



Effect of Growing Conditions on Growth, Flower Yield and Vase Characters of Gladiolus Varieties

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Abstract

An investigation was carried out to observe the performance of gladiolus varieties during May to October (first season) and November to April (second season), under two growing conditions. The three gladiolus varieties namely 'Oscar', 'Summer Sunshine' and 'White Prosperity', were grown as per KAU recommendation, both in open field and naturally ventilated polyhouse. The study clearly indicated that growing condition, season and genotype had significant influence on vegetative as well as floral characters of gladiolus. The vegetative characters like plant height, number of leaves and leaf area were better in polyhouse grown plants, during both seasons. Early spike, shorter duration from spike emergence to opening and longer blooming period were noticed in polyhouse grown plants. Total duration of the crop was shorter in polyhouse during both seasons. Spike length, rachis length, number of florets per spike, floret size and number of florets opened at a time were better in polyhouse grown plants, during both seasons. Polyhouse grown plants recorded significantly more vase life, during both seasons. Corm yield were maximum in plants grown in polyhouse. Among the varieties, 'Summer Sunshine' had better performance with respect to vegetative, spike and vase characters, compared to other varieties, both in polyhouse and open field. The results showed that spike qualities, as well as corm yield, can be enhanced by polyhouse cultivation. It was also noticed that November planting was found to be better than May planting, in order to obtain quality spikes as well as good corm yield in gladiolus under Vellanikkara conditions.

Keywords: *Gladiolus, growing condition, season.*

Introduction

Gladiolus (*Gladiolus grandiflorus* L) is one of the most attractive and popular cut flowers much known for its majestic spikes possessing attractive, stylish, and gentle florets. Gladiolus belongs to the family Iridaceae with its origin in South Africa. It is known as the 'Queen of bulbous flower crops'. It is one of the important cut-flower both in the domestic and international markets.

In Kerala, still it is not commercially cultivated. Intense rainfall and high relative humidity during monsoon and slightly high temperature during summer hinder the commercial production of gladiolus under Kerala conditions. Traditional cultivation

practices do not provide any opportunity for environmental control. Consequently, the productivity of the crop is not fully realized. Production and supply of gladiolus flowers in the summer or rainy season are very limited due to adverse weather conditions. In this context, protected cultivation has got much importance. Cultivation in poly houses facilitates quality improvement and multifold productivity enhancement, which helps to compete in the global market. Islam and Haque, 2011 reported that gladiolus plants grown under polytunnels performed better in respect of several florets per spike, several cormels per plant, the weight of corm per

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plant, and weight of cormels per plant than the plants grown without a polytunnel. Adequate research works on protected cultivation of gladiolus during different seasons are scanty. So the present investigation was undertaken to compare the performance of gladiolus varieties under open field and naturally ventilated polyhouse conditions.

Materials and Methods

The experiment was conducted in two seasons, from May 2012 to October 2012 (first season) and from November 2012 to April 2013 (second season) at the College of Agriculture, Kerala Agricultural University. Variety, planting time, and growing condition were the three factors considered in this study. The experimental design was RBD with four replications. 'Oscar', 'Summer Sunshine' and 'White Prosperity' varieties of gladiolus were planted both in May and November in two growing conditions viz., naturally ventilated polyhouse and open field.

The selected area for the experiment was ploughed, stubbles removed, levelled, and raised beds of size 1.5 m x 0.8 m were prepared. Well-decomposed farmyard manure at the rate of 25 t ha⁻¹ was applied and mixed well with the soil at the time of land preparation. The recommended dose of 100:60:60 kg NPK per hectare was applied in the form of Urea, Single Super Phosphate, and Muriate of Potash respectively. At the time of planting half the dose of N, full doses of P₂O₅ and K₂O were applied. Pest and disease-free corms of uniform size were cleaned and dipped in Bavistin (0.2%) solution for 30 minutes as a preventive measure for wilt disease. These corms were planted at a spacing of 20 cm x 30 cm in each bed at a depth of 5-6 cm. The crop was top-dressed with the remaining half dose of N at 45 days after planting. Irrigation, drainage, and other intercultural operations were done as and when necessary. Soil drenching with Bavistin 0.2% was done periodically as a preventive measure for Fusarium wilt disease. Staking of the plants was done at the time of spike

emergence. Irrigation was held, two weeks before the lifting of the corms.

