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Optimization of Planting Time for Better Flowering, Corms and Cormels Production in Gladiolus (*Gladiolus grandiflorus*)

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ABSTRACT: Present study was conducted to assess the effect of planting time and growing conditions on floral and corm characters of gladiolus *Cv.* American Beauty at Department of Horticulture, CCS Haryana Agricultural University, Hisar. The results revealed that planting of corms on 15th October resulted into maximum number of florets per spike (11.22), spike length (80.15 cm), rachis length (71.37 cm), floret diameter (8.55 cm), size of corm (5.75 cm), weight of corm (41.30 g), number of cormels per plant (9.90) and weight of 10 cormels (5.96 g). Between two growing conditions, open field was significantly superior in respect to number of florets per spike (11.50), spike length (80.18 cm), rachis length (68.25 cm), diameter of floret (7.97 cm), size of corm (4.33 cm), weight of corm (35.49 g), number of cormels per plant (8.55) and weight of 10 cormels (6.37 g) in comparison of shade net house. By finding proper planting time vegetative growth and quality of flowers can be improved to steady supply in market and satisfying customer's demand. It is concluded from the study that 15th October planting of gladiolus under open field results in better flowering, Corms and Cormels production.

Keywords: Corms, Gladiolus, Growing conditions, Spike, Planting time

INTRODUCTION

The beauty of flower has attracted attention of mankind with the beginning of the civilization. In an ancient and religious country like India, flowers are intricately associated with almost all social celebrations and festivals. Flowers are frequently used as cut-flowers for bouquets, *gajra*, *rangoli*, and *veni* making along with uses in worshiping. Gladiolus is one of the most important cut flowers in international and domestic market. In floriculture industry, gladiolus occupies prime position and ranks next to tulip in European market and is being cultivated in almost all countries of world (Cohat, 1993). It prefers cool and dry conditions, and temperature plays a major role in growth and flowering of the crop. Gladiolus cultivation has gained popularity among farmers due to ease of cultivation and good profit. In some parts of country which have favourable climate conditions, gladiolus is planted throughout the year. In northern India, gladiolus is planted from September to November (Bose and Yadav, 1989). Flower quality can improve by adopting proper planting time however, farmer take risk and go for early and late planting. The suitable cultivars and their optimum planting times for each area must be investigated. In regulating growth and quality of gladiolusdate of planting plays an important role,environmental factors have a significant effect on growing higher-quality spikes (Saleem *et al.* 2013). Different planting dates ensure a longer availability of gladiolus spikes to the consumer, reducing the risk of lower profitability and ensuring that customer demands are met for a longer period of time and under ideal environmental conditions the timing of flowering from different planting dates is quite predictable (Younis *et al.*, 2018). Arora and Sandhu (1987) explained that the late plantation leads to rise in temperature, which eventually encouraged corm sprouting, as high temperatures have a positive effect on corm sprouting. The use of polyhouse and green house may be helpful for growing gladiolus throughout the year. Planting time and growing conditions are the most important factors which influence the performance and quality of flowers. Hence, presence study was aimed to explore the possibility of producing a high valued crop from greenhouse and open field and to standardize the time of planting.

MATERIALS AND METHODS

The present investigation was conducted on gladiolus *Cv.* American Beauty at Precision Farming Development Centre of Department of Horticulture, CCS Haryana Agriculture University, Hisar (Haryana) during year 2011-2012, situated at 29°10′ North Latitude and 75°46′ East longitude at an elevation of 215.2 m above mean sea level. This region has semi-arid climate with severe cold winter and hot dry summer, with no specific pattern of rainfall during growing season. The soil of the experimental field was sandy loam in nature and climate in general was semi-arid. The average annual rainfall is about 420 mm mostly from mid April to mid October which is

unevenly distributed with peak rainfall occurring during month of July and August. The experiment was conducted in randomized block design with four replications, 24 treatments with three planting dates 15th October, 15th November and 15th December and two growing conditions open field and shade net house. Healthy corms were planted by adopting 30 × 20 cm spacing in the experiment plots of net area of 1m^2 each. Corms were dipped in 0.02% Carbendazim solution for 30 minutes before planting. Standard cultural practices operations were carried out uniformly during the crop season. Irrigation was applied at 7 days interval and in winter irrigation was applied at 15 days interval in summers. After 40 days of planting, the plants were earthed up in the form of ridges to provide support and to avoid lodging. Upon spike emergence, stalking with bamboo sticks was also done to avoid lodging and bending and to keep the spikes in vertical position. Observations were made on floral and corm characters using conventional methods.All agronomic practices, viz., stalking, earthing up, weeding, irrigation, fertilization, and IPM were similar for all treatments during entire experiment period. Meteorological data during experiment period were collected from Agro-meteorology Department, Chaudhry Charan Singh Haryana Agricultural University, Hisar, Haryana and is presented in Table 1.

