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RESPONSE OF EUROVISION GLADIOLUS CULTIVAR PLANTS TO ROCK PHOSPHATE AND YEAST.

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ABSTRACT

The present study was conducted to evaluate the response of Gladiolus cv. Eurovision plants grown in a sandy calcareous soil to four rates (0, 75, 150 and 300 kg / fed.) of Abou – Tartour rock phosphate (ARP) and four concentrations (0, 2, 4 and 6 g / l.) of active dry yeast (ADY) during 2006 and 2007 seasons.

Different vegetative growth parameters, flowering aspects, corm production and chemical constituents were considerably increased due to the all rates of ARP. Active dry yeast at 4 and 6 g / L. were the most effective treatments for augmenting growth, flowering, corm production and chemical constituents of plant.

So, it could be recommended to supply gladiolus cv. Eurovision plants with the high rate of ARP at 300 kg / fed. and spraying with ADY at 6 g / l. in order to obtain reasonable growth, marketable flowering quality and quantity as well as higher productivity of corms and cormels.

INTRODUCTION

Eurovision cultivar is one of the introduced gladiolus cultivars to Egypt. The evaluation of this cultivars in terms of vegetative growth, flowering and bulb formation under middle Egypt environmental conditions is needed in order to choose the most suitable one (s) that performed the highest desirable quality of flowering and corm production. Phosphorus fertilization is among many other agricultural practices known to enhance growth and development of plants.

Rock phosphates are natural sources of rocks containing phosphorus, which was been used in some countries as a source of P fertilization. Awasthl *et al.,* (1977) reported that Mussorie rock phosphate was economical to the farmers – as a source of P_2O_5 as it was 30 – 50 % less costly and was efficient as other water soluble phosphate sources for groundnut crops. Hammond *et al.,* (1986) stated that phosphate rocks are chemically reactive and can be substituted in finely ground form for the capital intensive manufactured fertilizers such as superphosphates.

Few studies, concerning the effect of Abou – Tartour rock phosphate source on growth of flowering bulbs have been reported, while, many on other horticultural plants were revealed. Badran and Hassanein (2000) supplied gladiolus plants in clay soil with Abou – Tartour rock phosphate at 50, 100 and 150 kg / fed. They declared that vegetative growth, flowering bulb production and chemical composition were increased. Khattab *et al.,* (1983) obtained the maximum vegetative growth and flower production of Chrysanthemum by the high rate of Abou – Tartour rock phosphate source. Working on yarrow plants, Badran *et al.,* (1988) revealed that Abou – Tartour rock phosphate was almost equal to calcium superphosphate in increasing plant height, and flowers fresh and dry weights as well as percentage of phosphorus of the herb. Omar (1996) supplied guar plants with different rates of Abou – Tartour rock phosphate and obtained an increase in plant height, stem diameter and phosphorus percentage. Soliman (1997) demonstrated

that the high rate of Abou – Tartour rock phosphate (150 kg / fed.) was equal to the medium rate of triple superphosphate (100 kg / fed.) in increasing phosphorus percentage by *Nigella sativa* plants.

The effect of phosphorus fertilization on enhancing growth, flowering, corm formation and chemical composition of many plant species was revealed by different authors. It was found to increase number of flowers and fresh and dry weights of flower of Adonis (Zaied, 1976); inflorescence production and P percentage of the leaves of Gerbera, (Omar *et al.,* 1978) and number and dry weights of flowers and P percentage in the leaves of *Tropaeolum majus* (Badran *et al.,* 1984).

Regarding flowering aspects and corm and cormels production of Gladiolus, Shah *et al.,* (1984), Potti and Arora (1986) and Mukherjee *et al.,* (1994) pointed out the role of phosphorus fertilization in promoting the quality and quantity of spikes, flowers, corms and cormels. Also, on Iris, Manoly (1996) found that the high rate (1%) of orthophosphoric (100% P_2O_5) improved reducing sugars and phosphorus percentage in the leaves and bulbs. Badran *et al.,* (1989) emphasized such role of phosphorus as they obtained a great increase in stalk length, diameter, number and fresh and dry weights of flowers, P percentage and rhizome production of calla plants.

In addition, Anuradha *et al.,* (1990) on marigold and Al – Badawy *et al.,* (1994) on Chrysanthemum Found that phosphorus fertilization increased the level of photosynthetic pigments.

Several authors reported the response of various medicinal, aromatic and ornamental plants, vegetable crops and fruit trees to active dry yeast in promoting and enhancing growth, flowering and chemical composition of different plant species such as , Ahmed *et al.,* (1998) on roselle, El – Ghamriny *et al.,* (1999) on tomato, Ali (2001) on pot marigold, on coriander, Abd El – Gawad (2001), Eid (2001) and El – Sayed *et al.,* (2002). Abdou and El – Sayed (2002) on caraway, Badran *et al.,* (2002) on marjoram, Hassanein *et al.,* (2003) on *Calendula officinalis* and Shalan *et al.,* (2006) on *Thymus vulgaris*.

