18 *Egypt. J. Hort.* **30**, No.3- 4, pp. 267- 280 (2003)

The Response of Some Gladioli Cultivars to Gibberellic Acid (GA_3)

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THE EFFECTS of soaking gladioli corms in GA_3 (0.0, 100, 200 and 400 ppm) on the reproductive growth and flowering characteristics as well as physiological behavior of Rose-Supreme and Prosperity gladioli cultivars were investigated during two successive seasons under Al-Qassim conditions. The obtained results indicated that all GA_3 concentrations hastened flowering processes of both cultivars. The 400 ppm shortened the period to flowering for both cultivars. Flowering-stems, inflorescences and new corms measurements were markedly improved by increasing GA_3 concentrations up to 200 ppm; while higher concentrations (400 ppm) caused a reduction in these parameters. The lowest values of flowering-stem and new corm measurements were recorded for the control. Rose-Supreme flowered earlier and produced more corms and new cormels than Prosperity cv. However, Prosperity gave significantly taller, thicker and heavier flowering stems than the Rose-Supreme cv. The percentages of N, P and K in the aerial parts and new corms were generally in inverse ratio with the dry matter produced during the experimental course. GA_3 had a positive effect and can be used to improve the formation and quality of gladioli flowers under the prevailing conditions of Al-Qassim region.

Gladiolus is a very popular cut flower and garden plant. It is cultivated in almost all countries of the world where the weather conditions are favorable. Excellent quality *Gladiolus* cultivars are used as cut flowers by home gardeners and professional growers as one of the most important flowering bulbs required for both local and foreign markets. Therefore, improving both the quantitative and qualitative characteristics of this florist crop was and still is the aim of many investigators.

Two major ways are often followed to accomplish this purpose. The first one is to perform a breeding program, which is relatively costly and takes long time and a great deal of effort. The other is to use chemical treatments that can reach the target with less endeavor.

Regarding the last point, it has been reported that, plant growth regulators (PGRs) are widely used to enhance flowering and improve the quality of flower produced by different ornamental plants (Wareing & Philips, 1981). Gibberellic acid (GA_3) is known to have a positive effective role on growth and flowering of different flowering bulbs (Wareing & Phillips, 1981; Pharis & King, 1985 and Salisbury & Ross, 1992). Furthermore, the application of GA_3 is known to influence nearly all processes of reproductive development including flower initiation and differentiation, organogenesis, pollination, pollen germination and pollen tube growth, and all stages of the growth and development of flower parts (Pharis & King, 1985). Thus, the practical possibility of promoting floral induction for flower production, with good yield and quality, using GAs is being utilized increasingly for cut flower plants.

In this respect, Auge (1982) reported that GA_3 shortened the period to flowering of gladioli by ten days compared with the period for untreated plants. In addition, Dua *et al.* (1984); Afify (1986) and Afify *et al.* (1993) found that different concentrations of GA_3 (50-200 ppm) increased plant height and improved spike quality, in terms of number and size of flowers, of gladioli plants. They, also, found that the production of new corms and cormels was improved by GA_3 treatments. Moreover, Bose *et al.* (1980) and Bhahacharjee (1983) working with *Hippeastrum hybridum* reported that, GA_3 application at suitable doses improved both flowering and bulb production. In a recent study by Al-Humaid (2001), it has been found that 250 ppm of GA_3, either alone or in combination with suitable doses of Sangral fertilization, improved markedly both the growth and flowering characteristics of *Rosa hybrida* cv. Sntrix.

Obviously, a range of environmental conditions and cultural treatments including day length, photosynthetic active radiation, and day/night temperatures could alter the response of a certain crop or a cultivar to the application of a particular treatment. Gene expression and genetic behavior may differ also according to the environmental conditions prevailing during the growth period (Cohat, 1993).

The current investigation was carried out to evaluate the possible effects of gibberellic acid (GA_3),a common horticultural agrochemical, on growth and flowering characteristics of two gladioli cultivars (Rose-Supreme and Prosperity) grown under Al-Qassim environmental conditions, in area located in the Central Region of the Kingdom of Saudi Arabia.

