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EFFECT OF PLANTING GEOMETRY AND CORM SIZE ON YIELD AND ECONOMICS OF GLADIOLUS

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Abstract

An experiment entitled "Effect of planting geometry and corm size on yield and economics of gladiolus" was carried out at Floriculture Unit, Horticulture Section, College of Agriculture, Nagpur (M.S.), India; from October, 2015 to April, 2016 with nine treatment combinations in Factorial Randomised Block Design. The treatments comprised of three spacing *viz.*, S_1 – 45 cm × 15 cm, S_2 – 30 cm × 20 cm and S_3 – 30 cm × 15 cm and three corm sizes *viz*., C_1 – Large (5-6 cm dia.), C_2 - Medium (4-5 cm dia.) and C_3 - Small (3-4 cm dia.). The results revealed that, the cost of cultivation of gladiolus increased with reduced plant spacing due to increase in cost of planting material. Similarly, the corm and spike yield ha^{-1} in gladiolus increased with increase in corm size and planting density. Though the gross and net monetary returns were noted highest with the treatment of closer spacing (30 × 15 cm) planted with large sized corms of 5-6 cm diameter, the cost: benefit ratio was found to be the highest with the medium spacing (30 × 20 cm) planted with large sized corms (5-6 cm dia.).

Key words : Gladiolus, planting geometry, corm size, yield, economics.

Introduction

Gladiolus (*Gladiolus grandiflorus*), a herbaceous plant belonging to the family *Iridaceae* is propagated by corms. The popularity of this crop as a cut flower is increasing day by day because of its keeping quality and extensive in range of colors of the spikes. This flower crop possesses a great potential for export market especially during winter. The scope for expansion of area under this crop is limited and hence, it is necessary to utilize the available land efficiently. One way of doing this is not only to increase the yield but also to obtain higher returns per unit area. At present not much information is available on economic feasibility of adopting different plant densities and corm size in gladiolus crop. Hence, the present investigation was carried out to find out suitable combination of spacing and corm size to obtain maximum yield and cost : benefit ratio from cultivation of gladiolus cv. 'American Beauty'.

Materials and Methods

The investigation was carried out at Floriculture Unit, Horticulture Section, College of Agriculture, Nagpur from October, 2015 to April, 2016 under open field conditions with nine treatment combinations in Factorial Randomised Block Design with three replications. The treatments comprised of three different spacing *viz.,* S_1 – 45 cm × 15 cm, S_2 – 30 cm × 20 cm and S_3 – 30 cm × 15 cm and three different corm sizes *viz*., C_1 – Large (5-6 cm dia.), C_2 - Medium (4-5 cm dia.) and C_3 - Small (3-4 cm dia.).

At the time of land preparation, well-rotten FYM @ 20 t ha^{-1} was mixed uniformly in the soil before last harrowing. The gladiolus corms of the variety "American Beauty" were obtained from Satpuda Botanic Garden, College of Agriculture, Nagpur (M.S.), India. The rested, cold stored healthy gladiolus corms having different corm sizes *i.e.* small (3 to 4 cm dia.), medium (4 to 5 cm dia.) and large (5 to 6 cm dia.) were separated according to diameter and treated with copper fungicide before planting. After treatment of fungicide for 15 minutes, corms were planted on raised beds at 5 cm depth at different spacing *viz.,* 45 cm × 15 cm, 30 cm × 20 cm, and 30 cm × 15 cm. All the cultural operations *viz*., weeding, staking, earthing up, pest control etc. were carried out as and when required. Irrigation was applied through drip irrigation system. Various observations on vegetative and floral traits were recorded during flowering stage. The parameters on yield and quality of corms and cormels were studied soon after lifting of plants. Information on cost of mother corms, prices of spikes and corms etc. were recorded for the purpose of working

out economics and the data was analysed statistically by the method suggested Panse and Sukhatme (1967).

Results and Discussion

The data presented in table 1 revealed that cost of cultivation of gladiolus increased with increase in planting density.

Cost of cultivation

Highest cost of cultivation was noticed with the closer spacing (30 cm × 15 cm) treatment (Rs. 9,64,573 ha^{-1}), whereas, minimum cost of cultivation was observed with the wider spacing (45 cm × 15 cm) treatment (Rs. 7,27,536 ha^{-1}). This might be due to the fact that, with increase in planting density the number of corms required for planting increases and automatically the cost of planting material also increases.

Yield

The data from tables 2 and 3 indicated that, effect of spacing and corm size and their interaction on spike and corm yield ha^{-1} in gladiolus was found significant.