The spikes were harvested when the first floret starts showing colour and used for recording post-harvest observations. The corms and cormels were lifted from the ground, when the foliage turned to yellow colour. These harvested corms and cormels were used for recording different post-harvest yield parameters. Observations were tabulated and analyzed statistically. MSTAT package was used for analysis of plant characters, spike characters, vase characters, corm and cormel yield in a randomized block design (RBD).

Results and Discussion

Growing conditions exerted significant influence on vegetative characters of all the varieties under study, during both seasons (Table 1). The plants showed better plant height in naturally ventilated polyhouse than in the open field. The light intensity available inside the naturally ventilated polyhouse, observed in the present study ranged between 52-72 percent. Optimum light intensity in combination with a warmer environment and higher relative humidity inside the polyhouse might have helped in good vegetative growth. Differential response of gladiolus with respect to plant height in different growing conditions was also observed by Islam and Haque, 2011; Kirtimala. *et al.*, 2011. Leaf area was significantly influenced by growing condition for all the varieties during both seasons. In general highest leaf area was recorded by all three varieties in polyhouse, during both seasons. Growing conditions exerted significant influence on spike characters of all the varieties under study, during both seasons (Table 2 and 3). It was revealed from this study that spike emergence was earlier in polyhouse than in open field for all varieties during both seasons (Table 4 and 5) According to (Sivasamy and Dadlani, 2002), greenhouse-grown plants showed a 20% reduction in time taken for spike emergence and flowering compared to those in the field. Islam and Haque, (2011) reported that plants grown under poly tunnel

produced flowers earlier compared to plants grown without a polytunnel.

Polyhouse grown plants recorded a lesser number of days from spike emergence to opening during both seasons. Similar results were reported by Sivasamy and Dadlani, (2002) and Islam and Haque, (2011).

The time taken from planting to flowering was significantly influenced by the growing condition in all the varieties during both seasons. Polyhouse grown plants showed a significant reduction in the time taken for flowering compared to open field, for all the varieties, during both seasons (Table 4 and 5). It is found that growing conditions significantly influenced the blooming period of all the varieties during both seasons. The blooming period is longer in polyhouse than in open field. It may be because polyhouse grown spikes are longer and had more florets per spike compared to that in the open field. The duration from planting to the end of the blooming period gives the total duration. Lesser crop duration is preferred always, as more number of crops could be taken a year.

The growing conditions significantly influenced the total duration in all the varieties during both seasons. In all the varieties, the polyhouse grown plants exhibited a shorter duration than plants grown in the open field (Table 4 and 5). Malhotra and Kumar, (2000) earlier reported that plants come to the reproductive phase earlier if it has enough carbohydrate. This might be the reason for the shorter duration of polyhouse grown plants compared to open field plants.

From this study, it was revealed that the spike length was significantly influenced by the growing condition. All the varieties had better spike length in polyhouse than in open field. The results are in conformity with Sarkar and Maitra, (2005). Mohanty. *et al.*, (2011) reported that the availability of optimum light intensity inside the poly house will maintain higher chlorophyll content which would produce and maintain higher carbohydrate reserve that will be diverted for quality flower

production. Rachis length determines the number of florets as well as the spacing between the florets. A longer rachis with more number of florets arranged at closer spacing is usually desirable as it gives a compact look to the spike. Rachis length of all the varieties was significantly influenced by the growing condition. The maximum rachis length of all the varieties was recorded in polyhouse.