Material and Methods

This investigation was undertaken during the 2000/2001 and 2001/2002 seasons at the Research Station of the College of Agriculture and Veterinary Medicine, King Saud University in Al-Qassim; to evaluate the effect of soaking gladioli corms in different concentrations of gibberellic acid (GA_3), on growth and flowering characteristics. Corms (10-12 cm circumference) of Prosperity (cv_1) and Rose-Supreme (cv_2) were obtained from Orman Botanical Garden in Cairo, Egypt. The corms were soaked in 0.0, 100, 200 and 400 ppm GA_3 solution for 24 hr before planting. Then, corms were planted on the 10^{th} of October in both seasons in plots of 2 × 2m at 20 × 50 cm rows. Plants were fertilized with

Sangral commercial fertilizer (20% N, 20% P, 20% K, 0.02% Mg, 70 ppm Fe, 14 ppm Zn, 16 ppmCu, 42 ppm Mn, 22 ppm B and 14 ppm Mo) at the rate of 600 kg/ha, as recommended by Mazrou & Al-Humaid (2000). The amount of fertilizer was applied in three equal side-dressing parts in each season. The first fertilization dose was applied after one month from planting, while, the second addition was one month later. The third dose was added after flower cutting. The physical and chemical properties of the experimental soil are recorded in Table 1.

TABLE 1. Chemical and physical analyses of the soil.

Chemical properties		Physical properties	
pH:	8.20	Fractions (%):	
ECe (ms):	2.06	Sand:	95.30
Soluble cations ($meq.L^{-1}$):		Silt:	3.60
Na^+	11.00	Clay:	1.10
Ca^{2+}	4.35		
Mg^{2+}	2.50		
Soluble anions ($meq.L^{-1}$):		Texture:	Sandy Soil
$CO_3^{2-} + HCO_3^-$	2.99		
SO_4^{2-}	11.70		
Cl^-	7.60		
$CaCO_3$	4.00%		
O.M.	0.23%		

The experiments were arranged in a complete randomized block design in three replications. At the end of each growing season, the following parameters were determined:

Flowering characteristics

The time taken from planting to flowering; length, base thickness, and fresh weight of the flowering-stem; inflorescence length, number and fresh weight of florets/spike; diameter, fresh and dry weights of the new corms; and number of cormels /plant.

Chemical analysis

The aerial parts of plants were oven dried (70°C) to constant weight, were finely powdered, and the following chemical constituents were measured: total N% (using Micro-Kjeldahl method as described by Chapman & Pratt, 1978); P% (measured colorimetrically using stannus chloride method described by Frie *et al.*, 1964); K% (using Flame Photometry method described by Jones & Steyn, 1973).

All data were statistically analyzed according to Snedecor & Cochran (1980) with the aid of the COSTAT computer program for statistics. Differences among treatments were tested with LSD at a 5% level of significance.

Results and Discussion

Flowering time

Recorded data (Table 2) indicate that, at both growing seasons, Rose-Supreme (cv_2) reaching flowering stage earlier than Prosperity (cv_1) regardless of GA_3 treatments. The differences between cultivars in their flowering time, in spite of their growth under the same conditions, may reflect the variation in their genetic structure and/or the differences in the gene expression between both cultivars. In this respect, several studies showed that flowering processes of gladioli species and varieties are controlled by both genetic and environmental factors. These results agreed with the findings of Al-Humaid & Mazrou (1998) and Mazrou & Al-Humaid (2000) on different gladioli cultivars.

Despite the fact that flowering is a unitary and integrated process, it is generally divided into the two major phases of flower initiation and development. These phases do not react similarly in all cultivars; besides, they do not respond similarly to the environmental and internal variables (Pharis & King, 1985). In this connection, several studies draw attention to the high diversity between gladioli cultivars. They also showed that the differences between varieties in quantitative characteristics such as earliness of flowering have a high heritability. In many cases too, it could be related to genotype/environment interaction, especially if the plants have to be grown under conditions different from those of the breeding (Ohri & Khoshoo, 1985 and Cohat, 1993).