The soil of the experimental site was analyzed for various physico-chemical attributes and the data are presented in Table 2. On the basis of soil analysis and the mean values, the soil was found to be sandy loam in texture, medium in organic carbon, low in available nitrogen, medium in phosphorus and high with respect to available potassium.

Table 1: Meteorological information during the study.

Year	Month	Avg. Air Temp. (°C) Open Field		Avg. Air Temp (°C) Shade Net House		Mean Relative Humidity (%)		Mean Sunshine hours (hours)	Avg. Rainfall (mm)
		Max.	Min.	Max.	Min.	Morning	Evening		
2010	October	32.7	17.2	29.2	14.4	89.5	35.5	7.6	0.0
	November	28.2	12.4	26.2	10.3	87.0	36.5	6.9	0.0
	December	23.3	4.4	20.4	2.2	91.0	34.2	6.1	0.0
2011	January	16.6	4.6	14.4	2.6	94.8	50.3	8.9	43.6
	February	22.4	7.8	19.5	5.3	94.5	51.0	6.5	16.2
	March	27.8	10.1	24.6	9.1	92.2	46.0	7.7	4.9
	April	32.9	15.1	30.9	13.2	85.2	43.2	8.6	17.6

Table 2: Physico-chemical analysis of the experimental field soil.

Character	Contents	Method of determination
Texture	Sandy loam	International Pipette method
Organic carbon (%)	0.30	Walkley and Black rapid titration method
pH	8.2	1:2 soil water suspension
EC (dS m^{-1})	0.27	1:2 soil water suspension
Available nitrogen (kg ha^{-1})	178	Alkaline permanganate method
Available phosphorus (kg P_2O_5 ha^{-1})	4	Olsen's method
Available potassium (kg K_2O ha^{-1})	198.1	Flame photometric method

The statistical method described by Panse and Sukhatme, (1978) was followed for analysis and interpretation of the experimental results and the techniques of analysis of variance describe by Fisher, (1956) was used. The data were analysed with the help of a windows based computer package OPSTAT (Sheoran, 2004).

RESULTS AND DISCUSSION

The results revealed that maximum numbers of florets per spike were recorded from the spike of corms planted on 15th October (11.22) followed by 15th November (10.17). Maximum numbers of florets (11.50) were recorded in those plants grown under open field and minimum (8.35) under shade net house.

Number of florets per spike is a genetical character but is also influenced to a large extent by the environmental factors particularly light. This character also depends on the size of corm used and also on the growing environment. Under the ideal growing conditions, the corms give out the true potential in terms of number of florets per spike. The results of experiment are in agreement with Arora and Sandhu (1987) who reported about effects of planting time (October and November) on the in performance of gladiolus under Punjab condition. Open conditions produced more numbers of florets per spike which might be due to more light required by gladiolus.This specific study opens a gateway for further research on suitable agroclimatic conditions to achieve the quality yield production from this commercial cut flower.

Ferdousi *et al.,* (2018) reveled that the significant variation found due to different planting dates with respect to no. of florets per spike. Maximum (9.77) and minimum (8.97) were obtained from planting dates 25 October and 25 November respectively. Similarly, length of spike was affected significantly by growing conditions and longer spikes (80.18 cm) were recorded under open field condition as compare to shade net house (75.61 cm). This might be due to requirement of ample photoperiod at the time of flowering in gladiolus. Planting dates had a significant effect on spike length. Maximum spike length (80.15 cm) was recorded in early planting and minimum (75.40 cm) in late 15th December planting. All the floral characters that contribute to flower quality deteriorated under higher shade level in winter. Similar trend of results was also observed by Imanishi and Imae (1990). Maximum length of rachis (68.25 cm) was recorded in open field condition compare to shade net house (65.46 cm). Maximum rachis length (71.37 cm) was recorded in 15th October planting and minimum (62.23 cm) in 15th December planting. Maximum diameter of floret (7.97 cm) was recorded in plants grown in open field and minimum (6.10 cm) under shade net house condition.