Significantly maximum spike and corm yield ha^{-1} (3.07 and 3.57 lakh, respectively) was noted when gladiolus plants planted at closer spacing *i.e* S_3 (30 cm × 15 cm) and it was followed by 30 cm × 20 cm spacing *i.e.* S_2 (2.71 and 3.20 lakh, respectively), however, wider spacing *i.e.* S_1 (45 cm × 15 cm) recorded minimum spike and corm yield ha^{-1} (2.43 and 2.92 lakh, respectively). This might have been due to the fact that, with decrease in spacing number of plants per unit area increased so, automatically yield per unit area also increased. The results are in line with the findings of Ghosh and Pal (2008) in marigold and Narayan *et al.* (2015) in gladiolus.

In respect of corm size, significantly maximum spikes and corms ha^{-1} (3.06 and 3.56 lakh, respectively) were recorded with the large sized corms (C_1) in gladiolus and it was followed by the medium sized corms *i.e.* C_2 (2.73 and 3.22 lakh, respectively), whereas, the small sized corms *i.e.* C_3 exhibited minimum number of spikes and corms ha^{-1} (2.43 and 2.92 lakh, respectively). An increase in spike and corm yield ha^{-1} in gladiolus due to large sized corms might be due to the fact that, flowers are important sink organs in bulbous flowering plants that depend on the reserves stored in the bulb for their initial growth and development. Large bulbs have higher reserves than small bulbs and this might have been the reason for production of maximum spikes. The stored reserves might have been diverted towards corm development after flowering which resulted in an increase in number of corms ha^{-1}. The results are in accordance with Sarkar *et al.* (2014), who reported that, larger corms (120.125 g) increased the yield of spikes, corms and cormels about 33%, 8% and 14%, respectively as compared to control (80-100 g) in gladiolus.

Interaction effect of spacing and corm size on spike and corm yield ha^{-1} was found to be significant. The treatment combination of S_3C_1 *i.e.* large sized corms planted at closer spacing recorded significantly the highest number of spikes ha^{-1} (3.60 lakh), which was followed by S_3C_2 (3.06 lakh) *i.e.* medium sized corms planted at closer spacing, whereas, the least number of spikes were counted with the treatment combination of S_1C_3 (2.30 lakh) i.e. small sized corms planted at wider spacing (table 3).

In respect of corm yield significantly the highest yield of gladiolus corms ha^{-1} was obtained with the treatment combination of S_3C_1 (4.10 lakh) *i.e.* large corms planted at closer spacing which was followed by S_3C_2 (3.58 lakh) and S_2C_1 (3.60 lakh) *i.e.* medium sized corms planted at closer spacing and large sized corms planted at 30 cm × 20 cm spacing, respectively. This might have been due to combined effect of spacing and corm size in gladiolus i.e. production of the highest number of corms $plant^{-1}$ due to planting of large sized corms of gladiolus and accommodation of maximum number of plants when planted at closer spacing on raised beds.

Economics

The data presented in table 2 indicated that the treatment differences were significant in respect of gross and net monetary returns due to different treatments of spacing and corm size in gladiolus and the interaction effect of spacing and corm size on gross and net monetary returns was also found significant (table 3).

The gross and net monetary returns ha^{-1} were significantly maximum with the treatment S_3 *i.e.* closer spacing and C_1 *i.e.* large sized corms (Rs. 21.19 and 11.55 lakh) and (21.14 and 12.88 lakh), respectively and they were followed by the treatment S_2 *i.e.* 30 cm × 20 cm spacing and C_2 *i.e.* medium sized corms (Rs. 18.89 and 18.99 lakh, respectively) in respect of gross monetary returns and found to be at par with S_2 and C_2 (Rs. 11.03 and 10.73 lakh, respectively) in respect of net monetary returns. However, the gross monetary and net monetary returns were found to be significantly minimum with the treatment S_1 *i.e* wider spacing (Rs. 17.12 and 9.85 lakh, respectively) and the treatment C_3 *i.e.* small sized corms (Rs. 17.07 and 8.81 lakh, respectively).

The treatment combination of S_3C_1 *i.e.* large sized corms of gladiolus planted at closer spacing of 30 cm × 15 cm recorded the highest gross monetary returns ha^{-1} (Rs. 24.59 lakh) and net monetary (Rs. 14.95 lakh) returns

Table 1 : Total cost of cultivation of gladiolus (Rs ha^{-1}).

Treatment combinations	Cost of cultivation (Rs ha^{-1})		
	Cost of planting material	Other costs	Total cost
S_1C_1	4,74,074	2,53,462	7,27,536
S_1C_2	4,74,074	2,53,462	7,27,536
S_1C_3	4,74,074	2,53,462	7,27,536
S_2C_1	5,33,333	2,53,462	7,86,795
S_2C_2	5,33,333	2,53,462	7,86,795
S_2C_3	5,33,333	2,53,462	7,86,795
S_3C_1	7,11,111	2,53,462	9,64,573
S_3C_2	7,11,111	2,53,462	9,64,573
S_3C_3	7,11,111	2,53,462	9,64,573

Others costs include: Human labour; FYM; Plant Protection chemicals and Fertilizers etc.
Price of corms used for calculation of cost of planting material: Rs. 4 corm^{-1}.

