



Growth and quality of Gladiolus (*Gladiolus hybrida*) vary by cultivar and chemical fertilization

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Abstract

The experiment was conducted at nursery in Baghdad city during the period 15 March to 15 August. Five cultivars of gladiolus namely Fidelio, Nova Lux, Oscar, White Prosperity, Victor Borge were evaluated at three levels of NPK fertilization (0, 100 and 200ppm). Cultivars were significantly different in growth and flowering characteristics, cultivar Oscar produced the highest plant height (118.25cm), maximum number of leaves (10.08), biggest first floret (9.54cm), lengthiest inflorescence (51.64cm), maximum number of florets (12.96) and the highest fresh weight of the spike (69.19)gm, while cultivar White Prosperity was the best in earliness. Chemical fertilization significantly affect plant height, leaf chlorophyll content, days for flowering, and fresh weight of corm, the medium level (100 ppm) produced the best characteristics except the fresh weight of corm. The interactions between varieties and fertilization were not significant.

Keywords: Gladiolus, Cultivars, Chemical fertilization, Iraq.

Introduction

Gladiolus is Latin name for "little sword" and was used by Pliny; it alludes to the shape of the leaves. There are as many as 250 species and thousands of named hybrids of these lovely flowers, the genus has 2 regions of distribution: one in South Africa and tropical Africa, and the other in Eurasia from SW Europe and the Mediterranean coastal regions east to C Asia. Few of the wild species are grown today, but the varicolored hybrids are known the world over (Bryan, 2002). Gladiolus is considered a superior bulbous cut flower, It has a high demand in global cut flowers trade which requires development of new, promising, high yielding cultivars and their evaluation for their suitability for commercial production (Ahmad *et al.*, 2012). The flower quality and spike length of *Gladiolus* can be improved by adopting proper package of cultural practices like timely planting, proper planting distances between rows and plants, weeding and proper irrigation. Beside these cultural practices application of plant nutrients can play a vital role to produce good quality flowers, Soil and climate of a particular region are important factors influencing the fertilizer requirement of gladiolus, it also depends on cultivars and size of corms or cormlets, cultivars showing rapid growth and developing large

plants and large flower spikes responds more to fertilizer than those with low vigor and producing smaller plants and spike (Woltz, 2001). If the gladiolus is grown for the first year only then it does not need to be fertilized as it is a bulbous plant and has enough food materials, Nevertheless if it is used commercially then it needs to be fertilized with all the essential nutrients (Zubair *et al.*, 2013). The objective of the study was to compare five cultivars for their suitability for production and to investigate an optimum level of NPK fertilizer for their growth and flowering .

Material and Methods

An experiment was conducted at a nursery in Baghdad city during the year 2013. Cultivars Fidelio , Nova Lux , Oscar , White Prosperity and Victor Borge were used in the experiment, and arranged alphabetically. The corms (No.1) of these cultivars were imported from Netherlands, and planted on 15/3/2013 in plastic pots (20cm diameter) filled with mixture of 4 parts sandy loam soil and 1part sphagnum moss peat (Table 1) at a depth of 7cm. Three levels of NPK fertilizer (0, 100 and 200ppm) were applied weekly with irrigation water since the 3-leaf stage (using compound fertilizer 20:20:20 Nitrogen : Phosphorus : Potassium).

Table (1): Some physical and chemical properties of the used potting media.

EC(1: 1) Ds./m	pH	Sand	Silt $g.Kg^{-1}$	Clay	Available N	Available P $mg.Kg^{-1}$	Available K
4.2	7.6	67.6	18.8	13.6	94.5	101.33	255.00

* Ministry of Agriculture/Agric. Res. Centre-Soil Res. Dep.-Laboratories

Maximum and minimum temperature was measured (Table 2), the routine agricultural practices were carried out as recommended for such plantation. The flowering time take place between May 28th and June 18th, the following parameters were studied : plant height(cm), number of leaves, leaf chlorophyll content (was measured by SPAD-502 plus), days for flowering, length of inflorescence(cm), diameter of first floret(cm), number of florets/spike, diameter of the

spike(mm), fresh weight of the spike (gm), vase life(days) and weight of corm (gm). The experiment layout was a randomized complete blocks design(RCBD) with two factors(five cultivars and three fertilizer levels) with 15 treatment with three replicates (each experimental unit contains 4 pots). All data was subjected to analysis of variance (ANOVA) and the means separated using the least significant difference (LSD).

