Post-harvest studies of different varieties of gladiolus

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Abstract
A study was carried out to post harvest studies of different varieties of gladiolus. Swapnil recorded the best performance with respect of most of the post-harvest parameters i.e. days to opening 5th florets, days to withering of 5th florets, numbers of florets open at a time, percentage of open florets/spike, water uptake on 5th day, total water uptake (ml), vase- life (days) and pigment content. Regency show the best performance with respect of days to opening of 3rd and 4th florets, days to withering of 3rd and 4th florets. The maximum diameter of 3rd, 4th, 5th florets and reducing sugar was recorded with c.v. Pricilla. The maximum non- reducing sugar and total sugar was recorded with c.v. Friendship, while dry weight of cut spikes at senescence was recorded with c.v. Punjab Dawn.

Keywords: Gladiolus, cultivars, post-harvest, biochemical and spike

Introduction
Flowers not only offer aesthetical beauties, but also have become commercial object. Flower production is a branch of horticultural cultivation today in several countries and can contribute to national economies providing millions of dollars (Bulut, 1994). Cut flower cultivation is a part of ornamental plant production having the largest part either in production or economic value. Gladiolus is an important commercial flower crop and is very popular as cut flower both in domestic and international market. The flower is popular for its majestic spikes, which contain attractive elegant, dazzling and delicate florets. Generally, flowers remain turgid condition when harvested at proper stage of development. Flowers cut at advanced stage have shortened longevity than younger ones. Optimum harvesting stage of gladiolus is at the stage when 2-5 buds showing colors. At present it has been come imperative to find out suitable varieties for post-harvest life, post-harvest senescence is an integral part of normal development cycle of plants and is highly regulated process that involves structural, biochemical and molecular changes in the plant tissue. Different flowers and varieties are reported to differ in their vase life due to genetic, physiological or anatomical characteristics. However the information on comparative performance of gladiolus cultivars for post-harvest attributes is very meagre. Hence this experiment was carried out to get information on comparative performance of gladiolus cultivars for various post-harvest attributes so that specific type of cultivars may be identified (Ahmed et al., 2014) [1]

Materials and Methods
The present experiment was undertaken at Horticulture Research Farm and post-harvest studies was carried out in the laboratory of the Department of Floriculture and Landscape Architecture, The study will be conducted in the PG Lab, K.N.K. College of Horticulture, Mandsaur (M.P.). In this experiment 09 cultivars namely African Star, Friendship, Hunting Song, Pricilla, Punjab Dawn, Regency, Sancere, Sunayana and Swapnil were used as experiment material. These varieties grow in the field, standard packages of cultural practices were followed during the field experiment. For post-harvest study the cut spikes were harvested in the morning when two lower florets of spike shows color are harvested with the help of sharp knife and placed in bucket containing water and immediate brought to the laboratory. Spikes were placed in 250 ml conical flasks which contain distilled water. During the experiment baseline of spikes were re-cut 1.00 cm, with the help of sharp knife to proper uptake of distilled water solution. Different observations were recorded with the help of essential tools and equipments and these data statistically analyzed.
Results and Discussion

