Rootstock Influence on 2,4-D Damage to 'Bartlett' and 'd'Anjou Pear Trees

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Abstract. A 2,4-dichlorophenoxy acetic acid (2,4-D) application in September, 1972, to a grass cover crop and most of a weed free 1.2 m wide strip under the tree row followed by sprinkler irrigation within 24 hours injured 8 year-old pear trees. Fall leaf abscission was inhibited and foliage development was abnormal the following spring. 'Bartlett'/imported French seedling had no apparent damage while 'Bartlett'/Pyrus calleryana Decne., 'East Malling Quince A' and 'Provence' quince was seriously damaged. 'd'Anjou'/imported French seedling was damaged the least of the 9 combinations and was most seriously damaged on the same 3 rootstocks as 'Bartlett'. Fruit yields were correlated with damage ratings.

The use of herbicides such as 2,4-D in orchards is an established practice. While fruit trees differ in susceptibility to damage from 2,4-D, until recently it has been generally supposed that no damage would occur if the foliage was not exposed directly or as a result of drift. However, Benson (1) and Benson and Covey (2) in Washington State showed that soil contamination by 2,4-D sprays under apple and pear trees can cause tree damage if sprinkler irrigation follows soon after 2,4-D application. Damage symptoms were terminal dieback and yellowing of terminal leaves and other symptoms similar to those described by Woodbridge and Kamal (4). Davison and Clay (3) in England found that high rates of soil applied 2,4-D damaged

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Table 1. The influence of rootstock on soil applied 2,4-D damage to 8 yr-old 'Bartlett' and 'd'Anjou' pears and yields the year following application.

<table>
<thead>
<tr>
<th>Rootstock</th>
<th>Damage</th>
<th>Yield</th>
<th>% of</th>
<th>Damage</th>
<th>Yield</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>rating</td>
<td>(kg)</td>
<td>1972</td>
<td>rating</td>
<td>(kg)</td>
</tr>
<tr>
<td>Imp. French sdg.</td>
<td>10.0a</td>
<td>633</td>
<td>110</td>
<td>7.5a</td>
<td>329</td>
</tr>
<tr>
<td>P. betulifolia sdg.</td>
<td>9.5a</td>
<td>622</td>
<td>89</td>
<td>5.0b</td>
<td>163</td>
</tr>
<tr>
<td>Bartlett sdg.</td>
<td>8.4ab</td>
<td>559</td>
<td>100</td>
<td>5.8b</td>
<td>357</td>
</tr>
<tr>
<td>Old Home</td>
<td>7.7ab</td>
<td>474</td>
<td>91</td>
<td>4.8b</td>
<td>65</td>
</tr>
<tr>
<td>Old Home x Farmingdale</td>
<td>6.5b</td>
<td>449</td>
<td>72</td>
<td>5.5b</td>
<td>256</td>
</tr>
<tr>
<td>Winter Nelis sdg.</td>
<td>6.1b</td>
<td>352</td>
<td>70</td>
<td>5.5b</td>
<td>252</td>
</tr>
<tr>
<td>P. calleryana sdg.</td>
<td>5.8c</td>
<td>272</td>
<td>43</td>
<td>3.1c</td>
<td>127</td>
</tr>
<tr>
<td>EM Quince A</td>
<td>3.4c</td>
<td>156</td>
<td>20</td>
<td>1.2d</td>
<td>29</td>
</tr>
<tr>
<td>Provence quince</td>
<td>3.1c</td>
<td>180</td>
<td>23</td>
<td>2.8c</td>
<td>74</td>
</tr>
</tbody>
</table>

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2Seedling rootstocks are so designated. All others are clones. At the time of propagation, the 'Old Home' and 'Old Home x Farmingdale' were from selected unnumbered stock.

3Trees rated 10 were unaffected. Trees rated less than 5 lacked complete coverage of foliage to the extent that those rated 1 had only 20% coverage. Mean separation by Duncan's multiple range test, 5% level.

