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 flowering stage. The parameters on yield and quality of corms and cormels were studied soon after lifting of flowering stage.
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. S₁ (30 cm × 15 cm)
and it was followed by 30 cm × 20 cm spacing i.e. S₂
(2.71 and 3.20 lakh, respectively), however, wider spacing
i.e. S₁ (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

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 (C₁) in gladiolus and
it was followed by the medium sized corms i.e. C₂ (2.73
and 3.22 lakh, respectively), whereas, the small sized
corms i.e. C₃ 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 S₁ C₁ 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 S₁ C₂ (3.06 lakh) i.e. medium sized corms planted at
closer spacing, whereas, the least number of spikes were
recorded with the treatment combination of S₁ C₃ (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 S₁ C₁ (4.10 lakh) i.e. large corms planted
at closer spacing which was followed by S₁ C₂ (3.58 lakh)
and S₁ C₃ (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 S₁ i.e. closer
spacing and C₁ 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 S₂ i.e. 30 cm × 20 cm
spacing and C₂ 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 S₁ and C₁ (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 S₁ i.e wider spacing (Rs. 17.12 and 9.85 lakh,
respectively) and the treatment C₁ i.e. small sized corms
(Rs. 17.07 and 8.81 lakh, respectively).

The treatment combination of S₁ C₁ 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
Effect of Planting Geometry and Corn Size on Yield and Economics of Gladiolus

Table 1: Total cost of cultivation of gladiolus (Rs ha⁻¹).

<table>
<thead>
<tr>
<th>Treatment combinations</th>
<th>Cost of cultivation (Rs ha⁻¹)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cost of planting material</td>
</tr>
<tr>
<td>S₁C₁</td>
<td>4,74,074</td>
</tr>
<tr>
<td>S₂C₁</td>
<td>4,74,074</td>
</tr>
<tr>
<td>S₃C₁</td>
<td>5,33,333</td>
</tr>
<tr>
<td>S₁C₂</td>
<td>5,33,333</td>
</tr>
<tr>
<td>S₁C₃</td>
<td>5,33,333</td>
</tr>
<tr>
<td>S₂C₂</td>
<td>7,11,111</td>
</tr>
<tr>
<td>S₂C₃</td>
<td>7,11,111</td>
</tr>
<tr>
<td>S₃C₃</td>
<td>7,11,111</td>
</tr>
</tbody>
</table>

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 corn size on yield and returns from gladiolus.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Spike yield ha⁻¹ (lakh)</th>
<th>Corm yield ha⁻¹ (lakh)</th>
<th>Spike yield returns ha⁻¹ (Rs. lakh)</th>
<th>Corm yield returns ha⁻¹ (Rs. lakh)</th>
<th>Gross returns (Rs. lakh)</th>
<th>Net returns (Rs. lakh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>S₁ – 45 cm x 15 cm</td>
<td>2.43</td>
<td>2.92</td>
<td>7.75</td>
<td>9.36</td>
<td>17.12</td>
<td>9.85</td>
</tr>
<tr>
<td>S₂ – 30 cm x 20 cm</td>
<td>2.71</td>
<td>3.20</td>
<td>8.64</td>
<td>10.25</td>
<td>18.89</td>
<td>11.03</td>
</tr>
<tr>
<td>S₃ – 30 cm x 15 cm</td>
<td>3.07</td>
<td>3.57</td>
<td>9.79</td>
<td>11.40</td>
<td>21.19</td>
<td>11.55</td>
</tr>
<tr>
<td>SE (m) ±</td>
<td>0.06</td>
<td>0.06</td>
<td>0.21</td>
<td>0.24</td>
<td>0.41</td>
<td>0.43</td>
</tr>
<tr>
<td>CD at 5%</td>
<td>0.19</td>
<td>0.19</td>
<td>0.62</td>
<td>0.70</td>
<td>1.23</td>
<td>1.28</td>
</tr>
<tr>
<td>C₁ – Large (5-6 cm)</td>
<td>3.06</td>
<td>3.56</td>
<td>9.77</td>
<td>11.37</td>
<td>21.14</td>
<td>12.88</td>
</tr>
<tr>
<td>C₂ – Medium (4-5 cm)</td>
<td>2.73</td>
<td>3.22</td>
<td>8.69</td>
<td>10.30</td>
<td>18.99</td>
<td>10.73</td>
</tr>
<tr>
<td>C₃ – Small (3-4 cm)</td>
<td>2.43</td>
<td>2.92</td>
<td>7.73</td>
<td>9.34</td>
<td>17.07</td>
<td>8.81</td>
</tr>
<tr>
<td>SE (m) ±</td>
<td>0.06</td>
<td>0.06</td>
<td>0.21</td>
<td>0.24</td>
<td>0.41</td>
<td>0.43</td>
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<td>1.23</td>
<td>1.28</td>
</tr>
</tbody>
</table>

ha⁻¹ as compared to other treatment combinations and it was followed by S₃C₃ (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 S₂C₁ 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 S₁C₃ (Rs.16.30 lakh) i.e. small sized corms planted at wider spacing of 45 cm × 15 cm and S₃C₁ (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 corn 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 corn size in gladiolus is presented in table 3.