Table (2): The daily means of Maximum & Minimum temperature 2013.

Month Temp °C	March	April	May	June	July	August
Max.	24.6	32.1	38.0	38.0	41.3	40.4
Min.	9.0	19.0	24.0	25.3	26.8	26.3

Results and Discussion

Plant height: Among gladiolus cultivars, significant differences were recorded for plant height (Table 3), the tallest plants of (118.25cm) were recorded in cultivar Oscar whereas cultivar White Prosperity produced the shortest plants of (101.16cm). Similar results were reported by Ahmed *et al.* (2002) who found that cv. Oscar was the tallest among 10 cultivars, and the cultivars appears to responses differentially according to their genotype, also these results are in line with the findings of Al-Humaid (2004) and Shaukat *et al.* (2013). Among NPK treatments, plants supplied with (100)ppm were significantly tallest compared with (0,200)ppm which were statistically similar (Table 3) these results were in accordance with the findings of Raheim *et al.* (1986) and Zubair *et al.* (2013) that medium levels of fertilizers produced the tallest gladiolus plants. Interaction between cultivars and fertilization was not significant.

Number of leaves: It is obvious from the data (Table 3) that maximum number of leaves was recorded in cultivar Oscar (10.08 leaf) and the minimum was in cultivar Nova Lux (7.50 leaf) while (9.00, 8.75, 8.50)leaves were recorded in Fidelio, White Prosperity and Victor Borge respectively which were

statistically similar. These results were in agreement with the findings of Ahmed *et al.* (2002), Al- Saad (2010) and Ahmad *et al.* (2013). NPK fertilization had no significant effect on this character (Table 3) which was contrary to the findings of Ahmad *et al.* (2013) who found significant increment in number of leaves as a response to chemical fertilization. Interaction between the two studied factors was not significant.

Leaf chlorophyll content: Among gladiolus cultivars, Oscar had significantly higher leaf chlorophyll content (56.87 SPAD unit) and was statistically similar with Victor Roge, and the least was recorded in Fidelio (52.57 SPAD unit) (Table 3). These results were confirmed with the findings of Al-Saad (2010) who reported that cultivars differ in chlorophyll content due to their vigorously. Plants provided with (100 and 200ppm) NPK had the highest leaf chlorophyll content (55.61 and 55.58) SPAD unit respectively, while those without NPK application had the least (50.74 SPAD unit) (Table 3), the increased chlorophyll content might be due to the acceleration of N uptake, enhancing N metabolism and production of protein that ultimately increase chlorophyll content (Ahmad *et al.*, 2013). The interaction was not significant .

Table (3): Effect of cultivar variance and fertilization on some vegetative characteristics of *Gladiolus hybrid*.

Treatments	Plant height (cm)	Number of leaves	Leaf chlorophyll content (SPAD unit)
cultivars			
Fidelio	101.80	9.00	52.57
Nova Lux	103.40	7.50	53.06
Oscar	118.25	10.08	56.87
White Prosperity	101.16	8.75	52.99
Victor Borge	107.16	8.50	54.83
LSD 5%	5.29	0.69	2.22
Fertilization levels (ppm)			
0	104.90	8.75	50.74
100	109.85	8.80	55.61
200	104.35	8.75	55.58
LSD 5%	4.09	NS	1.7
Interaction			
Cultivars × Fertilization	NS	NS	NS

Days for flowering: The means values regarding days for flowering revealed that cultivars significantly affected days for flowering, the earliest flowering (77.83)days was recorded in White Prosperity while (83.16, 84.25, 85.16 and 85.75)days were taken by Fidelio, Nova Lux, Oscar and Victor Borge respectively which were statistically similar (Table 4). These results are in line with the findings reported by Ahmed *et al.* (2002) who found that cultivar Wine and Roge was the earliest among 10 gladiolus cultivars, and this might be due to the differences in genotypes. Plants fertilized with (100)ppm NPK take significantly more days for flowering (84.30)days than those none fertilized (81.75)days, while the (200)ppm level reported (83.65)days which was statistically similar with other treatment (Table 4), these results were confirmed by findings of Zubair *et al.* (2013) on gladiolus and Alsheikly (2013) on *Iris hollandica*. The interaction between cultivars and fertilization was not significant.

