potatoes deteriorated in quality under those conditions (unpublished data).

Literature Cited


Dark-storage Temperature and Duration Influences Flowering and Quality Retention of Hibiscus

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Received for publication 3 Feb. 1988. The cost of publishing this paper was defrayed in part by the payment of page charges. Under postal regulations, this paper therefore must be hereby marked advertisement solely to indicate this fact.

Abstract. Pot-grown ‘Angie Physic’ hibiscus (Hibiscus rosa-sinensis L.) plants at the tight bud and blooming stages were stored in darkness for 3, 6, or 9 days at 4.5, 10.0, 15.5, 21.0, 26.5, or 32.0C and then placed in a greenhouse for 21 days. Plants showed the least amount of damage at 10.0 or 15.5C or when stored for 3 days. Plants stored at 10.0 or 15.5C had delayed flowering, larger and more flowers, less flower bud and leaf abscission, a higher plant quality. Storage for 6 or 9 days resulted in plants with smaller and fewer flowers, greater bud and leaf abscission, less fresh weight, and a lower quality.

Shipping potted flowering plants to market with minimum loss of quality is a major problem in the floriculture industry. Plants usually are in transit for several days and may be exposed to darkness and temperature extremes. Nearly 50% of all damage claims are attributed to shipping temperatures not being maintained within a desirable range.

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were watered throughout the storage period as needed. Data collected during the dark storage were: diameter of the first flower on those plants having flowers opened following the initiation of dark storage, total flower number, number of total abscised flower buds and leaves. There was one plant as an experimental unit replicated five times for each treatment combination.

Following dark storage, plants were transferred to the greenhouse used earlier and observed for 21 days. During this period, plants were fertilized at every watering with 200 ppm N from the same fertilizer source used previously. Number of flowers and abscised flower buds and leaf drop were again recorded and added to data collected during the dark storage.

At the termination of a given treatment (21 days after storage), fresh weight (plants severed at the soil line) and overall plant quality (1 = poor, not salable; 3 = good, salable; 5 = excellent quality) were determined. A similar experiment using plants at the tight flower bud stage was also conducted. Since the results were similar in the two experiments, only results from the first experiment are reported. Analysis of variance was performed on all data, and treatment differences were separated by single degrees of freedom.

Temperature had a major impact on flowering and quality of hibiscus that received dark storage. Flower diameter was greatest at 15.5°C (Table 1). Total flower number was inversely related to storage duration, and number of abscised flower buds increased linearly with the increase in storage duration.

Chilling injury was obvious on all the plants stored at 4.5°C, and became more severe with longer exposure times (data not shown). Symptoms of CI included wilted leaves and leaf tissues that appeared water-soaked and spotted with necrotic areas. Heavy fertilization during production may have increased the sensitivity of the plants to CI (Poole and Conover, 1983).

Although leaf drop on plants stored at 4.5°C was lower than in those stored at 26.5 or 32.0°C, plants that had been stored at 4.5°C had much less fresh weight due to the reduced subsequent growth. Fresh weight peaked at 21.0°C (Table 1). Similar results have been reported with Ficus benjamina (Collins and Blessington, 1983). The two highest temperatures caused severe leaf drop. Leaf chlorosis became more severe on plants stored at 21.0°C or above. The loss of leaf chlorophyll and development of leaf yellowing in Kalanchoe blossfeldiana was shown to be faster at 33°C than at 23°C (Marousky and Harbaugh, 1980b). Overall plant quality 21 days after removal from dark storage was highest for those plants previously stored at 15.5°C.

When plants were stored for >3 days, flower diameter, number of flowers, fresh weight, and overall plant quality decreased (Table 1). Number of abscised buds and leaf drop increased as storage duration increased. Marousky and Harbaugh (1980b) found that leaves of Kalanchoe blossfeldiana became more chlorotic and contained less chlorophyll after 3 days in dark storage. The time for the first flower bud to open was unaffected by the duration of dark storage.

Results from this experiment indicate that damage to pot-grown flowering hibiscus during transit may be minimized by shipping them at low, but nonchilling, temperatures. To maintain maximum flowering and best plant quality, ‘Angie Physic’ hibiscus plants should be held no more than 3 days in darkness and at 10.0 to 15.5°C.

### Table 1. Postharvest effects of temperature and duration of dark storage on flowering, plant quality, and subsequent growth of ‘Angie Physic’ hibiscus at the flowering stage.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Flower diam (mm)</th>
<th>Days to anthesis</th>
<th>Total no. flowers per plant</th>
<th>Total no. abscised buds</th>
<th>No. leaves dropped</th>
<th>Fresh wt (g)</th>
<th>Plant grade*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage temp (°C)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>4.5</td>
<td>78</td>
<td>6</td>
<td>16</td>
<td>40</td>
<td>146</td>
<td>2.9</td>
<td></td>
</tr>
<tr>
<td>10.0</td>
<td>83</td>
<td>12</td>
<td>19</td>
<td>3</td>
<td>18</td>
<td>217</td>
<td>3.8</td>
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<tr>
<td>15.5</td>
<td>91</td>
<td>11</td>
<td>19</td>
<td>2</td>
<td>16</td>
<td>211</td>
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<tr>
<td>21.0</td>
<td>56</td>
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<td>16</td>
<td>47</td>
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<td>8</td>
<td>22</td>
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<tr>
<td>32.0</td>
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<td>5</td>
<td>25</td>
<td>82</td>
<td>235</td>
<td>2.9</td>
</tr>
<tr>
<td>Storage duration (days)</td>
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<td></td>
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<tr>
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<td>6</td>
<td>7</td>
<td>18</td>
<td>66</td>
<td>168</td>
<td>2.5</td>
</tr>
</tbody>
</table>

*1 = poor; 3 = good; 5 = excellent quality.

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**Linear (L); quadratic (Q). Nonsignificant (ns); P = 0.05 (*) or 0.01 (**).**