The maximum cost: benefit ratio was obtained with the treatment combination S₂C₁ (2.65) i.e large sized corms planted at 30 cm × 20 cm spacing followed by S₃C₃ i.e. large sized corms planted at 30 cm X 15 cm spacing (2.55) and S₁C₁ i.e. large sized corms planted at...
Table 3: Interaction effect of spacing and corm size on yield and returns from gladiolus.

<table>
<thead>
<tr>
<th>Treatment combinations</th>
<th>Spike yield $\text{ha}^{-1}$ (lakh)</th>
<th>Corm yield $\text{ha}^{-1}$ (lakh)</th>
<th>Spike yield returns $\text{ha}^{-1}$ (Rs. lakh)</th>
<th>Corm yield returns $\text{ha}^{-1}$ (Rs. lakh)</th>
<th>Gross returns (Rs. lakh)</th>
<th>Net returns (Rs. lakh)</th>
<th>Cost : benefit ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>S$_1$C$_1$</td>
<td>2.57</td>
<td>3.06</td>
<td>8.18</td>
<td>9.79</td>
<td>17.97</td>
<td>10.70</td>
<td>2.47</td>
</tr>
<tr>
<td>S$_1$C$_2$</td>
<td>2.43</td>
<td>2.91</td>
<td>7.74</td>
<td>9.34</td>
<td>17.08</td>
<td>9.81</td>
<td>2.35</td>
</tr>
<tr>
<td>S$_1$C$_3$</td>
<td>2.30</td>
<td>2.80</td>
<td>7.35</td>
<td>8.95</td>
<td>16.30</td>
<td>9.03</td>
<td>2.24</td>
</tr>
<tr>
<td>S$_2$C$_1$</td>
<td>3.02</td>
<td>3.51</td>
<td>9.63</td>
<td>11.23</td>
<td>20.86</td>
<td>13.00</td>
<td>2.65</td>
</tr>
<tr>
<td>S$_2$C$_2$</td>
<td>2.69</td>
<td>3.18</td>
<td>8.58</td>
<td>10.18</td>
<td>18.76</td>
<td>10.90</td>
<td>2.39</td>
</tr>
<tr>
<td>S$_2$C$_3$</td>
<td>2.42</td>
<td>2.92</td>
<td>7.71</td>
<td>9.32</td>
<td>17.03</td>
<td>9.17</td>
<td>2.17</td>
</tr>
<tr>
<td>S$_3$C$_1$</td>
<td>3.60</td>
<td>4.10</td>
<td>11.49</td>
<td>13.10</td>
<td>24.59</td>
<td>14.95</td>
<td>2.55</td>
</tr>
<tr>
<td>S$_3$C$_2$</td>
<td>3.06</td>
<td>3.56</td>
<td>9.76</td>
<td>11.36</td>
<td>21.12</td>
<td>11.48</td>
<td>2.19</td>
</tr>
<tr>
<td>S$_3$C$_3$</td>
<td>2.55</td>
<td>3.06</td>
<td>8.13</td>
<td>9.74</td>
<td>17.87</td>
<td>8.23</td>
<td>1.85</td>
</tr>
<tr>
<td>SE (m)$\pm$</td>
<td>0.12</td>
<td>0.13</td>
<td>0.36</td>
<td>0.39</td>
<td>0.71</td>
<td>0.74</td>
<td>-</td>
</tr>
<tr>
<td><strong>CD at 5%</strong></td>
<td>0.36</td>
<td>0.38</td>
<td>1.07</td>
<td>1.12</td>
<td>2.14</td>
<td>2.23</td>
<td>-</td>
</tr>
</tbody>
</table>

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$_3$C$_3$, 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$_3$C$_1$, i.e. large sized corms planted at 30 cm × 20 cm spacing had produced the maximum spikes as well as corm yield $\text{ha}^{-1}$ 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.

References


Panse, V. G. and P. V. Sukhatme (1967). *Statistical Methods for Agricultural Workers*. New Delhi, Publication and Information Division, ICAR.