Statistical analysis showed that soaking the corms of Prosperity and Rose-Supreme in GA_3 solution significantly accelerated the appearance of flowers, resulting in early inflorescences as it shortened the period from planting to flowering as compared with the control plants. This result was true in the two growing seasons. It is obvious that the time to flowering decreased gradually with increasing GA_3 concentration to reach its minimum value (the earliest flowering time) at 400 ppm treatment. The results were conclusive for both cultivars and seasons.

A wealth of data has demonstrated that GA_3 as a corm dipping, foliar spray or soil drench induced early sprouting of non-dormant corms, early flower differentiation, and early anthesis (Tonecki, 1980; Auge, 1982 and Bhahacharjee, 1983). The responsibility of GAs in shortening the flowering period could be explained through more than one physiological function of GAs; the role of GA_3 in accelerating the flowering-bud initiation on treated-corms of gladioli plants is well known (Afify *et al.* 1993; Auge 1982 and Afify, 1986), tulipa (Brage & Gelder, 1979) and *Hippeastrum hybridum* (Bhahacharjee, 1983). Besides, GA can replace the requirements of long day and/or low temperature treatments in cold requiring plants for flower initiation (Pharis & King, 1985).

TABLE 2. Effects of gibberellic acid (GA_3) on the flowering earliness and flowering-stem characteristics of gladioli cultivars during two successive growing seasons.

Treatments		Days to flower		Flowering-stem characteristics							
				Length (cm)		Thick. (cm)		F.wt (g)		D.wt (g)	
cv*	GA_3 (ppm)	1st S**	2nd S	1st S	2nd S	1st S	2nd S	1st S	2nd S	1st S	2nd S
		Effect of cvs									
cv_1	-	113.4	114.2	119.4	99.9	1.66	1.47	147.3	105.6	21.98	16.96
cv_2	-	95.4	93.3	106.5	88.5	1.70	1.48	127.9	97.7	20.18	14.53
L.S.D (5%)		2.06	2.24	4.49	3.08	NS	NS	5.16	7.38	0.77	1.29
		Effect of GA_3									
-	00	110.1	110.1	109.7	81.4	1.60	1.39	123.6	86.1	18.8	13.2
-	100	106.9	104.8	114.8	93.8	1.69	1.42	138.5	95.2	21.2	14.8
-	200	103.7	101.1	120.0	101.5	1.71	1.60	146.0	118.1	22.6	18.5
-	400	96.7	97.4	107.1	100.3	1.65	1.53	142.8	107.0	21.8	16.6
L.S.D (5%)		2.91	3.17	6.34	4.36	0.09	0.04	7.30	11.85	1.08	1.82
		Effect of cvs x GA_3 (interaction)									
cv_1	00	119.0	119.2	116.1	84.9	1.64	1.42	139.9	91.4	20.9	14.6
	100	116.4	114.9	120.3	100.3	1.70	1.44	146.9	105.2	22.0	16.8
	200	112.8	111.7	129.5	110.3	1.72	1.51	157.0	127.4	23.5	20.7
	400	105.3	108.0	111.5	104.4	1.57	1.49	145.6	98.2	21.5	15.7
cv_2	00	101.2	101.1	103.3	78.0	1.60	1.35	107.3	80.8	16.6	11.7
	100	97.4	94.6	109.3	87.3	1.65	1.39	130.0	85.2	20.4	12.7
	200	94.7	90.5	110.5	92.6	1.71	1.49	134.2	108.8	21.7	16.3
	400	88.1	86.8	102.7	96.2	1.73	1.46	131.0	105.9	20.0	15.4
L.S.D (5%)		3.98	4.49	8.97	6.16	0.13	0.05	10.3	16.8	1.53	2.58

* cv = cultivar S = season

Flowering-stem characteristics

As shown by the statistical analysis (Table 2), it seemed that the flowering-stems of Prosperity (cv.$_1$) are relatively taller and heavier than those of Rose-Supreme, regardless of GA_3 treatments. The differences between heights of both cultivars were as high as 19% and 21% at the first and second season, respectively. While the corresponding differences in dry weights were 9% and 17%, respectively. In this regard, Cohat (1993) reported that gladioli cultivars were considerably different from each other in terms of the reproductive-growth characteristics due to the differences in the sequences and expression of their genes under the different environmental conditions existing during corm storage and the prevailing conditions dominating during growth and flower production.