Inflorescence length: Oscar had significantly longer inflorescence (51.64cm) than other cultivars, and the shortest was in Nova Lux (35.19 cm) while (45.79, 45.29 and 44.89cm) were recorded in White Prosperity, Victor Borge and Fidelio respectively (Table 4), these results were in accordance with the findings of Al-Saad (2010), Ahmad *et al.* (2013) and Shaukat *et al.* (2013) who found that cultivars differ significantly in inflorescence length. Data given in Table (4) showed that plants fertilized with 100 ppm NPK produced significantly longer inflorescence compared to those non fertilized, the levels (0,200)ppm were statistically similar and so did the levels (100,200)ppm, this may be due to the positive effect of NPK on the activity of the apical meristem which stimulates cell division and elongation of the inflorescence. These results are in

harmony with those obtained by Raheim *et al.* (1986) and Zubair *et al.* (2013). Interaction between cultivars and fertilization was not significant.

First floret diameter: Among gladiolus cultivars Oscar produced the largest floret (9.54cm) and differ significantly from the others, while the smallest was found in Nova Lux (Table 4), these results were in line with the findings of Ahmad *et al.* (2002) and Al-Saad (2010), this may be justify that cultivars have different capability of producing florets with different sizes, therefore different sizes of florets were noted in different cultivars (Zubair *et al.*, 2013). NPK application and its interaction with cultivars had no significant effect on this character (Table 4), this results were in agreement with the results reported by Raheim *et al.* (1986).

Number of florets per spike: Data presented in Table 4 showed that cultivar Oscar had significantly more florets than other cultivars (12.96 floret), and the fewer number (9.90 floret) was found in Nova Lux while the other three cultivars were statistically similar, these results were in accordance with the findings of Ahmad *et al.* (2013) and Shaukat *et al.* (2013). There was no significant effect of NPK application on number of florets (Table 4), these results were confirmed with the findings of Ahmad *et al.* (2013). Interaction between the two studied factors was not significant.

Girth of spike: The data (Table 4) illustrated that cultivars Oscar and White Prosperity had statistically similar girth of spike (7.66 and 7.58)mm respectively and significantly more than the other cultivars. These results were supported by Ahmad *et al.* (2013) and Al-Saad (2010). No significant effect was found due to NPK application (Table 4), similar results were obtained by Ahmad *et al.* (2013). Interaction between the studied factors was not significant.

Table (4): Effect of cultivar variance and fertilization on floral characteristics of Gladiolus hybrid.

Treatments	Days for flowering	Length of inflorescence (cm)	Diameter of first floret (cm)	Number of floret	Girth of Spike (mm)	Fresh weight of spike (gm.)	Vase life (day)
Cultivars							
Fidelio	83.16	44.89	8.32	10.89	7.16	56.29	8.33
Nova Lux	84.25	35.19	7.54	9.90	6.04	45.69	7.83
Oscar	85.16	51.64	9.54	12.96	7.66	69.19	8.33
White Prosperity	77.83	45.79	8.65	11.19	7.58	58.09	8.25
Victor Borge	85.75	45.29	8.62	10.89	7.20	54.99	8.16
LSD 5%	2.93	3.16	0.48	0.86	0.33	5.19	NS
Fertilization levels (ppm)							
0	81.75	43.02	8.52	10.98	7.05	54.83	8.25
100	84.30	46.20	8.57	11.32	7.17	58.43	8.15
200	83.65	44.46	8.52	11.20	7.17	57.29	8.15
LSD 5%	2.18	2.45	NS	NS	NS	NS	NS
Interaction							
Cultivars × Fertilization	NS	NS	NS	NS	NS	NS	NS

Fresh weight of spike: Among gladiolus cultivars Oscar had significantly higher fresh weight of spike (69.19 gm) than other cultivars while Nova Lux produced the minimum fresh weight (Table 4), similar results were obtained by Arora and sandhu (1987) who found that cultivar Oscar produced the heavier spikes among fifteen cultivars. Chemical fertilization had no significant effect on this character (Table 4) and so did the interaction.

Vase life: The data (Table 4) illustrated that cultivars had statistically similar vase life, these results were in accordance with the findings of Al-Saad (2010). NPK application and its interaction with cultivars were not significant. These results may be explain that high temperature and high light intensity during June led to rapid opening of spikes and seem to have exhausted the food reserve and hence short vase life observed.