Table 2 : Effect of spacing and corm size on yield and returns from gladiolus.

Treatments	Spike yield ha^{-1} (lakh)	Corm yield ha^{-1} (lakh)	Spike yield returns ha^{-1} (Rs. lakh)	Corm yield returns ha^{-1} (Rs. lakh)	Gross returns (Rs. lakh)	Net returns (Rs. lakh)
S_1 – 45 cm x 15 cm	2.43	2.92	7.75	9.36	17.12	9.85
S_2 – 30 cm x 20 cm	2.71	3.20	8.64	10.25	18.89	11.03
S_3 – 30 cm x 15 cm	3.07	3.57	9.79	11.40	21.19	11.55
SE (m) ±	0.06	0.06	0.21	0.24	0.41	0.43
CD at 5%	0.19	0.19	0.62	0.70	1.23	1.28
C_1 – Large (5-6 cm)	3.06	3.56	9.77	11.37	21.14	12.88
C_2 - Medium (4-5 cm)	2.73	3.22	8.69	10.30	18.99	10.73
C_3 - Small (3-4 cm)	2.43	2.92	7.73	9.34	17.07	8.81
SE (m) ±	0.06	0.06	0.21	0.24	0.41	0.43
CD at 5%	0.19	0.19	0.62	0.70	1.23	1.28

ha^{-1} as compared to other treatment combinations and it was followed by S_3C_2 (Rs. 21.12 lakh) *i.e.* medium sized corms planted at closer spacing of 30 cm × 15 cm in respect of gross monetary returns and found to be at par with the treatment combination of S_2C_1 *i.e.* large sized corms of gladiolus planted at 30 cm × 20 cm spacing (Rs. 13.00 lakh), whereas, the minimum gross and net monetary returns ha^{-1} were obtained with the treatment combinations S_1C_3 (Rs.16.30 lakh) *i.e.* small sized corms planted at wider spacing of 45 cm × 15 cm and S_3C_3 (Rs. 8.23 lakh) *i.e.* small sized corms planted at closer spacing of 30 cm × 15 cm, respectively.

The net returns ha^{-1} increased when large sized corms of gladiolus planted at closer spacing. This might have been due to increase in the spike and corm yield because of accommodation of more number of plants per unit area with closer spacing and maximum number of corms and spikes produced by individual plants planted with large sized corms. The results are in conformity with those of Singh *et al.* (2011) in gladiolus.

Cost: benefit ratio

The data regarding cost: benefit ratio as influenced by spacing and corm size in gladiolus is presented in table 3.

The maximum cost: benefit ratio was obtained with the treatment combination S_2C_1 (2.65) *i.e* large sized corms planted at 30 cm × 20 cm spacing followed by S_3C_1 i.e. large sized corms planted at 30 cm X 15 cm spacing (2.55) and S_1C_1 *i.e.* large sized corms planted at

Table 3 : Interaction effect of spacing and corm size on yield and returns from gladiolus.

Treatment combinations	Spike yield ha^{-1} (lakh)	Corm yield ha^{-1} (lakh)	Spike yield returns ha^{-1} (Rs. lakh)	Corm yield returns ha^{-1} (Rs. lakh)	Gross returns (Rs. lakh)	Net returns (Rs. lakh)	Cost : benefit ratio
S_1C_1	2.57	3.06	8.18	9.79	17.97	10.70	2.47
S_1C_2	2.43	2.91	7.74	9.34	17.08	9.81	2.35
S_1C_3	2.30	2.80	7.35	8.95	16.30	9.03	2.24
S_2C_1	3.02	3.51	9.63	11.23	20.86	13.00	2.65
S_2C_2	2.69	3.18	8.58	10.18	18.76	10.90	2.39
S_2C_3	2.42	2.92	7.71	9.32	17.03	9.17	2.17
S_3C_1	3.60	4.10	11.49	13.10	24.59	14.95	2.55
S_3C_2	3.06	3.56	9.76	11.36	21.12	11.48	2.19
S_3C_3	2.55	3.06	8.13	9.74	17.87	8.23	1.85
SE (m) ±	0.12	0.13	0.36	0.39	0.71	0.74	-
CD at 5%	0.36	0.38	1.07	1.12	2.14	2.23	-

Average sale price of spikes and corms used for calculation of gross returns is Rs. 3 each.

40 cm × 15 cm spacing (2.47). While, minimum cost: benefit ratio was recorded under the treatment combination of S_3C_3 i.e. small sized corms planted at 30 cm × 15 cm spacing (1.85).

This might be due to the fact that, the treatment combination S_2C_1 *i.e.* large sized corms planted at 30 cm × 20 cm spacing had produced the maximum spikes as well as corm yield ha^{-1} with minimum input cost, which could have resulted into maximum cost: benefit ratio. The results obtained are in confirmation with the findings of Singh *et al*. (2011) in gladiolus.

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