The Present study aimed to evaluate the response of gladiolus cv. Eurovision plants to rock phosphate as a natural source of rock containing , phosphorus which has used as a source of P fertilization source and active dry yeast as a biofertilizaer.

MATERIALS AND METHODS

A field experiment was carried out in order to study the effect of Abou – Tartour rock phosphate (ARP) and active dry yeast (ADY) on vegetative growth, flowering, corm formation and chemical composition of Gladiolus cultivar Eurovision during two successive seasons, 2005/2006 and 2006/2007 in a sandy calcareous soil at a private Farm at the new reclaimed land, West Samalout, Minia Governorate, Egypt. The physical and chemical properties of the experimental soil were shown in Table (A).

Soil type	Particle distribution (%)			Organic matter (%)	$CaCo_3$ (%)	pH (1 : 2.5 w)	E.C (m.mhos/c)	Total N (%)	P_2O_5 (ppm)	Exch K (me / l00 /g)
	Sandy	Silt	Clay							
Sandy calc.	91.0	5.7	3.3	0.08	12.70	8.16	1.10	0.02	3.89	0.20

Average corm weight was 9.7 - 10.1 g and diameter was 2.9 - 3.2 cm for the two seasons, such corms were obtained from Netherlands through Basiony nurseries, Cairo, Egypt. Prior planting, all corms were soaked for one minute in penlate at the concentration of 1 g / L. and then planted on October 8th of both seasons in rows, 60 cm apart with 20 cm distance between hills and the corms were placed at the lower third part of the row. An eighty – cm levee width was left between the different experimental units from all directions for each one of the three replicates. Abou – Tartour rock phosphate (8.8 % P_2O_5) was applied at rates of 0, 75, 150 and 300 kg / fed., control treatment received no phosphorus fertilization. The amounts of fertilizer were added at three batches, 4 and 8 weeks after planting and 2 weeks after the end of flowering. All plants including the control ones received ammonium nitrate (33.5% N) and potassium sulphate (48.5% K_2O) at the rates of 200 and 100 kg / fed., respectively at the same schedule of rock phosphorus treatment applications. Active dry yeast concentrations were foliar sprayed at 0, 2, 4 and 6 g / l. till run off 3 times starting one month from planting with 2 – weeks interval. In addition, control plants were sprayed with a distilled water. Active dry yeast solution was prepared by mixing with sugar at 1 : 1 in warm water for ten minutes before spraying for activating yeast production. Chemical analysis showed that active dry yeast contained 34.87% protein, 7.55% ash, 6.54% glycogen, 2.09% fats and 4.92% cellulose.

Layout of this experiment was split plot design with three replicates. Rock phosphate source was assigned to the main plots, while active dry yeast was assigned to the sub plots, respectively.

During the flowering period, the following data were recorded, leaf number and area $(cm)^2$, flowering date (days), spike length (cm) and diameter (m.m), length of flowering part of spike (cm), fresh weight of spike (g), number of florets / spike as well as fresh and dry weights of single floret (g). Six weeks after flowering termination, fresh weight of corms / plant (g) and diameter (cm), number and fresh weight of cormels (g) / plant were recorded.

Concerning chemical analysis, total chlorophyll content (mg / g f.w). was determined according to Fadl and Seri – Eldeen (1978), while P percentage in the leaves and bulbs was determined following the method of Jackson (1958).

In addition, reducing sugars in the bulbs were estimated according to Somogyi and Shaffer (1933). All obtained data were statistically analyzed according to Little and Hills (1978) using of L.S.D. test at 5 and 1%.

RESULTS

Vegetative growth characters :

Leaf number and area were significantly increased in the two seasons due to all Abou – Tartour rock phosphate (ARP) rates in comparison with values of untreated plants. Moreover, the values of such two traits were sloping upward by the gradual increase in the fertilizer rates within rock phosphate source (Table 1), The role of ARP in increasing the different

vegetative growth characters was reported by Badran and Hassanein (2000) on Gladiolus, Khattab *et al.,* (1988) on Chrysanthemum, Badran *et al.,* (1983) on yarrow, Omar (1996) on guar and Soliman (1997) on *Nigella sativa*, while Zaied (1976) and Badran *et al.,* (1984) declared the importance of phosphorus fertilization for promoting vegetative growth of Adonis and *Tropaeolum majus*, respectively.

Table (1) : Effect of Abou – Tartour rock phosphate and active dry yeast on number of leaves, leaf area and flowering date /plant *of Gladiolus grandiflorus* cv. Eurovision for the two seasons 2005 / 2006 and 2006 / 2007.