In 15th October planting maximum diameter of floret (8.55 cm) was recorded and minimum (5.53 cm) in 15th December. In 15th October planting maximum diameter of floret (7.97 cm) was recorded in open field and minimum (6.10 cm) under shade net house. Increase in size of florets in October planting might be due to availability of optimum temperature and light during growth of plants. Shiragur *et al.* (2004) reported the variation in carnation flower diameter due to their genetic characters of particular genotypes. Similar variations in flower diameter among the cultivars were also observed previously in carnation by Kumar *et al.* (1999), Patil, (2001) and Singh *et al.* (2001). Variation on flower diameter of different cultivars may be due to their (Halevy and Mayak, 1981). Corms obtained from the open field condition were bigger in size (4.33 cm) and under shade net house corm was smaller (3.66 cm) in size. The reduced corms size could be attributed to reduced crop duration in the shade net house, while the overall growth of the plants (above and below ground) is not affected, there could be a disturbance in the partitioning between shoot and root production. Talia and Traversa (1986) reported about variation in size of corms obtained by different planting time of gladiolus. Gladiolus crop shows excellent results in areas with moderately high temperature and plenty of sunlight. In plains the most suitable planting time is when temperatures range between 15-25°C and availability of sunlight is more than 8 hours, while late sowing in November delayed sprouting, because low temperature and shorter photoperiod (Adil *et al.,* 2013).Early planting on 15th October gives larger size corms (5.75cm) and late 15th December planting gives smaller size of corms (2.11 cm). Planting dates and growing conditions had significant interaction effect on size of corms. Maximum weight of corm (35.49 g) was recorded in open field condition and minimum (32.58 g) was recorded under shade net house condition. In 15th October planting maximum (41.30 g) weight of corm was recorded and minimum (28.46 g) on 15th December. This might be due to the fact that maximum plant growth occurred in early planting and so large numbers of photosynthates were available for the production of large size corms (Mckay *et al.* 1981a). Also suggested that certain environmental factors favoured floral production at the expense of corms/cormels production due of utilization of available photosynthates. The results of this experiment are in agreement with Arora *et al.,* (2002) who reported that corm production character varies with time of planting. Maximum numbers of Cormels (8.55) were recorded in open field and minimum (4.30) under shade net house planting. In 15th October planting maximum number of cormels (9.90) were recorded and minimum (3.43) on 15th December planting. Younis *et al.,* (2018) examined that climatic conditions mainly temperature and temperature are responsible for variable size of corms in gladiolus. Adil *et al.,* (2013) reported similar results that temperature had significant effect on number of corms and sprouting of corms. Early planting dates in with favourable temperature (25-27°C) and longer photoperiod produced strong flowers and corms yield as compared to late sowing when temperature dropped below 20°C with shorter photoperiod. Dilta *et al.,* (2004) depicted that different growing conditions results in variation in sprouting percentage and flower quality of gladiolus. Khan *et al.,* (2008) founds that planting time of corms plays very important role in growth, yield and quality of gladiolus crop. Late planting significantly results in reduction in cormels production (Saaie, 2010). Similarly, more weight of 10 cormels (6.37 g) was recorded in open field condition and as compared to shade net house (2.44 g). Planting on15th October gave more weight (5.96 g) of 10 cormels and 15th December planting gives minimum weight (3.18 g) of 10 cormels.

This may be due to more dry matter accumulation. Hence it is concluded from the study that 15th October planting in open field results in better flowering, corms & cormels production in gladiolus.

Table 3: Effect of planting date and growing conditions flowering, corms and cormels production.

Treatments	No. of florets/ spike	Spike length (cm)	Rachis length (cm)	Diameter of floret (cm)	Size of corm (cm)	Wt. of corm (g)	No. of cormels/ plant	Wt. of 10 cormels
Planting Date								
15th Oct.	11.22	80.15	71.37	8.55	5.75	41.30	9.90	5.96
15th Nov.	10.17	79.35	66.96	7.03	4.13	32.35	5.95	4.15
15th Dec.	8.37	75.4	62.23	5.53	2.11	28.46	3.43	3.18
C.D (P=0.05)	**1.25**	**3.88**	**1.85**	**0.24**	**0.25**	**2.30**	**0.71**	**0.26**
Growing conditions								
Open field	11.50	80.18	68.25	7.97	4.33	35.49	8.55	6.37
Shade net	8.35	75.61	65.46	6.10	3.66	32.58	4.30	2.44
C.D (P=0.05)	**1.02**	**3.16**	**1.51**	**0.20**	**0.20**	**1.88**	**0.57**	**0.21**
C.D (P=0.05) (Planting Date X Growing condition)	**N.S.**	**N.S.**	**N.S.**	**0.35**	**0.36**	**N.S.**	**1.00**	**N.S.**

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