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Effect of Different Spacing and Corm Size on Growth and Corm Production of Gladiolus (*Gladiolus grandiflorus* L.) cv Punjab Dawn under Malwa Plateau of Madhya Pradesh

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ABSTRACT

The present experiment was carried out at Bahadari research farm of College of Horticulture, Mandsaur (Madhya Pradesh) during *rabi* season of 2020-21 with an aim to find out the effect of different spacing and corm size on growth and corm production of gladiolus, using the three spacing's (S_1 30 × 30 cm, S_2 30 × 20 cm and S_3 20 × 20 cm) and three corm sizes (C_1 <3.0 cm, C_2 3.0-4.0 cm and C_3 >4.0 cm). The experiment was laid out in Factorial Randomized Block Design (FRBD) with three replications. The result revealed that, the plant produced from wider spacing with larger corm size (30 × 30 cm + >4.0 cm) was superior in days taken to sprouting (9.07 days), number of sprouts per hill (3.07), plant height at 60 DAP (62 cm), number of leaves per hill at 60 DAP (20.73), length of longest leaf at 60 DAP (46.47 cm), width of longest leaf at 60 DAP (2.85 cm), number of corms per hill (3.47) and weight of corms per hill (71.20 g) at maturity stage.

Keywords Gladiolus, Corm sizes, Corms weight.

INTRODUCTION

Floriculture has become one of the most important commercial trades in agriculture sector. Because of the steady increase in flower demand, the Indian government has designated floriculture as a sunrise industry with a 100% export orientation. As a result, industrial floriculture has evolved into a high-tech industry, with processing taking place in a greenhouse under properly controlled climatic conditions (APEDA 2020). Gladiolus (*Gladiolus grandiflorus* L.) is a famous flowering plant with chromosome number (2n) lies between 30 to 120 and belongs to the Iridaceae family. Pliny the Elder (A.D. 23-79) invented the term gladiolus to define the form of the leaf, which resembles as a sword. Latin word gladiolus means sword originated from South Africa (Singh *et al.* 2018). Gladiolus was introduced to India by British colonists in the 16th to 19th centuries. Gladiolus is ranked 4th in global trade, 3rd in cut flower production in India, and 6th in loose flower production (Nath *et al.* 2016). Gladiolus is known as the "Queen of Bulbous Ornaments" due to its widespread popularity among bulbous ornamentals grown around the world. Gladiolus is appreciated for its beautiful spikes, lovely

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colors, elegant forms, and outstanding vase life. Its cut spikes are in high demand for display and interior decoration since they stay fresh for at least a week. Gladiolus is one of the most popular cut flower plants in the world, particularly among bulbous cut flowers. Gladiolus has a high demand in both domestic and international markets, and commercial cultivation of gladiolus is growing on a global level (Rao and Sushma 2015).

MATERIALS AND METHODS

The experiment was carried out on Gladiolus cv Punjab Dawn at Bahadari Research Farm of College of Horticulture, Mandsaur (Madhya Pradesh) in the year 2020-21 during *rabi* season. The soil of the experimental farm was clay rich in nutrients, pH 8.26 and EC was 0.18 dSm^{-1}. Mandsaur belongs to sub-tropical climate having a temperature range of minimum 5°C and maximum 44°C in winter and summer, respectively. The experiment was laid out in Factorial Randomized Block Design (FRBD) with three replications. The planting of gladiolus corms on 24^{th} November 2020. The all growth and corm parameters were recorded from five randomly selected plants in each treatment among every replication. The nine treatment combination with three spacing's (S_1 30 × 30 cm, S_2 30 × 20 cm and S_3 20 × 20 cm) and three corm sizes (C_1 <3.0 cm, C_2 3.0-4.0 cm and C_3 >4.0 cm). The details about all different combination are given in Table 1.

Table 1. Treatment details.

(A)	Different spacing (cm)	S_1 – 30 × 30 cm
		S_2 – 30 × 20 cm
		S_3 – 20 × 20 cm
		C_1- <3.0 cm
(B)	Different corm size (cm)	C_2 - 3.0 cm to 4.0 cm
		C_3- >4.0 cm
	Symbol	Treatment combination
	S_1C_1	30 × 30 cm + <3.0 cm
	S_1C_2	30 × 30 cm + 3.0 – 4.0 cm
	S_1C_3	30 × 30 cm + >4.0 cm
	S_2C_1	30 × 20 cm + <3.0 cm
	S_2C_2	30 × 20 cm + 3.0 – 4.0 cm
	S_2C_3	30 × 20 cm + >4.0 cm
	S_3C_1	20 × 20 cm + <3.0 cm
	S_3C_2	20 × 20 cm + 3.0 – 4.0 cm
	S_3C_3	20 × 20 cm + >4.0 cm