In this study, polyhouse grown plants exhibited a higher number of florets compared to open fields. This study revealed that growing conditions significantly influence the number of florets per spike in gladiolus. The modified microclimate inside a naturally ventilated polyhouse would have contributed to more number of florets per spike in polyhouse grown plants. Islam and Haque, (2011) also reported that plants grown under poly tunnel performed better in respect of the number of florets per spike. According to Sivaswamy and Dadlani, (2002), the number of florets was better under greenhouse conditions than in the open field in cv. American beauty.

As the diameter of the floret increases, the tendency for overlapping of the nearest floret increases. This in turn enhances the beauty of the spike. The floret size of all the varieties under study was significantly influenced by growing conditions during both seasons. Floret size was more for polyhouse grown spikes.

All the varieties recorded more florets opened at a time, in polyhouse. Dadlani, *et al.*, (1990) had reported that the number of florets opened at a given time was 26% greater in gladiolus grown in the plastic greenhouse compared to an open field.

The performance of the spike in the vase determines the value of gladiolus as a cut flower. The vase characters like percentage of fully opened florets, percentage of partially opened florets, percentage of unopened florets, the longevity of individual florets, number of florets opened at a time, nature of bending, water uptake, and vase life are very important. This study shows that growing

conditions significantly influence certain vase characters of gladiolus varieties (Table 6 and 7).

The growing condition exerted a significant influence on the fresh weight of spike for all the varieties, during both seasons. The fresh weight of the spike recorded was higher for polyhouse grown plants. Significant influence of growing condition was noticed on the percentage of fully opened florets in a vase for all the varieties, during the first season. The maximum percentage of fully opened florets in a vase for all the varieties was recorded in polyhouse. The influence of growing conditions on the percentage of fully opened florets in the vase was not statistically significant for all the varieties, during the second season. Even then, all the varieties had more percentage of fully opened florets in a vase, for polyhouse grown spikes.

The longevity of individual florets of all the varieties was not significantly influenced by growing conditions, during the first season. Even then the longevity was more in naturally ventilated polyhouse grown plants than in open fields for all the varieties. Growing conditions had a significant influence on the longevity of individual florets, during the second season. Polyhouse grown spikes had more longevity of individual florets than open field grown spikes. Dadlani. *et al.*, (1990) also reported that the life of the florets on the spike was 30% longer in the case of plastic greenhouse-grown spikes compared to that in the open field.

The effect of growing condition was statistically insignificant on the number of florets opened at a time of all the varieties during the first season. During the second season, growing conditions exerted significant influence on number of florets opened at a

time of all the varieties. Polyhouse grown spikes recorded more florets opened at a time than the open field grown spikes.

The growing conditions could not significantly influence the nature of bending in any of the varieties during both seasons.

From this study, it can be concluded that growing conditions significantly influenced the vase life of gladiolus spikes. This was in accordance with the findings of Sarkar and Maitra, (2005). They reported that the longevity of spikes on the vase was found to increase by 16.88 percent under poly house conditions.

The growing condition significantly influenced the weight and size of corms in all the varieties during both seasons (Table 8). Corms of polyhouse grown plants of all the varieties showed maximum weight and size during both seasons. The optimum light intensity coupled with high temperature and relative humidity might have resulted in more carbohydrate reserve in polyhouse grown plants which in turn would have diverted for larger corm production. Dadlani. *et al.*, (1990) reported that corm weight was 21 percent greater for the plants grown in the greenhouse. Sivasamy and Dadlani, (2002) reported 38 percent increase in corm weight and 20.04 percent increase in corm size in the greenhouse-grown gladiolus than in the open field. Islam and Haque, (2011) also reported better performance concerning corm weight, in polytunnel grown gladiolus.

During both seasons, the number of cormels produced and the weight of cormels were significantly influenced by growing conditions in all the varieties. Polyhouse grown cormels weighed more than the open field grown cormels, during both seasons.