19 post harvest studies of nine varieties were collected and presented in Tables 1, 2 Gladioli cultivars varied significantly for postharvest studies of different varieties of gladiolus. Data revealed that among the different varieties studies, there was a significant difference in the days to opening of 3rd floret. The maximum days to opening of 3rd floret registered with cultivars Friendship (4.05 days) followed by Friendship (4.00 days) and African Star (3.60 days). Minimum duration required to opening of 3rd floret was recorded with cultivars Sunayana (2.93 days) followed by cultivars Sancere (3.13 days), Pricilla (3.17 days), Swapnil (3.20 days), Hunting Song (3.27 days) and Punjab Dawn (3.27 days) all of these are statistically at par to each other. Maximum duration required to opening of 4th floret registered with cultivars Regency (4.60 days), which was statistically at par with cultivars Friendship (4.50 days), Pricilla (4.47 days), Sancere (4.33 days) and Minimum duration required to opening of 4th floret was recorded with cultivars Hunting Song (3.40 days) followed by Punjab Dawn (3.67 days), Swapnil (3.93 days), Sunayana (4.13 days) and African Star (4.17 days). Maximum duration required to opening of 5th floret registered with cultivars Swapnil (7.80 days), followed by Sancere (6.87 days), Regency (6.67 days), Sunayana (6.53 days). Minimum duration required to opening of 5th floret was recorded with cultivars Friendship (5.27 days) followed by cultivars African Star (5.33 days), Hunting Song (5.67 days), Punjab Dawn (5.80 days) and Pricilla (6.13 days). The maximum days taken to withering of 3rd floret was recorded with Regency (7.40 days) which was statistically at par with Pricilla (7.33 days) and Sunayana (7.13 days) and significant to other cultivars. However, the minimum days taken to withering of 3rd floret was recorded in cultivar Friendship (6.27 days) followed by with cultivars African Star (6.47 days), Hunting Song (6.60 days), Swapnil (6.73 days) and Punjab Dawn (6.87 days). The maximum days taken to withering of 4th floret was recorded with Regency (8.67 days) which was statistically at par with Sunayana (8.60 days), Sancere (8.53 days) and Hunting Song (8.20 days) and significant to other cultivars. However, the minimum days taken to withering of 4th floret was recorded in cultivar African Star (7.60 days) which was at par with cultivars Pricilla (7.66 days), Swapnil (7.80 days) and Punjab Dawn (7.93 days) and significant to other cultivars. The maximum days to withering of 5th floret was recorded with Swapnil (11.40 days) which was statistically at par with Regency (11.00 days) and significant to other cultivars. However, the minimum days to withering of 5th floret was recorded in cultivar Hunting Song (10.13 days) which was at par with cultivars African Star (10.20 days), Friendship (10.33 days), Sancere (10.40 days) and Pricilla (10.53 days). The maximum diameter of 3rd floret was found in Pricilla (9.26 cm) followed by Punjab Dawn (8.94 cm), Swapnil (8.84 cm), Pricilla show the statistically significant result with respect of all other cultivar under this experiment. The minimum floret diameter was recorded in Hunting Song (7.77 cm) followed by Regency (7.77 cm), Sunayana (8.06 cm) and African Star (8.37 cm). The maximum diameter of 4th floret was found in Pricilla (9.31 cm) followed by cultivars Punjab Dawn (8.98 cm) and Swapnil (8.88 cm). However the minimum floret diameter (7.66 cm) was recorded in Hunting Song followed by Regency (7.87 cm), Sunayana (8.09 cm) and African Star (8.39 cm) all of these cultivars are statistically differ to eachother. The maximum diameter of 5th floret was found in Pricilla (9.36 cm) which was statistically significant to other cultivars. However the minimum floret diameter was recorded in Hunting Song (7.72 cm) which was statistically at par with Regency (7.93 cm) and differs to Friendship (8.29 cm), African Star (8.46 cm), Sancere (8.85 cm) and other cultivars. The maximum number of florets open at a time were recorded in Swapnil (7.31 florets) which was statistically superior to other cultivar of this experiment. However, the minimum number of florets open at a time was recorded in cultivars Pricilla (4.19 floret) followed by Regency (5.36 florets) African Star (6.11 florets), followed by Sunayana (6.44 florets), Punjab Dawn (6.62 florets). The maximum percentage of open florets was found with cultivars Swapnil (74.3%) followed by Sancere (73.47%) both of these are statistically similar to each other and superior to other cultivars i.e. Friendship (72.53%), Punjab Dawn (68.36%), Hunting Song (69.48%). However, the minimum percentage of open florets/spike was recorded with cultivars Pricilla (62.59%) Regency (64.51%), African Star (65.54%) and Sunayana (66.79 %). The higher amount of water uptake on 5th day of vase was recorded with cultivar Swapnil (68.35 ml) which was statistically significant to other cultivars. However the minimum water uptake on 5th day of vase was recorded with cultivars Sancere (43.47 ml) followed by Sunayana (46.34 ml), Regency (48.54 ml), Pricilla (56.67 ml). The higher amount of water uptake was recorded with cultivar Swapnil (91.81 ml) which was statistically significant to other cultivars. However, the minimum water uptake was recorded with cultivar Sancere (67.91 ml) followed by Regency (72.97 ml), Sunayana (73.02 ml), Friendship (74.01 ml). The maximum dry weight of cut spikes at senescence was recorded with cultivar Punjab Dawn (8.30 g) which was significantly superior to other cultivars. However, the minimum dry weight of cut spikes at senescence was recorded with cultivar African Star (4.42 g) followed by Pricilla (4.66 g), Swapnil (4.87 g), Friendship (5.21 g) and Sunayana (5.34 g). The longest vase-life of cut spike was found with cultivar Swapnil (16.47 days) and African Star (15.75 days) both of these are statistically at par to each other and differ to other cultivars. However, the shortest vase-life of cut spikes was recorded with cultivar Sancere (10.44 days), which was at par with Regency (11.42 days), Friendship (12.47 days), Sunayana (12.78 days) and Hunting Song (13.30 days) was significant to other cultivars. The highest reducing sugars was found with cultivar Pricilla (0.99 mg/g) which was statistically superior to other cultivars. However, the lowest reducing sugars was recorded with cultivar African Star (0.67 mg/g) followed by Friendship both of these are statistically at par to each other and different to other cultivars. The highest non-reducing sugars was found with cultivar Friendship (0.71 mg/g) which was significantly different to other cultivars. However, the lowest non-reducing sugars was recorded with cultivar Sancere (1.05 mg/g) both of these were at par with each other and significant to other cultivars. The highest total sugars was found with cultivar Friendship (1.44 mg/g) which was at par with cultivar Hunting Song (1.32 mg/g) and significant to other cultivars. However the lowest total sugars was recorded with cultivar African Star (0.92 mg/g) followed by Sancere (1.05 mg/g) both of these were statistically similar to each other and differ to other cultivars. The highest pigment content was found with cultivar Swapnil (1.83 mg/100g) followed by with cultivars Sancere (1.77 mg/100g) Regency (1.70 mg/100g), Pricilla (1.65 mg/100g). However, the lowest pigment content was recorded with cultivar African Star (0.27 mg/100g) followed by Hunting Song (1.06 mg/100g), Friendship (1.15 mg/100g), Sunayana (1.28 mg/100g), Punjab Dawn (1.46 mg/100g).
### Table 1: Performance of gladiolus cultivars for post-harvest studies