Fresh weight of corm: Data in Table (4) showed that Cultivars Oscar and Nova Lux had statistically similar weight of corm (28.2 and 27.9gm) and significantly higher than other cultivars, and the minimum weight was produced by Fidelio (22.2gm), these results were supported by Ahmed *et al.* (2002), Zubair *et al.*, (2013) and Shaukat *et al.* (2013). Plants receiving (200ppm) NPK produced significantly heaviest corm (27.40gm) while those

with (0 and 100) ppm were statistically similar (24.74 and 25.20gm), these results were confirmed by findings by Raheim *et al.* (1986) and Sewedan *et al.* (2012). Interaction between the two studied factors was not significant.

Differences between cultivars in most characteristics might be due to different genetic make-up of the cultivars, and their interact with the environmental conditions during spring and summer cultivation in Baghdad city which provide high temperature, high light intensity and long day, led to rapid growth, early flowering and some decline in the standard characteristics of cultivars, to improve flower quality we have to follow Pad & Fan cooling and shading in greenhouses to win (30/18)C as max./min. temp. (Raheim *et al.*, 1986). The limited response of gladiolus plants to NPK application may be explain that gladiolus is a bulbous plant and has enough food materials, so if soil fertility is good (Table 1) then gladiolus does not need to fertilized for the first year only (Zubair *et al.*, 2013). Flannery and Vandiest (1963) reported that gladiolus plants are very efficient in utilizing the natural soil fertility, and does not response to rise the fertilizing levels more than the limits which considered low for growth of vegetables and field crops.

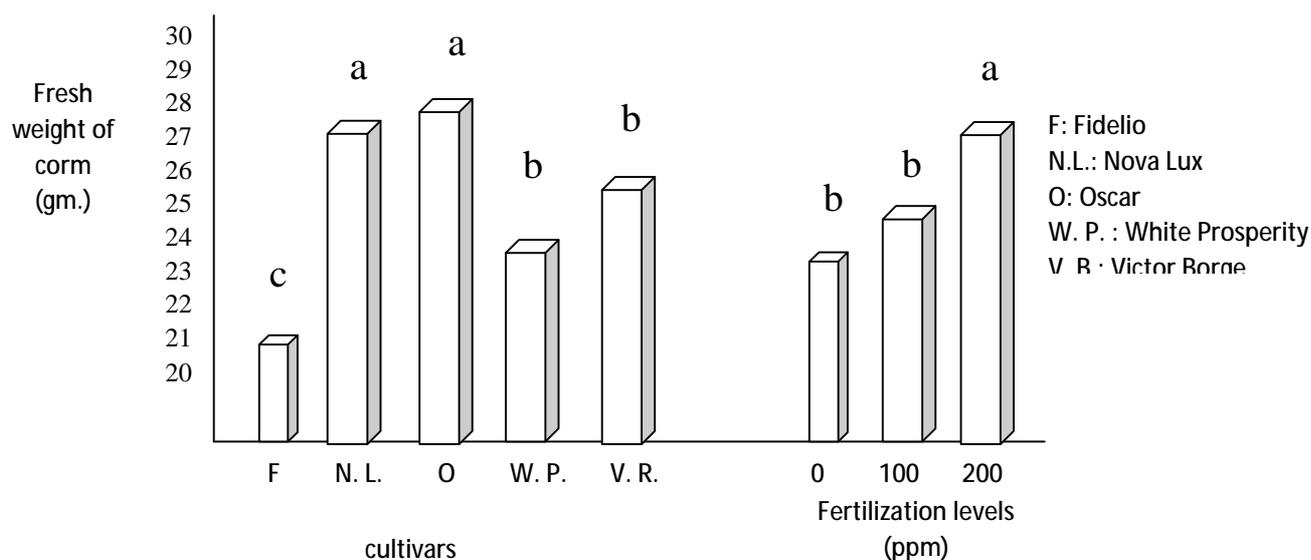


Figure (1): Effect of cultivar variance and fertilization on fresh weight of corm, *Different letters represent statistical differences between them.

Conclusions

It is concluded from the experiment results that cultivar Oscar surpassed all other cultivars under trial in most characteristics, while cultivars Fidelio, White Prosperity and Victor Borge were almost similar in their characteristics, Nova Lux produced the least means. Also, fertilization did not show significant effect for most of quality characteristics of gladiolus, and it affected significantly plant height, leaf chlorophyll content, inflorescence length and fresh weight of corm, any how it is advised that growers use NPK fertilizers while growing Gladiolus.

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