Table 1: Effect of growing conditions on vegetative characters of gladiolus varieties

Varieties	S1						S2					
	Plant height (cm)		No: of leaves		Leaf area (cm ²)		Plant height (cm)		No: of leaves		Leaf area (cm ²)	
	G ₁	G ₂	G ₁	G ₂	G ₁	G ₂	G ₁	G ₂	G ₁	G ₂	G ₁	G ₂
Oscar	51.0 6	43.9 1	8.4 8	7.8 8	713.6 1	551.3 9	56.7 6	47.9 2	8.5 3	8.4 5	777.7 8	678.9 6
Summer Sunshine	63.5 9	52.5 8	8.0 3	7.4 8	878.6 6	633.3 9	71.4 7	53.1 9	8.9 3	7.8 3	925.8 9	718.7 8
White Prosperity	54.9 8	46.0 3	8.4 5	7.7 5	870.0 7	569.4 7	64.0 6	51.0 3	8.5 5	7.9 8	903.0 0	885.5 3
CD (0.05)	1.67		NS		14.56		4.74		0.24		21.28	

S1 First season

S2 Second season

G₁ Naturally ventilated polyhouse

G₂ Open field

NS Not Significant

Table 2: Effect of growing conditions on spike characters in gladiolus varieties during first season

Varieties	Length of spike (cm)		Diameter of spike (cm)		Length of rachis (cm)		Number of florets/spike		Size of the florets (cm)		No: of florets opened at a time	
	G ₁	G ₂	G ₁	G ₂	G ₁	G ₂	G ₁	G ₂	G ₁	G ₂	G ₁	G ₂
Oscar	51.02	41.63	0.90	0.69	33.51	25.73	10.35	9.78	9.47	8.86	3.93	3.40
Summer Sunshine	73.54	42.46	0.89	0.72	44.42	20.47	11.38	8.98	8.79	6.57	6.33	5.13
White Prosperity	59.05	33.13	1.02	0.88	37.39	20.19	9.23	8.03	7.53	6.40	4.20	4.18
CD(0.05)	2.07		0.04		2.14		0.48		0.32		0.28	

Table 3: Effect of growing conditions on spike characters in gladiolus varieties during second season

Varieties	Length of spike (cm)		Diameter of spike (cm)		Length of rachis (cm)		Number of florets/spike		Size of the florets (cm)		No: of florets opened at a time	
	G ₁	G ₂	G ₁	G ₂	G ₁	G ₂	G ₁	G ₂	G ₁	G ₂	G ₁	G ₂
Oscar	62.91	52.26	1.34	1.28	42.66	38.65	12.00	10.25	10.31	9.11	4.30	3.43
Summer Sunshine	82.07	53.77	1.22	1.05	51.09	42.74	13.80	10.35	9.90	8.64	6.25	6.45
White Prosperity	67.66	51.94	1.02	0.97	44.90	36.89	11.57	9.60	9.15	8.17	5.55	4.38

CD(0.05)	1.41**	0.03**	2.47**	0.42**	0.17*	0.30*
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Table 4: Effect of growing conditions on flowering in gladiolus varieties during first season

Varieties	Planting to spike emergence (days)		Spike emergence to opening (days)		Time taken for flowering (days)		Blooming period (days)		Total duration(days)	
	G1	G2	G1	G2	G1	G2	G1	G2	G1	G2
Oscar	87.35	94.73	7.28	5.83	94.63	100.55	9.03	6.90	103.65	107.45
Summer Sunshine	61.90	72.03	8.08	8.70	69.98	80.73	11.68	8.95	81.65	89.68
White Prosperity	72.05	84.00	8.53	9.30	80.58	93.30	9.68	7.45	90.25	100.75
CD(0.05)	0.44		0.44		0.70		0.30		0.85	

Table 5: Effect of growing conditions on flowering in gladiolus varieties during second season

Varieties	Planting to spike emergence (days)		Spike emergence to opening (days)		Time taken for flowering (days)		Blooming period (days)		Total duration(days)	
	G1	G2	G1	G2	G1	G2	G1	G2	G1	G2
Oscar	73.25	78.68	6.60	7.68	79.85	86.35	10.08	9.05	89.93	95.40
Summer Sunshine	56.22	64.05	6.73	9.23	62.95	73.28	13.03	9.93	75.98	83.20
White Prosperity	62.08	70.40	7.68	10.10	69.75	80.50	12.05	8.70	81.80	89.20
CD(0.05)	0.72		0.28		0.82		0.24		0.92	