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Days to opening of 3rd 4th and 5th floret</th>
<th>Days to withering of 3rd 4th and 5th floret</th>
<th>Diameter of 3rd floret (cm)</th>
<th>Diameter of 4th floret (cm)</th>
<th>Diameter of 5th floret (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3rd floret</td>
<td>4th floret</td>
<td>5th floret</td>
<td>3rd floret</td>
<td>4th floret</td>
</tr>
<tr>
<td>T1 – African Star</td>
<td>3.60</td>
<td>4.17</td>
<td>5.33</td>
<td>6.47</td>
<td>7.60</td>
</tr>
<tr>
<td>T2 - Friendship</td>
<td>4.00</td>
<td>4.50</td>
<td>5.27</td>
<td>6.27</td>
<td>8.13</td>
</tr>
<tr>
<td>T3 – Hunting Song</td>
<td>3.27</td>
<td>3.40</td>
<td>5.67</td>
<td>6.60</td>
<td>8.20</td>
</tr>
<tr>
<td>T5 – Punjab Dawn</td>
<td>3.27</td>
<td>3.67</td>
<td>5.80</td>
<td>6.87</td>
<td>7.93</td>
</tr>
<tr>
<td>T6 – Regency</td>
<td>4.05</td>
<td>4.60</td>
<td>6.67</td>
<td>7.40</td>
<td>8.67</td>
</tr>
<tr>
<td>T7 – Suncerene</td>
<td>3.13</td>
<td>4.33</td>
<td>6.87</td>
<td>6.93</td>
<td>8.53</td>
</tr>
<tr>
<td>T8 - Sunayana</td>
<td>2.93</td>
<td>4.13</td>
<td>6.53</td>
<td>7.13</td>
<td>8.60</td>
</tr>
<tr>
<td>T9 – Regency</td>
<td>3.20</td>
<td>3.93</td>
<td>7.80</td>
<td>6.73</td>
<td>7.80</td>
</tr>
</tbody>
</table>

S.E.M.2            | 0.14       | 0.11       | 0.13       | 0.11       | 0.17       | 0.14       | 0.06        | 0.07        | 0.07        |

C.D. at 5%         | 0.41       | 0.32       | 0.38       | 0.34       | 0.51       | 0.43       | 0.18        | 0.20        | 0.22        |