Compared with the control, GA_3-treated corms significantly increased the length, base-thickness, and fresh and dry weights of the flowering-stem of both cultivars (Table 2). However, the response of Prosperity to GA_3 was much more higher than that of Rose-Supreme. This might be attributed to enhancement of water absorption and translocation and improvement of the relative water content (RWC) in cv. Prosperity more than that in cv. Rose-Supreme (Fig. 1). Nevertheless, this stimulating effect was, obviously, not linearly processed since values of these parameters tended to decrease again at 400 ppm after they reached their highest values at 200 ppm, by which stem length and base-thickness were increased over control by about 9% and 7%, respectively, while dry weight was increased by about 20%, during the first season. A similar trend was observed during the second season. In accordance with these findings, several studies indicated the improvement of gladioli flowering-stem as treated with GA_3 under conditions different from those existing during the present study (Dua *et al.*, 1984; Afify *et al.*, 1993). The negative effect of 400 ppm was observed also on the RWC of both cvs. This effect might be attributed to the deleterious effect of high concentrations of PGRs on the plasma membrane system of the cells causing plant cells to be unable to control the absorption of water and thus increasing RWC drastically (Fig. 1).

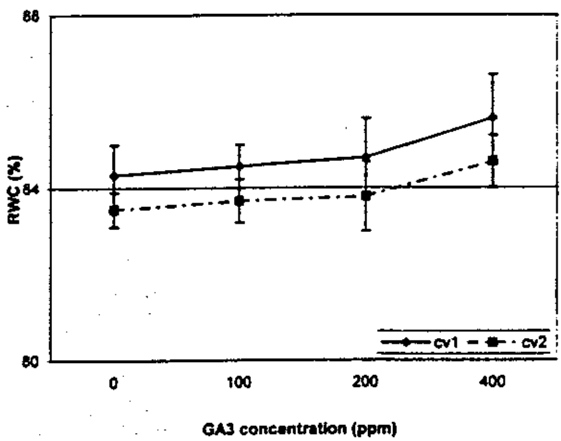

Fig. 1. Effects of GA3 on the relative water content of the flowering stem of gladioli cultivars.

The increase in stem-length, thickness, and weights of Prosperity and Rose-Supreme cultivars, recorded when GA_3 was used in appropriate levels, could be attributed to the promoting role of GA_3 on cell division and cell elongation as a result of regulating the absorption and translocation of water (Wareing & Phillips, 1981). It has been elucidated that exogenous applications of gibberellins stimulate cell growth because they increase the hydrolysis of starch and other carbohydrates to provide the energy needed for cell wall formation, and also because they enhance water to enter the cells more rapidly, thus diluting the hydrolyzed sugars and causing cell expansion and elongation (Salisbury & Ross, 1992). On the other hand, growth promoters often become inhibitors if levels higher than the suitable ones are used as they cause negative effects on the enzymatic system and cell membranes (Wareing & Phillips, 1981).

Inflorescence characteristics

Regardless of GA3 treatments, it is clear that Prosperity has taller inflorescence and a higher number of florets than do as the Rose-Supreme (Table 3). The difference between both cultivars in the number of florets was about 15% at the first and the second season. Despite the differences between the cultivars, a highly positive correlation (R^2 = 92%) between the length of florescence and the number of florets was evident (Table 3). On the other hand, Prosperity exceeded Rose-Supreme in the dry weight of florescence. Differences between data of a particular parameter collected during the two experiments may be attributed to the differences in the climatic conditions prevailing during both seasons. Moreover, as indicated above, genetic differences between plant cultivars may be involved and thus, a particular character may appear as dissimilar between the different cultivars, especially under certain growth conditions (Cohat, 1993). Floral morphogenesis of different cultivars and varieties of a crop species are often controlled by many genes that may be different in their codon sequences (Bernier, 1988).