Table 6: Effect of growing conditions on vase characters in gladiolus varieties during first season

Variety	Fresh wt of spike (g)		Percentage of fully opened florets		Percentage of partially opened florets		Percentage of unopened florets		Longevity of individual florets (days)		Number of florets opened at a time		Nature of bending				Water uptake (ml)		Vase life (days)	
	G1	G2	G1	G2	G1	G2	G1	G2	G1	G2	G1	G2	From which day in vase		From which floret		G1	G2	G1	G2
													G1	G2	G1	G2				
Oscar	23.90	19.00	27.27	20.00	18.18	20.00	54.55	60.00	1.67	1	2	2	4	4	4	4	31.23	22.03	5.00	3.67
Summer Sunshine	46.13	36.80	41.67	22.22	16.67	11.11	41.67	66.66	3.2	2.5	3	2	6	4	6	4	35.93	28.77	6.67	4.00
White prosperity	36.83	22.40	33.33	25.00	22.22	12.50	44.44	62.50	1.33	1	3	2	3	3	4	2	24.00	12.40	3.33	2.00
CD (0.05)	2.068		0.20		0.01		NS		NS		NS		NS		NS		3.326		0.80	

Table 7: Effect of growing conditions on vase characters in gladiolus varieties during second season

Variety	Fresh wt of spike (g)		Percentage of fully opened florets		Percentage of partially opened florets		Percentage of unopened florets		Longevity of individual florets (days)		Number of florets opened at a time		Nature of bending				Water uptake (ml)		Vase life (days)	
	G1	G2	G1	G2	G1	G2	G1	G2	G1	G2	G1	G2	From which day in vase		From which floret		G1	G2	G1	G2
													G1	G2	G1	G2				
Oscar	34.97	25.17	33.33	30.00	25.00	20.00	41.67	50.00	2.00	1.67	2.00	2.00	5.00	5.00	6.00	5.00	35.87	21.20	6.00	5.00
Summer Sunshine	55.67	44.27	42.86	36.36	21.43	18.18	35.71	45.45	3.67	3.25	4.00	3.00	7.00	5.00	7.00	6.00	41.43	33.07	8.67	6.33
White prosperity	41.03	35.20	41.67	30.00	25.00	20.00	33.33	50.00	2.20	2.00	4.00	2.00	5.00	5.00	6.00	5.00	31.23	25.70	4.00	3.00
CD (0.05)	2.974		NS		NS		0.028		0.002		0.801		NS		NS		2.803		0.67	

Table 8: Effect of growing conditions on the corm and cormel yield of gladiolus varieties

Varieties	S1								S2							
	Weight of corms (g)		Size of corms (cm)		Number of cormels		Weight of cormels (g)		Weight of corms (g)		Size of corms (cm)		Number of cormels		Weight of cormels (g)	
	G1	G2	G1	G2	G1	G2	G1	G2	G1	G2	G1	G2	G1	G2	G1	G2
Oscar	59.57	30.80	5.95	4.99	75.59	35.74	6.02	4.88	21.63	7.65	20.78	9.46	14.75	9.23	19.23	10.01
Summer Sunshine	108.11	70.50	7.24	5.74	147.33	84.76	8.10	6.04	6.93	17.49	8.72	13.60	5.75	17.75	8.41	13.37
White Prosperity	42.79	22.41	5.15	4.02	57.22	35.04	5.30	4.29	8.05	4.65	4.23	0.61	4.88	1.93	2.49	0.30
CD(0.05)	2.45		0.16		1.82		1.60		5.95		0.22		1.37		0.88	

Conclusion

The present study indicates that protected cultivation of gladiolus is promising for Kerala. In order to improve the protected production of gladiolus, improved cultivation practices such as organic gladiolus cultivation, fertigation, and biological management of diseases should be investigated under protected cultivation.

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