RESULTS AND DISCUSSION

Growth parameters

The growth parameters were significantly influenced by the different plant spacing and corm size. The data were presented in Table 2. The minimum days for sprouting (10.44 days) were recorded under spacing S_1 (30 x 30 cm), while maximum days for sprouting (14.11 days) were noted in spacing S_3 (20 x 20 cm). The maximum number of sprouts per hill (2.89) was recorded with S_1 (30 x 30 cm) and the minimum number of sprouts per hill (1.82) was noted under spacing S_3 (20 x 20 cm). The maximum plant height (59.89 cm) was recorded in spacing S_1 (30 × 30 cm) and the minimum plant height (51.51 cm) was recorded under spacing S_3 (20 × 20 cm). The plants produced from wider plant spacing S_1 (30 × 30 cm) had significantly more number of leaves (19.62) and closer plant spacing S_3 (20 × 20 cm) recorded least number of leaves per hill (14.11) at 60 DAP. The maximum length of longest leaf (44.58 cm) was recorded in S_1 (30 × 30 cm) and the minimum length of longest leaf (39.27 cm) was recorded in S_3 (20 × 20 cm). Plants produced from wider spacing S_1 (30 × 30 cm) had significantly maximum width of longest leaf (2.62 cm) whereas, S_3 (20 × 20 cm) showed minimum width of longest leaf (2.03 cm). This might be because the wider spacing basically allows the plant to take more nutrients from the soil and minimizes competition for nutrients and light around plants as well as promotes plant growth by Bhat and Khan (2007). Similar findings were recorded by Singh *et al.* (2018) and Deepashree *et al.* (2019).

The larger corm size C_3 (>4.0 cm) required significantly less time (11.02 days) for sprouting while smaller size corm C_1 (<3.0 cm) took maximum days for germination (13.47 days). The maximum number of sprouts per hill (2.89) was recorded with spacing S_1 (30 x 30 cm) and minimum number of sprouts per hill (1.82) was noted under spacing S_3 (20 x 20 cm). The larger corm size C_3 (>4.0 cm) recorded the plant height of 58.64 cm at 60 DAP (days after planting) which was significantly higher and minimum plant height (52.87 cm) was observed under C_1 (<3.0 cm). The larger corm size C_3 (>4.0 cm) produced significantly more number of leaves (18.36) while smaller

Table 2. Effect of different spacing and corm size on growth and corm production of gladiolus

Treatment	Days taken to sprouting (Days)	Number of sprouts/hill	Plant height	Number of leaves per hill	Length of longest leaf	Width of longest leaf	Number of corms per hill	Weight of corms per hill
Spacing								
S_1	10.44	2.89	59.89	19.62	44.58	2.62	2.51	61.07
S_2	12.16	2.40	55.89	16.69	41.87	2.26	2.13	57.87
S_3	14.11	1.82	51.51	14.11	39.27	2.03	2.08	47.02
SEm±	0.14	0.06	0.38	0.16	0.54	0.03	0.04	2.01
CD at 5%	0.41	0.18	1.13	0.49	1.61	0.10	0.12	6.03
Corm size								
C_1	13.47	2.07	52.87	15.38	40.00	2.08	1.64	47.69
C_2	12.22	2.33	55.78	16.69	41.76	2.32	2.17	54.87
C_3	11.02	2.71	58.64	18.36	43.96	2.52	2.91	63.40
SEm±	0.14	0.06	0.38	0.16	0.54	0.03	0.04	2.01
CD at 5%	0.41	0.18	1.13	0.49	1.61	0.10	0.12	6.03
Interaction effect (S × C)								
S_1C_1	11.67	2.67	56.80	18.13	42.67	2.33	1.80	46.80
S_1C_2	10.60	2.93	60.87	20.00	44.60	2.69	2.27	65.20
S_1C_3	9.07	3.07	62.00	20.73	46.47	2.85	3.47	71.20
S_2C_1	13.07	2.00	52.20	14.80	39.47	2.01	1.60	52.13
S_2C_2	12.00	2.40	55.33	16.47	42.27	2.28	2.13	54.40
S_2C_3	11.40	2.80	60.13	18.80	43.87	2.50	2.67	67.07
S_3C_1	15.67	1.53	49.60	13.20	37.87	1.91	1.53	44.13
S_3C_2	14.07	1.67	51.13	13.60	38.40	1.99	2.10	45.00
S_3C_3	12.60	2.27	53.80	15.53	41.53	2.19	2.60	51.93
SEm ±	0.23	0.10	0.65	0.29	0.93	0.06	0.07	3.48
CD at 5%	NS	NS	1.95	0.86	NS	NS	0.20	NS