Concerning the response to GA_3 treatments, data present in the same table showed that both cultivars responded positively to all concentrations of GA_3 solution. Thus, the characteristics of the inflorescence, in terms of the number of florets, length and fresh weight, were all improved by GA_3. It seems that, GA_3-treated corms caused precocious development in the buds and vegetative apices of the inflorescence in gladioli spikes which result in early bud-break and inflorescence elongation causing an increase in the length and floret number of the inflorescence in both cultivars. Even at a low GA_3 concentration, when corms were soaked in 100 ppm, an increase of about 5% in the number of florets was recorded. Higher GA_3 concentration (200 ppm) accelerated further the rate at which flowering buds reached their highest value, and the number of flowers increased by about 15% compared to the controls. These findings are in harmony with those obtained by Afify (1986) and Afify *et al.* (1993) on gladioli, and by Mazrou (1991) and Al-Humaid (2001) on roses. In this regard, Auge (1982); Bhahacharjee (1984) and Cohat (1993) indicated that GA_3 as a corm dip, a foliar spray, or a soil drench increased the height of gladioli plants, length of the spikes, and size and number of florets per spike.

TABLE 3. Effects of gibberellic acid (GA_3) on the inflorescence characteristics of gladioli cultivars during two successive growing seasons.

Treatments		No. florets/inflor.		Inflor. Length (cm)		Inflor. F. wt (g)	
		1st S	2nd S	1st S	2nd S	1st S	2nd S
cv	GA_3	Effect of cvs					
cv1	-	17.15	14.45	65.10	57.14	71.95	51.94
cv2	-	22.45	18.57	73.86	63.22	57.03	48.02
L.S.D (5%)		0.47	0.40	2.61	1.61	1.93	3.11
		Effect of GA_3					
-	0	17.12	14.56	63.47	55.11	54.35	44.24
-	100	17.93	14.91	66.73	59.84	66.64	46.99
-	200	18.32	15.28	73.40	63.34	70.86	54.55
-	400	17.83	15.10	70.34	62.44	66.11	52.14
L.S.D (5%)		0.67	0.57	3.70	2.28	2.73	4.40
		Effect of cvs x GA_3 (interaction)					
cv1	0	16.93	14.50	64.27	57.35	61.71	45.83
	100	17.40	14.60	67.13	64.43	76.72	49.38
	200	17.73	14.68	74.27	66.34	80.41	58.19
	400	16.53	14.01	66.73	64.76	68.95	54.35
cv2	0	17.30	14.61	62.67	52.86	46.99	42.65
	100	18.47	15.22	66.33	55.25	56.56	44.60
	200	18.90	15.87	72.53	58.53	61.32	50.90
	400	17.12	14.57	70.94	51.92	60.26	50.02
L.S.D (5%)		0.94	0.80	5.23	3.22	3.87	6.22

The reduction in the values of inflorescence parameters, which were recorded at 400 ppm, after reaching their peaks at 200 ppm, might be attributed to the nature of the contradictory effect of growth regulators on growth and flowering variables when applied in high doses. That also might negatively affect the membrane system of the cells and hence cause the loss of the control on the biological functions (Salisbury & Ross, 1992).

New corms and cormels

An interesting observation was that, contrary to the above ground part characteristics, the Rose-Supreme cultivar gave significantly heavier corms with wider diameters than Prosperity cultivar, under the environmental conditions prevailing during growth at both seasons, despite GA_3 treatments (Table 4). The number of cormels per plant was also higher in the latter cultivar than in the former one. Therefore, a high correlation coefficient (R^2 = 89) was found between the corm diameter and the number of cormels produced on the plant. The competition between the aerial and the underground parts for the nutrients and metabolites, which were either taken up from the soil or prepared by leaves through photosynthesis, may be one reason causing the cultivar with smaller aerial part to have heavier and larger corms than the other cultivar which had higher vegetative values.