Active dry yeast concentrations g / l (B)	Number of leaves									
	First season					Second season				
	Abou – Tartour rock phosphate rates (kg / fed.) A									
	0	75	150	300	M.	0	75	150	300	M.
0	5.47	6.80	7.08	7.19	**6.64**	6.15	7.53	7.74	7.82	**7.31**
2	6.77	8.04	8.22	8.56	**7.90**	7.59	8.85	9.00	9.25	**8.67**
4	7.01	8.12	8.46	8.74	**8.08**	7.88	9.04	9.15	9.38	**8.86**
6	7.36	8.55	8.64	8.93	**8.37**	8.03	9.16	9.55	9.61	**9.09**
Mean A	**6.65**	**7.88**	**8.10**	**8.36**		**7.41**	**8.65**	**8.86**	**9.02**	
L.S.D. 5 %	**A: 0.18**		**B: 0.12**		**AB: 0.25**	**A: 0.21**		**B: 0.14**		**AB: 0.30**
1 %	**A: 0.24**		**B: 0.18**		**AB: 0.33**	**A: 0.28**		**B: 0.19**		**AB: 0.40**
Leaf area (cm^2)										
0	56.74	60.26	66.02	70.35	**63.34**	69.60	74.06	77.74	80.02	**75.36**
2	58.47	65.06	70.96	73.96	**67.11**	73.87	78.72	80.75	84.81	**79.54**
4	62.28	69.71	74.60	78.99	**71.40**	77.35	82.87	83.59	86.25	**82.52**
6	67.36	73.25	77.43	82.82	**75.22**	82.71	85.80	87.95	91.60	**87.02**
Mean A	**61.21**	**67.07**	**72.25**	**76.53**		**75.88**	**80.36**	**82.51**	**85.67**	
L.S.D. 5 %	**A: 2.73**		**B: 1.93**		**AB: 3.86**	**A: 1.84**		**B: 1.30**		**AB: 2.61**
1 %	**A: 3.79**		**B: 2.68**		**AB: 5.37**	**A: 2.56**		**B: 1.81**		**AB: 3.63**
Flowering date (day)										
0	121.25	119.41	118.98	116.01	**118.91**	122.40	120.32	120.00	118.13	**120.21**
2	120.37	117.89	117.10	115.03	**117.60**	121.10	119.78	119.39	117.05	**119.33**
4	118.80	117.30	117.06	114.88	**117.01**	120.01	118.55	118.29	116.98	**118.46**
6	118.28	116.53	116.18	114.01	**116.25**	119.86	118.24	117.03	115.44	**117.64**
Mean A	**119.68**	**117.78**	**117.33**	**114.98**		**120.84**	**119.22**	**118.68**	**116.90**	
L.S.D. 5 %	**A: 1.05**		**B: 1.36**		**AB: 2.34**	**A: 1.96**		**B: 1.05**		**AB: 3.50**
1 %	**A: 1.44**		**B: 1.88**		**AB: 3.25**	**A: 2.72**		**B: 1.49**		**AB: 4.87**

Results in Table (1) show that the studied vegetative growth characters; number of leaves and area of gladiolus cv. Eurovision plant were significantly increased, in both seasons, due to the use of the three concentrations of active dry yeast in comparison with the untreated plants. However, both the medium and the high concentrations of biofertilizer were more effective than the low concentration. The present findings are in accordance with those reported by Ahmed *et al.,* (1998) on roselle, El – Gamriny *et al.,* (1999) on tomato, Ali (2001) on pot marigold, Abdou and El –

Sayed (2002) on caraway, Badran *et al.,* (2002) on marjoram, El – Sayed *et al.,* (2002) on coriander, Hassanein *et al.,* (2003) on *Calendula officinalis* and Shalan *et al.,* (2006) on *Thymus vulgaris*.

The interaction between ARP and ADY was significant for leaf number and area in both seasons, with the best results being obtained due to the use of ARP at 300 kg / fed. and spraying plants with 6 g / l ADY.

Flowering aspects :

Number of days from planting till flowering was significantly reduced due to the use of different rates of ARP fertilization, in both seasons, in comparison with those of control treatment as illustrated in Table (1).

Flowering date was also significantly reduced due to spraying with yeast at 6 g / l., in both seasons, compared to those untreated plants.

The combined effect was significant in both seasons. It could be noticed that producing earlier Gladiolus cv. Eurovision plants in sandy calcareous soil resulted from a supplement of ARP at 300 kg / fed. and spraying with ADY at 6 g / l.

As regarding the other seven flowering parameters, spike length and diameter, length of the flowering part of spike and fresh weight as well as number of florets and fresh and dry weights of single floret were significantly enhanced in both seasons as a result of using the medium and high rates of the ARP for the majority of such parameters in comparison with those of the unfertilized plants, as shown in Tables (2, 3 and 4). The highest ARP fertilization rate led to producing the longest, thickest and tallest length of the flowering part of spike / plant, heaviest fresh weight of spike and number of florets as well as single floret fresh and dry weights.

These results were in harmony with those obtained by Badran and Hassanein (2000) on Gladiolus; Khattab *et al.,* (1983) on Chrysanthemum and Badran *et al.,* (1988) on yarrow concerning rock phosphate and in agreement with the findings of Omar *et al.,* (1978) on gerbera, Shah *et al.,* (1984), Potti and Arora (1986) and Mukherjee *et al.,* (1994) on Gladiolus and Badran *et al.,* (1989) on Calla regarding phosphorus fertilization.

