Rootstock, Pruning, and Soil Fumigation in Relation to Dormancy and Cold Hardiness of ‘Redhaven’ Peach

Renee M. Harber and Andrew P. Nyczepir
U.S. Department of Agriculture, Agricultural Research Service, Southeastern Fruit and Tree Nut Research Laboratory, P.O. Box 87, Byron, GA 31008

Ronald R. Sharpe
U.S. Department of Agriculture, Agricultural Research Service, Southeastern Fruit and Tree Nut Research Laboratory, P.O. Box 87, Byron, GA 31008

Additional index words. budbreak, peach tree short life, Prunus persica, test

Abstract. The effects of rootstock, pruning, and preplant soil fumigation on floral bud dormancy status and shoot cold hardiness of ‘Redhaven’ peach [Prunus persica (L.) Batsch] trees were monitored. Dormancy status, expressed as percent floral budbreak, was significantly affected by rootstock and pruning, although differences were small. In late January, significant interactions occurred between rootstock and pruning treatments, as well as between pruning and soil treatments. Pruning of trees on Lovell rootstock resulted in significantly lower budbreak as compared to trees on Nemaguard and unpruned trees on Lovell. Also, for trees pruned in December, higher budbreak was associated with those growing in fumigated vs. nonfumigated soil. Treatment effects on dormancy status did not correspond with treatment effects on hardiness. In fact, differences in hardiness were minimal and probably not biologically meaningful.

Factors known to predispose trees to peach tree short life (PTSL) include, but are not limited to, a high population of ring nematode [Criconemella xenoplax (Raski) Luc and Raski], pruning in October through January, and rootstock (Brittain and Miller, 1978). Although the ultimate cause of death remains uncertain, the role of freeze injury in the occurrence of PTSL has been emphasized in the southeastern United States. Treatments associated with increased survival have also been reported to result in greater cold hardiness of peach shoots on a PTSL site (Nemaguard vs. Nemaguard seedlings); treatments were wrapped in distilled water-moistened tissue paper, placed in a plastic bag, sealed, and either held at 4C as the temperature control or placed in a -3C ethylene glycol circulating bath. Ice formation in treatment samples was initiated with ice crystals, and tissues were allowed to equilibrate overnight. Temperatures were lowered at a rate of 2.5C/h and held for 1 h at each treatment temperature; these (at 5C intervals) varied with sampling date, based on expected hardiness level. Samples were thawed at 4C overnight, then held at 23C in the dark for 4 to 6 days. Viability was determined based on a visual rating of tissue browning (1 = complete browning, 5 = completely brown). The estimated killing temperature for each tree’s shoots is the temperature at which the average rating was ≥ 4 (complete browning of c a m b i u m).

Shoots for dormancy status determination were held at 21 ± 3C under natural daylength (≥ 10 h) in a container through which fresh tap water flowed continuously. The basal ends of cuttings were recut weekly to prevent xylem blockage. Relative dormancy status was expressed as the percentage of floral buds at or beyond the green calyx stage (Scalabrelli and Couvillon, 1986) after 6 weeks.

Killing temperature and percent budbreak, on a per-tree basis, were tested by analysis of variance. Percentage data were transformed by arsin conversion before analysis. Means were converted back to percentage data for presentation.

Few significant treatment differences were observed in either percent budbreak or cold hardiness throughout the study period. Percent budbreak was most notably affected by pruning on Lovell rootstock and by soil fumigation of Dec-primed trees (Table 1). In both cases, the treatments known to promote viability on PTSL sites (i.e., fumigation and not pruning until March) resulted in higher percent budbreak. However, higher budbreak was not always associated with the beneficial treatment. For example, although differences were small, percent budbreak of shoots was generally higher on the more susceptible Nemaguard rootstock than on Lovell.

Deacclimation of shoots coincided with the
Table 1. Relative dormancy status of ‘Redhaven’ peach shoot cuttings (n = 6 for all means).

<table>
<thead>
<tr>
<th>Shoot harvest date</th>
<th>% Floral budbreak after 6 weeks</th>
<th>Main effects</th>
<th>Rootstock</th>
<th>Pruning</th>
<th>Soil treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3 Jan.</td>
<td>17 Jan.</td>
<td>30 Jan.</td>
<td>14 Feb.</td>
<td>27 Feb.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pruning</td>
<td>Unpruned</td>
<td>1 a</td>
<td>10 a</td>
<td>2 6'</td>
<td>4 9'</td>
</tr>
<tr>
<td></td>
<td>Dec.-pruned</td>
<td>2 a</td>
<td>5 b</td>
<td>14</td>
<td>4 2</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>1 a</td>
<td>7 a</td>
<td>18 b</td>
<td>1 3'</td>
</tr>
<tr>
<td></td>
<td>Fumigated</td>
<td>1 a</td>
<td>8 a</td>
<td>22</td>
<td>4 8</td>
</tr>
</tbody>
</table>

Significant interactions:

- **Rtsk × Prn**
  - Lov, Unpruned: 24 a
  - Lov, Dec.-pruned: 29 a
  - Nem, Unpruned: 22 a

- **Prn × Soil**
  - Unpruned, Cont: 28 a
  - Unpruned, Fum: 25 ab
  - Dec.-pruned, Cont: 10 c
  - Dec.-pruned, Fum: 19 b

- **Rtsk × Prn**
  - Lov, Unpruned: 24 a
  - Lov, Dec.-pruned: 29 a
  - Nem, Unpruned: 22 a

- **Prn × Soil**
  - Unpruned, Cont: 28 a
  - Unpruned, Fum: 25 ab
  - Dec.-pruned, Cont: 10 c
  - Dec.-pruned, Fum: 19 b

- **Rtsk × Prn**
  - Lov, Unpruned: 24 a
  - Lov, Dec.-pruned: 29 a
  - Nem, Unpruned: 22 a

- **Prn × Soil**
  - Unpruned, Cont: 28 a
  - Unpruned, Fum: 25 ab
  - Dec.-pruned, Cont: 10 c
  - Dec.-pruned, Fum: 19 b

Main effect means separated by F test (P ≤ 0.05), within sampling date.

Main effects not interpreted due to significant interactions.

Significant interaction (P = 0.05) means compared by individual contrasts at P ≤ 0.05.

Gradual release from dormancy observed between 17 Jan. and 27 Feb. Treatment effects on dormancy status, however, did not correspond with treatment effects on hardness. In fact, differences in hardness were minimal and probably not biologically meaningful (data not presented).

Although cold injury is thought to be one of the leading causes of PTSL in the southeastern United States, treatments to control PTSL had little effect on cold hardiness. This result, together with the fact that the treatments affected dormancy, suggests the possibility of a connection between dormancy status and PTSL, independent of cold hardiness.

**Literature Cited**