TABLE 4. Effects of gibberellic acid (GA_3) on the corms and cormels characteristics of gladioli cultivars during two successive growing seasons.

Treatments		Corm diameter (cm)		New cormels					
				F.wt g/coemel		D.wt g/cormel		No./plant	
cv	GA_3	1st S	2nd S	1st S	2nd S	1st S	2nd S	1st S	2nd S
		Effect of cultivars (cvs)							
cv1	-	6.1	5.92	26.83	30.15	8.20	8.13	51.39	54.25
cv2	-	8.0	7.45	40.06	39.00	12.91	12.37	65.35	64.68
L.S.D (5%)		0.23	0.20	3.00	2.62	0.93	0.92	4.13	2.36
		Effect of GA_3							
-	0	4.90	4.75	31.76	28.72	9.59	9.39	50.99	49.28
-	100	5.58	5.35	32.78	35.22	10.48	9.97	64.20	57.63
-	200	6.28	5.70	36.10	38.54	11.25	11.55	69.07	65.63
-	400	5.93	4.93	33.15	35.83	10.90	10.41	68.22	65.33
L.S.D (5%)		0.33	0.28	4.25	3.70	1.32	1.30	5.85	3.33
		Effect of cvs x GA_3 (interaction)							
cv1	0	4.33	4.47	26.26	24.18	7.88	7.62	44.85	45.57
	100	5.30	5.17	27.33	33.23	8.35	8.09	50.67	54.80
	200	6.30	5.43	30.63	35.68	9.19	9.80	57.57	59.51
	400	5.57	4.60	23.10	27.51	7.39	7.01	52.47	57.14
cv2	0	5.47	5.03	37.25	33.25	11.30	11.17	57.13	52.98
	100	5.87	5.53	38.23	37.20	12.62	11.85	77.73	60.47
	200	6.17	5.97	41.57	41.40	13.31	13.30	80.58	71.75
	400	6.30	5.27	40.20	40.15	12.40	11.82	80.00	70.53
L.S.D (5%)		0.47	0.40	6.01	5.24	1.87	1.85	2.64	4.72

The differences between both cultivars might be attributed to the genetic differentiation that might exist between them, and as a consequence, the differences in the characteristics of their corms were observed (Table 4). These results are in accordance with those reported by Al-Humaid & Mazrou (1998) and Mazrou & Al-Humaid (2000) on gladioli cultivars.

As for the effect of GA_3, data recorded in the same table indicated that all concentrations influenced the diameter, the fresh and dry weights, and the number of new cormels per plant.

Except for the number of cormels/plant, the highest values of corm parameters were recorded at 200 ppm for either Prosperity or Rose-Supreme cv. However, at 400 ppm, the obtained values of diameter and weight started to decline, although they are still higher than those of the control. The trend of these results was similar during both seasons. In this regard, several studies showed that GA_3 as corm dip, foliar spray, or soil drench induced early sprouting of new cormels of gladioli plants. In addition, the number and weight of corms and cormels produced per plant was also increased (Auge, 1982; Bhahacharjee, 1983 and Cohat, 1993).

Two possible explanations can be drawn to elucidate the positive effect of GA_3 on gladioli new corms. The first can be attributed to the promoting effect of GA_3 on the vegetative growth, which, in turn, enhances the photosynthetic activity to produce more carbohydrates and other metabolites to be moved to and stored in the new corms (Cohat, 1993). In this concern, Bernier (1988) reported that initiation and growth of new reproductive organs, such as flowers, corms and cormels are the result of modifying the source/sink relationship within a plant in such a way that the leaves produce a high concentration of assimilates, moving along in the phloem sap to the under-ground parts. The second explanation is supported by the fact that some effects of exogenous PGRs on corm production may be explained on the basis that they increase the water absorption (Salisbury & Ross, 1992) and nutrient uptake (Warieng & Philips, 1981), leading to an improvement in the nutritional state of plant organs. Results of the present study showed that GA_3 enhanced RWC in both cultivars as compared with control plants (Fig 2). Furthermore, the application of GA_3 is known to influence nearly all processes of reproductive development including bud stimulation and the formation of corm, which are involved in building new cormels (Cohat, 1993).