All flowering parameters including spike length and diameter as well as length of the flowering part of spike and fresh weight, number of florets and fresh and dry weights of single floret were significantly increased, due to the use of yeast, in both seasons. However, both 4 and 6 g / l. concentrations were more effective, on the seven flowering parameters, than the low concentration (2 g / l.) as clearly indicated in Tables (2, 3 and 4). The obtained results are in harmony with those found by Ali (2001) on pot marigold and Hassanein *et al.,* (2003) on *Calendula officinalis*.

The interaction between ARP and ADY was significant in the two seasons, for spike length and diameter as well as fresh and dry weight of single floret, while number of florets, length of the flowering part of spike and fresh weight were not significantly affected in the two seasons. The most effective combinations was ARP at 300 kg / fed. + ADY 6 g / l.

Corm and cormles formation :

The four examined corms and cormels formation traits, i.e. fresh weight of corms and diameter as well as number and fresh weight of cormles were considerably increased due to the use of Abou – Tartour rock

phosphate (ARP) fertilization, however, the highest rate (300 kg / fed.) of ARP gave the best results, followed by the medium (150 kg / fed.) one, in the two seasons, in comparison with those of the control plants as illustrated in Tables (4 and 5). Numerically, corm fresh weight and diameter, number and fresh weight of cormels were increased by 32.2, 13.7, 39.5 and 51.1 % in the first season due to high rate of ARP, respectively in comparison with that of unfertilized plants. Almost similar results were obtained in the second season. These findings were in accordance with those revealed on Gladiolus by Shah *et al.,* (1984), Potti and Arora (1986) and Mukherjee *et al.,* (1994) who demonstrated the role of phosphorus fertilization and Badran and Hassanein (2000) regarding Abou – Tartour rock phosphate.

Table (2) : Effect of Abou – Tartour rock phosphate and active dry yeast on spike length , length of the flowering part of spike and spike diameter /plant of *Gladiolus grandiflorus* cv. Eurovision for the two seasons 2005 / 2006 and 2006 / 2007.

Active dry yeast concentrations (g / l) (B)	Spike length (cm)									
	First season					Second season				
	Abou – Tartour rock phosphate rates (kg / fed.) A									
	0	75	150	300	M.	0	75	150	300	M.
0	69.36	73.41	75.43	76.98	**73.80**	70.19	75.33	77.28	77.83	**75.18**
2	71.29	76.17	77.03	78.59	**75.77**	73.40	78.01	78.64	79.28	**77.33**
4	74.61	77.46	78.58	80.01	**77.67**	75.40	78.81	79.90	81.03	**78.79**
6	76.03	78.27	80.47	81.90	**79.17**	77.69	80.14	82.26	83.72	**80.95**
Mean A	**72.82**	**76.33**	**77.88**	**79.37**		**74.17**	**78.07**	**79.52**	**80.47**	
L.S.D. 5 %	**A: 1.36**		**B: 0.96**		**AB: 1.92**	**A: 1.54**		**B: 1.09**		**AB: 2.18**
1 %	**A: 1.88**		**B: 1.33**		**AB: 2.67**	**A: 2.14**		**B: 1.51**		**AB: 3.03**
Length of the flowering part of spike (cm)										
0	42.22	47.63	48.15	49.38	**46.85**	45.53	49.47	51.64	53.55	**50.05**
2	45.71	51.69	52.74	54.26	**51.10**	49.49	53.33	55.62	57.61	**54.01**
4	48.91	53.43	54.40	55.62	**53.09**	50.62	55.37	55.12	58.91	**55.26**
6	51.62	56.47	57.61	59.33	**56.26**	53.28	58.55	59.47	60.10	**57.85**
Mean A	**47.12**	**52.31**	**53.23**	**54.65**		**49.73**	**54.18**	**55.71**	**57.54**	
L.S.D. 5 %	**A: 2.01**		**B: 2.72**		**AB: N.S**	**A: 1.92**		**B: 2.41**		**AB: N.S**
1 %	**A: 3.00**		**B: 3.78**		**AB: N.S**	**A: 2.66**		**B: 3.24**		**AB: N.S**
Spike diameter (mm)										
0	9.22	10.15	10.46	10.68	**10.13**	9.70	10.82	11.16	11.55	**10.81**
2	10.50	10.83	11.06	11.18	**10.89**	11.01	11.38	11.54	11.80	**11.43**
4	10.87	11.05	11.23	11.50	**11.16**	11.51	11.88	12.22	12.65	**12.07**
6	11.58	11.60	11.87	12.06	**11.78**	11.84	12.25	12.58	12.84	**12.38**
Mean A	**10.54**	**10.91**	**11.16**	**11.36**		**11.02**	**11.58**	**11.88**	**12.21**	
L.S.D. 5 %	**A: 0.14**		**B: 0.22**		**AB: 0.47**	**A: 0.12**		**B: 0.20**		**AB: 0.38**
1 %	**A: 0.19**		**B: 0.30**		**AB: 0.62**	**A: 0.18**		**B: 0.26**		**AB: 0.50**

Regarding the influence of active dry yeast (ADY) concentrations, the recorded data indicated that all concentrations significantly increased the corm fresh weigh and diameter, number and fresh weight of cormels / plant in comparison with unsprayed plants. The best results were observed for plants were sprayed with the high concentration of active dry yeast (6 g / L.). These findings were in accordance with those revealed on coriander by Abd El – Gawad (2001) and Eid (2001) who reported that foliar spray with active dry yeast at 1, 2.5 and 5 g / l. increased seed production.