4Yields are for 12 trees except for trees on quince where 21 trees occupy the same space as 12 trees on other rootstocks. 'd'Anjou' yields were estimated.
as follows: 10.0 = no apparent damage; 8.0 = very little apparent damage; 6.0 = many cupped or curled leaves but new growth not affected. Trees lacking complete coverage of foliage and having cupped and curled foliage on much of the remainder of the tree were rated by % of the tree covered with foliage, from 90% (4.5) to 10% (0.5). 'Bartlett' fruit yields were recorded by weight and 'd'Anjou' yields were estimated by fruit count and converted by kg on the basis of a random sample of weighed fruit. Trunk diameters were measured at the end of the growing season and compared to the previous season's measurements.

Damage was related to rootstock (Table 1). 'Bartlett' trees on French (from seed imported from France) rootstocks showed essentially no effect of 2,4-D. Only one tree on Pyrus betulaefolia Bunge, seedlings showed any effect. Trees on 'Bartlett' seedlings were affected to a greater degree, but all except 2 trees were rated 8 or above. Trees on 'Old Home' (clonal), 'Old Home x Farmingdale' (clonal) and 'Winter Nelis' (seedling) were given intermediate ratings. Most trees on P. calleryana seedlings were rather severely affected. Most trees on 'EM Quince A' and all trees on 'Provence' quince were rated 4.5 or lower.

On the average, 'd'Anjou' trees were damaged more than 'Bartlett'. The effect of rootstock on damage of 'd'Anjou' was similar to the effect on 'Bartlett'. Trees on quince and P. calleryana stocks were most affected and those on imported French seedlings were least affected with both scion cultivars.

Yield of 'Bartlett' trees corresponded very closely to the 2,4-D damage rating, but less with 'd'Anjou' (Table 1). Yield of 'Bartlett' in 1973 all decreased or remained about the same as for 1972 except for those on French stocks which increased slightly. Yield reductions in general corresponded to the damage rating. Yield of 'd'Anjou' was greater in 1973 than 1972 except for those on quince stocks. Some of this yield increase may be due to increased age and yield capability of the trees or 2,4-D may have stimulated fruit set directly or it may have indirectly affected fruit set through phloem damage. It should be noted, however, that the 'd'Anjou' yield increase in 1973 compared to 1972 tended to be less as damage increased, suggesting a negative effect of 2,4-D on yield rather than a positive effect.

The increases in trunk diameter did not consistently reflect the damage ratings because of the confounding effect of rootstock vigor, indicating that sizeable foliage reduction was necessary to overcome the vigor effect of rootstock. In general, trees with the highest ratings produced the greatest increases in trunk diameter.

No trees died during the first year after 2,4-D application. After the 1973-74 winter, 3 trees of 'd'Anjou'/'EM Quince A' and 2 trees of 'd'Anjou'/'Provence' quince were dead. A few other badly weakened trees will probably die as a result of increased susceptibility to cold and other adverse conditions.

Apparently, the danger of 2,4-D damage in pear orchards can be decidedly influenced by rootstock.

Pears on 'EM Quince A', 'Provence' quince and P. calleryana appeared to be much more prone to damage from soil applied 2,4-D than on the other rootstocks included in this test. Since most of the 2,4-D was probably in the upper 0.3 m to 0.4 m of soil (Benson, personal communication), the same zone as most feeder roots regardless of rootstock, rooting depth and areas of root concentration are not variables causing the observed differences. Perhaps rootstocks vary in permeability to 2,4-D or in their absorption or translocation capacity of 2,4-D or in their internal ability to modify this chemical.

Cover crop foliage will intercept and absorb 2,4-D. Therefore, it is assumed that the damage would have been reduced or possibly eliminated if the 2,4-D had been applied only on the grass cover between the rows and not on the bare strip of soil under the trees, in spite of the irrigation so close to the time of application.

Literature Cited


Glycophosate Toxicity to Apple Trees1

Roy C. Rom, Stanley A. Brown, and Jerry D. Markham2

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Abstract. Glycophosphate at rates found adequate (3.63 kg/ha) for orchard weed control is phytotoxic and possibly fatal to young trees. Tree death is intermediate by the tree's foliage in sufficient quantities. Its use appears safe, however, if precautions are used to avoid this contact. Following foliage absorption, the glycophosphate is translocated to active growing points resulting in leaf attenuation and cupping and necrosis to leaves, terminals, and trunks.

Glycophosphate, N-phosphonomethyl-glycine, is a non-selective broad

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