Mineral Elements

Regardless of GA_3 treatments, the Prosperity cultivar has higher P and K percentages in its aerial parts than Rose-Supreme dose with the reverse being true for the N% (Table 5). Corms, on the other side showed higher K in Prosperity than in Rose-Supreme and higher N and P percent in the latter cultivar than in the former. These findings are clear evidence of competition between plant parts for the nutrients and, of possible existing genetic variations between both cultivars, which seem to control the mineral absorption and accumulation in the plant organs. It should be noticed that corms always need more K than other organs of the plant in order to construct their tissues (Cohat, 1993). Data presented in this study support this judgment.

Data recorded in Table 5 showed also that N% was decreasing in both the aerial part and corms, while P and K were increasing linearly with increasing GA_3 levels. The lower values of N% could be attributed to the role of GA_3 in enhancing the vegetative growth and storage organs, as discussed above, which may cause a dilution effect on the nitrogen concentration in plant tissues. These results are in harmony with those reported by Mazrou & Al-Humaid (2000) for work on several gladioli varieties. P and K, on the other side, are found mostly either bound with other compounds or tight with the enzyme system. Thus, it was difficult to be diluted with increasing vegetative growth (Salisbury & Ross, 1992). Similar findings were reported by Al-Humaid & Mazrou (1998) and Mazrou & Al-Humaid (2000) on gladioli plants.

TABLE 5. Effects of gibberellic acid (GA3) on the N, P, and K in the aerial part and new corms of gladioli cultivars during two successive growing seasons.

Treatments		Aerial part						New corms					
		N%		P%		K%		N%		P%		K%	
cv	GA_3 (ppm)	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st s	2nd
		Effect of cvs											
cv1	-	0.790	0.846	0.380	0.388	1.33	1.77	0.866	0.738	0.543	0.410	1.870	1.825
cv2	-	0.805	0.886	0.365	0.363	1.31	1.70	1.143	0.842	0.728	0.510	1.790	1.783
		Effect of GA_3											
-	00	0.946	0.922	0.345	0.330	1.24	1.70	1.750	0.852	0.530	0.450	1.775	1.575
-	100	0.792	0.936	0.350	0.340	1.13	1.61	1.080	0.816	0.590	0.475	1.785	1.875
-	200	0.714	0.822	0.375	0.350	1.30	1.78	0.914	0.748	0.665	0.485	1.820	1.885
-	400	0.705	0.786	0.420	0.480	1.63	1.84	0.852	0.745	0.755	0.490	1.945	1.940
		Effect of cv x GA_3 interaction											
cv1	00	0.647	0.742	0.320	0.370	1.12	1.78	1.00	0.771	0.420	0.410	1.87	1.54
	100	0.719	0.809	0.350	0.300	1.18	1.62	0.841	0.727	0.480	0.390	1.77	1.89
	200	0.720	0.834	0.390	0.340	1.26	1.78	0.849	0.730	0.580	0.420	1.90	1.88
	400	0.774	0.859	0.460	0.540	1.77	1.88	0.774	0.722	0.690	0.420	1.94	1.99
cv2	00	0.644	0.792	0.340	0.290	1.14	1.62	1.350	0.932	0.640	0.490	1.68	1.61
	100	0.664	0.822	0.350	0.380	1.21	1.60	1.314	0.904	0.700	0.460	1.80	1.86
	200	0.708	0.839	0.360	0.360	1.33	1.77	0.978	0.765	0.750	0.510	1.74	1.77
	400	0.715	0.842	0.380	0.420	1.48	1.80	0.929	0.764	0.820	0.560	1.95	1.89