Table (3) : Effect of Abou – Tartour rock phosphate and active dry yeast on spike fresh weight, number of florets / spike and single floret fresh weight /plant of *Gladiolus grandiflorus* cv. Eurovision for the two seasons 2005 / 2006 and 2006 / 2007.

Active dry yeast concentrations (g / l) (B)	Spike fresh weight (g)									
	First season					Second season				
	Abou – Tartour rock phosphate rates (kg / fed.) A									
	0	75	150	300	M.	0	75	150	300	M.
0	19.51	24.13	25.46	27.83	**24.23**	21.59	25.68	26.32	28.62	**25.55**
2	22.40	25.53	27.33	28.59	**25.96**	23.18	27.40	29.10	29.81	**27.37**
4	26.46	28.30	29.43	30.25	**28.61**	27.04	30.12	31.43	33.62	**30.55**
6	28.63	30.06	31.76	33.80	**31.06**	30.01	31.68	33.54	34.94	**32.54**
Mean A	**24.25**	**27.01**	**28.50**	**30.12**		**25.46**	**28.72**	**30.10**	**31.75**	
L.S.D. 5 %	**A: 0.91**	**B: 1.20**	**AB: N.S**			**A: 1.00**	**B: 0.92**	**AB: N.S**		
1 %	**A: 1.26**	**B: 1.64**	**AB: N.S**			**A: 1.50**	**B: 1.30**	**AB: N.S**		
Number of florets / spike										
0	6.92	8.56	9.02	9.44	**8.49**	7.83	9.15	9.38	9.71	**9.02**
2	8.41	8.80	9.36	9.62	**9.05**	9.09	9.48	9.75	10.01	**9.58**
4	8.70	9.03	9.62	9.84	**9.30**	9.33	9.50	10.05	10.12	**9.75**
6	9.00	9.45	9.88	10.04	**9.59**	9.66	10.08	10.23	10.30	**10.07**
Mean A	**8.26**	**8.96**	**9.47**	**9.74**		**8.98**	**9.55**	**9.85**	**10.04**	
L.S.D. 5 %	**A: 0.30**	**B: 0.28**	**AB: N.S**			**A: 0.43**	**B: 0.35**	**AB: N.S**		
1 %	**A: 0.40**	**B: 0.37**	**AB: N.S**			**A: 0.54**	**B: 0.46**	**AB: N.S**		
Single floret fresh weight (g)										
0	5.04	5.82	6.00	6.13	**5.75**	5.10	6.11	6.20	6.34	**5.94**
2	5.75	5.93	6.17	6.36	**6.05**	5.80	6.44	6.52	6.75	**6.38**
4	5.84	6.05	6.38	6.50	**6.19**	6.15	6.78	6.83	6.94	**6.68**
6	5.90	6.13	6.62	6.81	**6.37**	6.45	7.01	7.05	7.10	**6.90**
Mean A	**5.63**	**5.98**	**6.29**	**6.45**		**5.88**	**6.59**	**6.65**	**6.78**	
L.S.D. 5 %	**A: 0.22**	**B: 0.20**	**AB: 0.42**			**A: 0.31**	**B: 0.22**	**AB: 0.44**		
1 %	**A: 0.30**	**B: 0.26**	**AB: 0.58**			**A: 0.41**	**B: 0.30**	**AB: 0.61**		

The interaction between the two studied factors, P fertilization and yeast treatments, was statically significant in both seasons, while fresh weight of corm and cormels was not significant in the second season only. The highest overall values were obtained due to supplying plants, with 300 kg / fed. ARP and spraying with active dry yeast at 6 g/ l.

Chemical composition

Total chlorophylls content and phosphorus percentage in the leaves

Total chlorophylls content and P% were significantly promoted due to the use of ARP at different rates in both seasons as shown in Tables (5 and 6) in comparison with those of unfertilized plants. Total chlorophylls content and P% were gradually increased by increasing the rate of the applied phosphorus fertilization, with the highest value being recorded for the high rate (300 kg / fed.) of ARP. Such results were almost identical for both seasons. The role of phosphorus in stimulating total chlorophylls content and P% in the leaves was emphasized by Manoly (1996) on Iris, Badran and Hassanein (2000) on Gladiolus, Zaied (1976) on Adonis, Omar *et al.,* (1978) on Gerbera, Badran *et al.,* (1984) on *Tropaeolum majus*, Anuradha *et al.,* (1990) on marigold, Al – Badawy *et al.,* (1994) on Chrysanthemum, Omar (1996) on guar and Soliman (1997) on *Nigella sativa*.