### Table 2: Post harvest studies of different varieties of gladiolus

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Number of florets open at a time</th>
<th>Percentage of open florets/spike</th>
<th>Water uptake on 5th day of vases (ml)</th>
<th>Dry weight of cut spikes at senescence (g)</th>
<th>Vase – life of cut spike (days)</th>
<th>Reducing sugars (mg/g)</th>
<th>Non-reducing sugars (mg/g)</th>
<th>Total Sugars (mg/g)</th>
<th>Pigment Content (mg/100g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1 – African Star</td>
<td>6.11</td>
<td>65.54</td>
<td>60.65</td>
<td>83.26</td>
<td>4.42</td>
<td>15.75</td>
<td>0.67</td>
<td>0.25</td>
<td>0.92</td>
</tr>
<tr>
<td>T2 – Friendship</td>
<td>7.13</td>
<td>72.53</td>
<td>47.32</td>
<td>74.01</td>
<td>5.21</td>
<td>12.57</td>
<td>0.73</td>
<td>0.71</td>
<td>1.44</td>
</tr>
<tr>
<td>T3 – Hunting Song</td>
<td>6.70</td>
<td>69.49</td>
<td>62.47</td>
<td>80.55</td>
<td>6.31</td>
<td>13.30</td>
<td>0.88</td>
<td>0.44</td>
<td>1.32</td>
</tr>
<tr>
<td>T4 - Priscilla</td>
<td>4.19</td>
<td>62.59</td>
<td>56.67</td>
<td>82.15</td>
<td>4.66</td>
<td>13.40</td>
<td>0.99</td>
<td>0.27</td>
<td>1.26</td>
</tr>
<tr>
<td>T5 – Punjab Dawn</td>
<td>6.62</td>
<td>68.36</td>
<td>58.37</td>
<td>83.48</td>
<td>8.30</td>
<td>14.40</td>
<td>0.82</td>
<td>0.28</td>
<td>1.1</td>
</tr>
<tr>
<td>T6 – Regency</td>
<td>5.36</td>
<td>64.51</td>
<td>48.54</td>
<td>72.97</td>
<td>7.37</td>
<td>11.42</td>
<td>0.90</td>
<td>0.33</td>
<td>1.23</td>
</tr>
<tr>
<td>T7 – Suncereen</td>
<td>7.18</td>
<td>73.47</td>
<td>43.47</td>
<td>67.91</td>
<td>6.41</td>
<td>10.44</td>
<td>0.89</td>
<td>0.16</td>
<td>1.05</td>
</tr>
<tr>
<td>T8 - Sunayana</td>
<td>6.44</td>
<td>66.79</td>
<td>46.34</td>
<td>73.02</td>
<td>5.34</td>
<td>12.78</td>
<td>0.86</td>
<td>0.28</td>
<td>1.14</td>
</tr>
<tr>
<td>T9 – Regency</td>
<td>7.31</td>
<td>74.30</td>
<td>68.35</td>
<td>91.81</td>
<td>4.87</td>
<td>16.47</td>
<td>0.88</td>
<td>0.18</td>
<td>1.16</td>
</tr>
</tbody>
</table>

S.E.M.2            | 0.03                             | 0.25                             | 1.00                                   | 0.83                                      | 0.05                          | 0.26                   | 0.03                      | 0.02                   | 0.05                     | 0.01                    |

C.D. at 5%         | 0.09                             | 0.73                             | 2.97                                   | 2.46                                      | 0.14                          | 0.77                   | 0.08                      | 0.05                   | 0.13                     | 0.04                    |

### Conclusions

Swapnil recorded the best performance with respect of most of the post-harvest parameters i.e. days to opening of 5th florets, days to withering of 5th florets, number of florets open at a time, percentage of open florets/spike, water uptake on 5th day (ml), total water uptake (ml), vase- life (days) and pigment content. Regency show the best performance with respect of days to opening of 3rd and 4th flowers, days to withering of 3rd and 4th flowers. The maximum diameter of 3rd, 4th 5th florets and reducing sugar was recorded with cv. Priscilla. The maximum Non- reducing sugar & total sugar was recorded with cv. Friendship while dry weight of cut spikes at senescence was recorded with cv. Punjab Dawn.

### References

10. Gupta P, Pathak AC, Banafar RNS. Studies on the performance of gladiolus (Gladiolus hybridus Hort.)