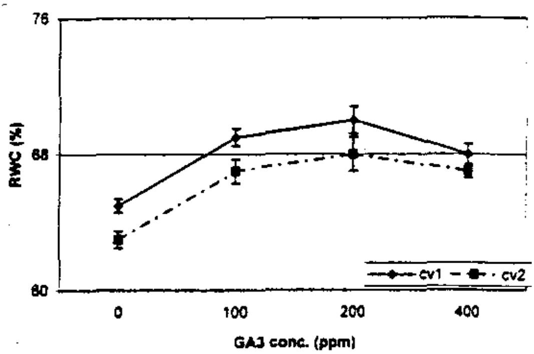

Fig. 2. Effects of GA3 on RWC of corms of gladioli cultivars during the season •

In conclusion, soaking the corms of Rose-Supreme and Prosperity gladioli cultivars in 200 ppm GA_3 for 24 hr before planting had a beneficial effect on growth, flowering-stem and inflorescence characteristics as well as new corm attributes. Furthermore, although the Prosperity cultivar was characterized by its vigorous growth in comparison to Rose-Supreme, the later cultivar produced heavier corms and more cormels.

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(*Received* 10 /5 / 2003)

التأثيرات الفسيولوجية لاستخدام حمض الجبريليك على صنفي الجلاديولس روزسبريم وبروسبرتي

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أجريت هذه الدراسة خلال موسمي ٢٠٠٠/٢٠٠١ ، ٢٠٠١/٢٠٠٢ وذلك بهدف دراسة تأثير نقع كورمات الجلاديولس لكلا الصنفين(روزسبريم وبروسبرتي) في حمض الجبريليك بتركيزات صفر ، ١٠٠ ، ٢٠٠ ، ٤٠٠ جزء في المليون على صفات النمو والإزهار وإنتاج الكورمات الحديثة. أظهرت نتائج هذه الدراسة إن الفترة من الزراعة حتى الإزهار قد تناقصت بشكل واضح في كلا الصنفين تحت الدراسة وذلك بزيادة تركيز حمض الجبريليك إلى ٤٠٠ جزء في المليون في كل من موسمي الزراعة وقد سجلت معاملة النقع لكورمات صنف روزسبريم في حمض الجبريليك بتركيز ٤٠٠ جزء في المليون أفضل النتائج في هذا الصدد. في حين سجلت معاملة نقع كورمات صنف بروسبرتي في الماء المقطر إلى إطالة الفترة من الزراعة حتى الإزهار مقارنة ببقية المعاملات ، كما أوضحت نتائج الدراسة تحسن كل من طول الساق الزهرية وسمكها وكذلك وزنها الرطب والجاف بالإضافة إلى عدد الزهيرات بالنورة علاوة على قطر الكورمات الجديدة ووزنها الرطب والجاف لكل من صنفي الدراسة بزيادة تركيز حمض الجبريليك إلى ٢٠٠ جزء في المليون في حين أدى استعمال التركيز الأعلى من حمض الجبريليك (٤٠٠ جزء في المليون) إلى حدوث تراجع في تلك القياسات في كل من موسمي الدراسة بينما سجلت نباتات المقارنة لكلا الصنفين أقل الصفات في هذا الخصوص. وتوضح النتائج المتحصل عليها أيضاً تفوق الصنف بروسبرتي لجميع المعاملات في صفات الشمراخ الزهري مقارنة بالصنف روزسبريم في حين أظهر الصنف روزسبريم تفوقاً واضحاً تحت تأثير جميع المعاملات في إنتاج الكورمات والكوريمات مقارنة بالصنف روزسبريم في كلا الموسمين.

بالإضافة إلى ذلك فقد أوضحت نتائج التحليل ال كيماوي وجود تناسب عكسي بصفة عامة في تركيزات عناصر النيتروجين والفوسفور والبوتاسيوم في كل من الأجزاء الهوائية والكورمات الجديدة لكل من الصنفين مع الوزن الجاف المتحصل عليه من تلك الأجزاء في كل من موسمي الدراسة.