Table (4) : Effect of Abou – Tartour rock phosphate and active dry yeast on single floret dry weight, corms fresh weight and number of cormels / plant of *Gladiolus grandiflorus* cv. Eurovision for the two seasons 2005 / 2006 and 2006 / 2007.

Active dry yeast concentrations(g/l) (B)	Single floret dry weight (g)									
	First season					Second season				
	Abou – Tartour rock phosphate rates (kg / fed.) A									
	0	75	150	300	M.	0	75	150	300	M.
0	0.561	0.712	0.839	0.854	**0.742**	0.680	0.828	0.846	0.865	**0.805**
2	0.784	0.805	0.943	0.965	**0.874**	0.790	0.831	0.962	0.989	**0.893**
4	0.840	0.912	0.963	0.970	**0.921**	0.864	0.946	0.970	1.001	**0.945**
6	0.893	0.941	1.030	1.071	**0.984**	0.978	1.042	1.066	1.080	**1.042**
Mean A	**0.770**	**0.843**	**0.944**	**0.965**		**0.828**	**0.912**	**0.961**	**0.984**	
L.S.D. 5 %	**A: 0.027**		**B: 0.033**		**AB: 0.066**	**A: 0.028**		**B: 0.031**		**AB: 0.056**
1 %	**A: 0.041**		**B: 0.044**		**AB: 0.089**	**A: 0.042**		**B: 0.041**		**AB: 0.082**
Corms fresh weight (g)										
0	82.48	91.70	110.46	117.78	**100.61**	83.92	92.06	112.55	118.31	**101.71**
2	90.97	94.36	113.77	119.04	**104.54**	92.26	95.98	116.38	121.42	**106.51**
4	95.12	103.63	115.53	122.08	**109.09**	96.70	105.34	118.41	124.52	**111.24**
6	97.25	106.46	117.99	124.64	**111.59**	99.04	110.50	122.52	127.11	**114.79**
Mean A	**91.46**	**99.04**	**114.44**	**120.89**		**92.98**	**100.97**	**117.47**	**122.84**	
L.S.D. 5 %	**A: 2.92**		**B: 2.41**		**AB: 4.82**	**A: 4.43**		**B: 3.27**		**AB: N.S**
1 %	**A: 4.43**		**B: 3.23**		**AB: 6.74**	**A: 6.65**		**B: 4.54**		**AB: N.S**
Number of cormels / plant										
0	22.44	26.14	29.35	31.24	**27.29**	24.56	28.29	31.58	33.44	**29.47**
2	24.67	29.41	31.43	34.52	**30.01**	25.94	30.10	33.63	36.71	**31.60**
4	26.18	30.20	34.32	35.68	**31.60**	28.20	32.48	36.50	38.74	**33.98**
6	27.21	32.25	36.54	38.70	**33.68**	29.32	35.50	39.60	40.43	**36.21**
Mean A	**25.12**	**29.50**	**32.91**	**35.04**		**27.01**	**31.59**	**35.33**	**37.33**	
L.S.D. 5 %	**A: 1.62**		**B: 1.42**		**AB: 2.84**	**A: 1.81**		**B: 1.33**		**AB:**
1 %	**A: 2.27**		**B: 1.83**		**AB: 3.98**	**A: 2.72**		**B: 1.75**		**2.66 AB: 3.72**

Table (5) : Effect of Abou – Tartour rock phosphate and active dry yeast on cormels fresh weight, corm diameter and total chlorophylls content / plant of *Gladiolus grandiflorus* cv. Eurovision for the twoseasons 2005 / 2006 and 2006 / 2007.