corm size C_1 (<3.0 cm) recorded least number of leaves per hill (15.38) at 60 DAP. The larger corm size C_3 (>4.0 cm) produced significantly maximum length of longest leaf (43.96 cm) and the minimum length of longest leaf (40.00 cm) was recorded in C_1 (<3.0 cm). The larger corm size C_3 (>4.0 cm) produced significantly maximum width of longest leaf (2.52 cm) while smaller size corm C_1 (<3.0 cm) showed minimum width of longest leaf (2.08 cm). This might be due to the large corms store more food, such as carbohydrates and hormones, and promote cell division and reproduction along with increased chlorophyll content it also increases the rate of photosynthesis, which in turn increases plant growth by Methela *et al.* (2019). Similar findings were recorded by Singh *et al.* (2018) and Beck *et al.* (2019).

The combined effect of different plant spacing and corm size showed the significant influence on plant height and number of leaves per hill at 60 DAT. The wider plant spacing S_1 (30 × 30 cm) with larger corm size C_3 (>4.0 cm) produced the highest plant height (62.00 cm) and the minimum plant height (49.60 cm) was observed under closer plant spacing S_3 (20 × 20 cm) with smaller corm size C_1 (<3.0 cm). The maximum number of leaves per hill (20.73) was recorded under treatment combination S_1C_3 (30 x 30 cm + >4.0 cm) while the minimum number of leaves per hill (13.20) was noted in S_3C_1 (20 x 20 cm + <3.0 cm). This may be due to wider plant spacing and large corm size which provides space between plants, optimal amount of nutrients with sufficient light and helps in storage of carbohydrate, the maximum food supply by large corms which ultimately promotes rapid growth and cell division (Methela *et al.* 2019) and similar findings was recorded by Singh *et al.*

(2018), Bhande *et al*. (2015), Deepashree *et al.* (2019) and Narayan *et al.* (2013) in gladiolus.

Corm parameters

The findings in Table 2 showed that the effect of different plant spacing and corm size on number of corm per hill and weight of corms per hill. The maximum number of corm per hill (2.51) was recorded under S_1 (30 × 30 cm) and minimum number corm per hill (2.08) was noted in S_1 (20 × 20 cm). Wider plant spacing S_1 (30 × 30 cm) had significantly highest weight of corms per hill (61.07 g) and from closer plant spacing S_3 (20 × 20 cm) recorded lowest weight of corms per hill (47.02 g). This could be due to the presence of more light at a wider distance, which ultimately increased the net rate of photosynthesis and the movement of assimilates to the storage organs. The wider spacing also provides a larger area for better root growth and absorption of nutrients, also increase the number of corms per hill (Yadav and Bhatia 2018). Similar findings was recorded by Joshi *et al.* (2011), Kumar *et al.* (2016), Deepashree *et al.* (2019), Bhat and Khan (2007).

The plant produced from larger corm size C_3 (>4.0 cm) recorded higher number of corm per hill (2.91) and the minimum number of sprouts per hill (1.64) was recorded under C_1 (<3.0 cm). Larger corm size C_3 (>4.0 cm) recorded significantly highest weight of corms per hill (63.40 g) and smaller corm size C_1 (<3.0 cm) recorded lowest weight of corms per hill (47.69 g). It may also be due to the presence of more food material stored in the larger corms, which have helped improve the growth of plants, corms and cormels (Bhat and Khan 2007). Similar findings were recorded by Sarkar *et al.* (2014), Joshi *et al.* (2011), Deepashree *et al.* (2019) and Singh *et al.* (2018) in gladiolus.

Combined effect of different plant spacing and corm size also had significant effect on number of corm per hill. Maximum number of corm per hill (3.47) was recorded under treatment combination S_1C_3 (30 × 30 cm + >4.0 cm) while the minimum number of corm per hill (1.53) was noted in treatment S_3C_1 (20 × 20 cm + <3 .0 cm). This may be due to wider spacing and availability of more food material stored in bigger sized mother corms that helped in better plant growth and corm production (Narayan *et al.* 2013). Similar finding was recorded by Singh *et al.* (2018) and Bhat and Khan (2007).

CONCLUSION

On the basis of above finding it may be concluded that the plant produced from wider spacing with larger corm size (30 × 30 cm + >4.0 cm) will be beneficial for production of gladiolus.

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