influence of bulb soaking and foliar spray of GA_3 on flower quality and yield of tuberose (*Polianthes tuberosa* L.). Journal-of-Soils-and-Crops. 2002, 12: 2, 293-295; 4 ref.

Youssef, A.S.M. (2004): Physiological studies on growth and flowering of *Strelitzia reginae* Ait. Plant. Ph.D. Thesis, Fac. of Agric., Moshtohor, Zag. Univ.

Youssef, A.S.M. and A.O. Gomaa (2007): Effect of some horticultural treatments on growth, flowering, bulb production and chemical composition of *Iris tingitana* cv. Wedgwood. The Third Conf. of Sustain. Agric. and Develop. Fac. of Agric., Fayoum Univ., 12-14 Nov.

Youssef, A.S.M. and M.M.M. Abd El-Aal(2014): Effect of kinetin and mineral fertilization on growth, flowering, bulbs productivity, chemical compositions and histological features of *Hippeastrum vittatum* plant. J. Plant Production, Mansoura Univ., Vol. 5 (3): 357 – 381.

تاثير الجبرلين و معاملات التسميد الكيماوي علي النمو والازهار وانتاج الكورمات والمحتوي الكيماوي لنبات الجلاديولاس

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اجري هذا البحث خلال موسمي (٢٠١٢/٢٠١٣و٢٠١٣/٢٠١٤) لتقييم تاثير اربعه مستويات من الجبرلين بتركيزات (صفرو٥٠و١٠٠و١٥٠جزء في المليون) واربعه مسويات من التسميد الكيماوي باستخدام النتروجين والفوسفور والبوتاسيوم بنسبه١:١:٢ علي التوالي بتركيزات (صفرو٢و٤و٦جم/نبات) وذلك علي النمو والازهار وانتاج الكورمات والمحتوي الكيماوي لنبات الجلاديولاس صنف White Prosperity . وأظهرت النتائج أن جميع التركيزات من الجبرلين و الأسمدة الكيماوية والتداخل بينهما ادت الي زياده صفات النمو الخضري كطول الورقة، مساحة الورقة وعدد والوزن الطازج للأوراق / نبات مقارنه بالكنترول في كلا الموسمين. وعلاوة على ذلك تم الحصول علي أعلى طول للشمراخ الزهري والجزء المزهر وكذلك أكبر عدد من الزهيرات / شمراخ تم الحصول عليه عند استخدام الجبرلين بتركيز ١٥٠ جزء ف المليون مع التسميد الكيماوي من النتروجين والفوسفور والبوتاسيوم عند تركيز ٦ جم/ نبات في كلا الموسمين . وسجل اعلي وزن طازج واكبر قطر للشمراخ الزهري عند استخدام الجبرلين بتركيز ١٠٠ جزء في المليون مع التسميد الكيماوي عند٦جم/ نبات بينما ادي استخدام الجبرلين بتركيز ٥٠ جزء في المليون مع التسميد الكيماوي ٦جم/ نبات اعطي افضل سمك للزهيره السفلي في كلا الموسمين . علاوه علي ذ لك اعطت معامله التداخل بين الجبرلين عند تركيز٥٠ جزء في المليون مع التسيد الكيماوي بتركيز ٦ جم/ نبات اعطت افضل قطر ووزن طازج للكورمات في كلا الموسمين .في حين انه تم الحصول علي اعلي عدد ووزن طازج للكريمات / نبات عند الرش بالجبرلين بتركيز ١٠٠ جزء في المليون مع التسميد الكيماوي بتركيز ٦جم/نبات في الموسمين.ايضا حققت نتائج التداخل بين الجبرلين والتسميد الكيماوي بالنتروجين والفوسفور والبوتاسيوم زياده معنويه في محتوي الاوراق من النتروجين والفوسفور والبوتاسيوم والكربوهيدرات وخاصه عند الرش بالجبرلين بتركيز ١٥٠ او ١٠٠ جزء في المليون مع التسميد الكيماوي بتركيز ٤ او ٦ جم/ نبات في كلا الموسمين.بناء علي النتائج المتحصل عليها للحصول على أفضل قياسات خضرية وزهريه وانتاج الكورمات بجوده عاليه لنبات الجلاديولاس يفضل ان ترش النباتات بالجبرلين بتركيز ١٥٠ او ١٠٠ جزء في المليون مدعما مع التسميد الكيماوي بالنتروجين والفوسفور والبوتاسيوم بتركيز ٤و٦ جم /نبات.