Active dry yeast concentrations(g / l) (B)	Cormels fresh weight (g)									
	First season					Second season				
	Abou – Tartour rock phosphate rates (kg / fed.) A									
	0	75	150	300	M.	0	75	150	300	M.
0	16.52	19.65	22.28	24.65	**20.78**	18.67	20.58	23.38	25.24	**21.97**
2	18.90	23.25	25.59	28.38	**24.03**	20.72	24.84	27.62	29.76	**25.74**
4	19.41	23.60	27.72	29.19	**24.98**	21.77	26.90	29.69	31.84	**27.55**
6	19.81	24.62	28.39	30.56	**25.85**	23.70	28.89	30.84	34.21	**29.41**
Mean A	**18.66**	**22.78**	**25.10**	**28.20**		**21.22**	**25.30**	**27.88**	**30.26**	
L.S.D. 5 %	**A: 1.24**		**B: 1.01**		**AB: 2.02**	**A: 1.81**		**B: 1.70**		**AB: N.S**
1 %	**A: 1.80**		**B: 1.41**		**AB: 2.81**	**A: 2.73**		**B: 2.38**		**AB: N.S**
Corm diameter (cm)										
0	2.70	4.01	4.10	4.18	**3.75**	2.84	4.10	4.23	4.30	**3.87**
2	4.15	4.22	4.30	4.38	**4.26**	4.26	4.35	4.44	4.53	**4.40**
4	4.29	4.32	4.41	4.46	**4.37**	4.38	4.42	4.51	4.60	**4.48**
6	4.35	4.48	4.50	4.56	**4.47**	4.46	4.55	4.72	4.80	**4.63**
Mean A	**3.87**	**4.26**	**4.33**	**4.40**		**3.99**	**4.36**	**4.48**	**4.56**	
L.S.D. 5 %	**A: 0.20**		**B: 0.20**		**AB: 0.40**	**A: 0.22**		**B: 0.20**		**AB: 0.40**
1 %	**A: 0.26**		**B: 0.26**		**AB: 0.55**	**A: 0.30**		**B: 0.26**		**AB: 0.55**
Total chlorophylls content (mg / g F.W.)										
0	2.130	3.311	3.424	3.509	**3.094**	2.218	3.424	3.533	3.551	**3.182**
2	2.244	3.353	3.435	3.522	**3.139**	2.330	3.441	3.553	3.677	**3.250**
4	2.262	3.367	3.446	3.532	**3.152**	2.345	3.463	3.577	3.680	**3.266**
6	2.337	3.408	3.553	3.645	**3.236**	2.364	3.488	3.590	3.689	**3.283**
Mean A	**2.243**	**3.360**	**3.465**	**3.552**		**2.314**	**3.454**	**3.563**	**3.649**	
L.S.D. 5 %	**A: 0.024**		**B: 0.020**		**AB: 0.040**	**A: 0.035**		**B: 0.031**		**AB: N.S**
1 %	**A: 0.036**		**B: 0.025**		**AB: 0.054**	**A: 0.053**		**B: 0.040**		**AB: N.S**

Table (6) : Effect of Abou – Tartour rock phosphate and active dry yeast on leaves phosphorus %, reducing sugars and phosphorus% in the bulbs of *Gladiolus grandiflorus* cv. Eurovision for the two seasons 2005 / 2006 and 2006 / 2007.

Active dry yeast concentrations (g / l) (B)	Leaves phosphorus %									
	First season					Second season				
	Abou – Tartour rock phosphate rates (kg / fed.) A									
	0	75	150	300	M.	0	75	150	300	M.
0	0.288	0.407	0.425	0.452	**0.393**	0.308	0.514	0.524	0.542	**0.472**
2	0.308	0.410	0.431	0.468	**0.404**	0.447	0.535	0.546	0.557	**0.521**
4	0.340	0.416	0.446	0.476	**0.420**	0.457	0.538	0.557	0.566	**0.530**
6	0.362	0.424	0.459	0.483	**0.432**	0.462	0.547	0.562	0.577	**0.537**
Mean A	**0.325**	**0.414**	**0.440**	**0.470**		**0.419**	**0.534**	**0.547**	**0.561**	
L.S.D. 5 %	**A: 0.006**		**B: 0.007**		**AB: 0.014**	**A: 0.009**		**B: 0.010**		**AB: 0.020**
1 %	**A: 0.008**		**B: 0.010**		**AB: 0.020**	**A: 0.014**		**B: 0.013**		**AB: 0.026**
Reducing sugars % in the bulbs										
0	0.59	1.18	1.25	1.28	**1.08**	0.87	1.22	1.28	1.30	**1.17**
2	1.21	1.26	1.38	1.44	**1.32**	1.31	1.40	1.45	1.52	**1.42**
4	1.32	1.43	1.50	1.56	**1.45**	1.41	1.50	1.58	1.64	**1.53**
6	1.40	1.48	1.55	1.63	**1.52**	1.54	1.63	1.69	1.72	**1.65**
Mean A	**1.13**	**1.34**	**1.42**	**1.48**		**1.28**	**1.44**	**1.50**	**1.55**	
L.S.D. 5 %	**A: 0.06**		**B: 0.09**		**AB: 0.15**	**A: 0.10**		**B: 0.14**		**AB: 0.26**
1 %	**A: 0.09**		**B: 0.12**		**AB: 0.23**	**A: 0.13**		**B: 0.19**		**AB: 0.34**
Phosphorus % in the bulbs										
0	0.172	0.221	0.229	0.240	**0.216**	0.184	0.326	0.333	0.350	**0.276**
2	0.191	0.230	0.241	0.258	**0.230**	0.200	0.341	0.352	0.361	**0.314**
4	0.210	0.235	0.266	0.272	**0.246**	0.215	0.360	0.368	0.380	**0.331**
6	0.215	0.242	0.279	0.282	**0.255**	0.219	0.371	0.384	0.391	**0.341**
Mean A	**0.197**	**0.232**	**0.254**	**0.263**		**0.205**	**0.350**	**0.359**	**0.371**	
L.S.D. 5 %	**A: 0.012**		**B: 0.007**		**AB: 0.014**	**A: 0.014**		**B: 0.009**		**AB: 0.018**
1 %	**A: 0.018**		**B: 0.010**		**AB: 0.020**	**A: 0.021**		**B: 0.012**		**AB: 0.024**

Total chlorophylls content and P% in the leaves / plant were significantly increased due to the application of active dry yeast at different rates (2, 4 and 6 g / L.) in both seasons, in comparison with that of the untreated plants as shown in Tables (5 and 6). The highest values were those resulted from spraying plants with the high concentration (6 g / L.). Similar results were announced by Ali (2001) on marigold, Badran *et al.,* (2002) on marjoram and El – Sayed *et al.,* (2002) on coriander.

The interaction between the two factors was statistically significant in the two seasons, except for total chlorophylls content which was not significant in the second season only. The most effective treatments was obtained when plants received ARP at the highest rate and sprayed with the maximum concentration of ADY.

Reducing sugars and phosphorus percentage in the bulbs

Reducing sugars and phosphorus percentage in the bulbs were significantly increased due to the rates of ARP at 75, 150 and 300 kg / fed. Reducing sugars and phosphorus percentage followed the same trend as all of the three treatments gave, in the two seasons, significantly higher values than control plants. Also, a gradual increase in reducing sugars and phosphorus percentage was accompanied with the gradual increase in the rate of ARP (Abou – Tartour rock phosphate). The increase in reducing

sugars and phosphorus percentage in the bulbs reached 30.9 and 33.5 %, respectively as a result of the high rate of ARP in comparison with that the unfertilized plants in the first season. Corresponding values in the second season reached 21.1 and 81.0 %, respectively. The, findings where in agreement with those abtianed by Manoly (1996) on Iris.

Also, both reducing sugars and phosphorus percentage in the bulbs were gradually increased by the gradual increase in the concentrations of active dry yeast in both seasons in comparison with untreated plants. The active dry yeast at 6 g / L. gave the best results as shown in Table (6).

In relation to the interaction effect between P fertilization and yeast concentrations, it was statistically significant for reducing sugars and phosphorus percentage in the bulbs. The maximum value for reducing sugars and phosphorus percentage in the bulbs resulted from Abou – Tartour rock phosphate 300 kg / fed. + active dry yeast at 6 g / l.

DISCUSSION

An explanation to the role of phosphorus in improving different vegetative characters, flowering parameters, corm formation and chemical composition of Gladiolus plants may be attributed to the fundamental role of phosphorus in very large number of enzymatic reactions that depend on phosphorelation. Phosphorus is a constituent of cell nucleus and essential for cell division and development of meristematic tissues. Such opinion was confirmed by Devlin (1979) who reported that the actively growing meristematic leaf and root cells of young barley plants contained more phosphorus than the cell that had ceased to divide.

In regard to the active dry yeast, its positive effects may be attributed to its active role in the hydrolysis of pectic substances. It is known that vitamins, enzymes and coenzymes are important components of the yeast. Also, yeast increases the release of carbon dioxide through fermentation process which effectively activates photosynthesis and accelerates biosynthesis of carbohydrates and proteins. Moreover, it increases the synthesis of plant growth promoters especially GA_3, IAA and cytokinins (Moore, 1979). In addition, yeast contains different nutrients, amino acids and vitamins which promote the uptake of different nutrient elements through the modification of the pH value of soil solution towards acidity medium (Subba Rao, 1984).

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استجابة نباتات الجلاديولس صنف الأيروفيجن لصخر الفوسفات والخميرة

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- أجريت هذه التجربة لدراسة استجابة نباتات الجلاديولس صنف الأيروفيجن النامية فى تربة رملية جيرية لأربعة معدلات من صخر الفوسفات (أبو طرطور) وهى صفر ، ٧٥ ، ١٥٠ و ٣٠٠ كيلوجرام للفدان ولأربعة تركيزات من الخميرة النشطة الجافة وهى صفر ، ٢ ، ٤ و ٦ جرام لكل لتر خلال موسمى ٢٠٠٦ / ٢٠٠٧ .
- ولقد حدثت زيادة كبيرة فى الصفات الخضرية ، الصفات الزهرية ، إنتاج الكورمات والمكونات الكيماوية نتيجة استعمال صخر فوسفات أبو طرطور بجميع معدلاته وأيضا فإن الخميرة النشطة الجافة بمعدل ٤ و ٦ جرام لكل لتر كانت أفضل المعاملات فاعلية فى زيادة النمو الخضرى والزهرى وإنتاج الكورمات والمحتوى الكيماوى لنباتات الجلاديولس صنف الأيروفيجن .
- وعلى ذلك يمكن التوصية بإمداد نباتات الجلاديولس صنف الأيروفيجن بالمعدل العالى وهو ٣٠٠ كيلوجرام للفدان من صخر الفوسفات (أبو طرطور) والرش بالخميرة النشطة الجافة بمعدل ٦ جرام لكل لتر وذلك للحصول على نمو جيد وصفات زهرية جيدة تسويقياً من الناحية الكمية والنوعية وكذلك الحصول على إنتاج أفضل من الكورمات والكريمات .