Cork Spot (Pit) of ‘Anjou’ Pear Related to Calcium Concentration in Fruit

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Abstract. Normal fruits of ‘Anjou’ pear and fruits with cork spot (pit) symptoms collected at harvest time from trees of various ages, were peeled, cored, and halved and the calyx ends analyzed for mineral nutrient concentration. Pitted fruits were significantly lower in Ca concentration, but there were no differences in Mg, K, Zn, Fe, Mn or Cu. Pitted fruits had a mean of 219 ppm Ca (dry-weight basis) with a range from 187 to 255 ppm. Normal fruits had a mean of 319 ppm with a range of 244 to 453 ppm.

Cork spot of ‘Anjou’ pear, sometimes known as Anjou pit or pear bitter pit, has been reported as a cause of serious losses in a number of seasons, both in the province of British Columbia and in the state of Washington. The symptoms become apparent during several weeks before picking. Affected fruits develop sunken areas that are darker green than the unaffected parts of the fruit. These are underlaid by pockets of necrotic tissue, some immediately beneath the pits, and others more deeply embedded. The flesh tissues become brown, dry and corky. The pits are usually most common near the calyx end (Fig. 1). Affected fruits soften prematurely.

Studies in Washington (2,3) suggested that light crop, high growing-season temperatures, periods of low relative humidity, strong drying winds, crowded trees, soils with low moisture-holding capacity, and Japanese rootstock all favored occurrence of the disorder. Affected fruit were borne on some trees in almost all seasons, but the total losses to the industry varied widely from season to season.

In British Columbia, serious crop losses were recorded in 1941, 1949, 1958, 1961 and 1969. Welsh and Keane estimated that in 1958 1/4 to 1/3 of the total crop of this cultivar was affected (4). Observations during the last 20 years have suggested that there are two patterns of occurrence. In the first, trees on Japanese rootstocks in a few orchards have borne varying proportions of affected fruits every year. Black-end symptoms are often found on the same trees. In the second, which occurred in the 1958, 1961 and 1969 seasons, fruits with pit were borne on many trees in most orchards of the region. The incidence is apparently independent of age of tree or type of rootstock.

Temperature and precipitation at Summerland for seasons in which the disorder has occurred do not correlate with incidence of the disorder. In 1958 and 1961 August temperatures were abnormally high, but in 1941, 1949 and 1969 they were average. In 1958 and 1969 August precipitation was abnormally low, but in 1961 it was average, and in the other two seasons it was much higher than normal.

In the fall of 1969, fruits were collected at harvest time in British Columbia orchards from trees of varying ages. These orchards characterizedly suffered losses from fruit pitting only in the occasional years of widespread cork spot occurrence.

Table 1. Conc of inorganic plant nutrients in the calyx end of ‘Anjou’ pear fruits, means of 8 orchards.

<table>
<thead>
<tr>
<th>Condition of fruit</th>
<th>Ca</th>
<th>Mg</th>
<th>K</th>
<th>Zn</th>
<th>Fe</th>
<th>Mn</th>
<th>Cu</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Dry wt</td>
<td></td>
<td>Fresh wt</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>319¹</td>
<td>383</td>
<td>9461</td>
<td>4.48</td>
<td>8.37</td>
<td>3.39</td>
<td>4.51</td>
</tr>
<tr>
<td>Pitted</td>
<td>219</td>
<td>407</td>
<td>10616</td>
<td>4.63</td>
<td>6.91</td>
<td>2.77</td>
<td>3.35</td>
</tr>
<tr>
<td>Normal</td>
<td>52</td>
<td>62</td>
<td>1544</td>
<td>0.73</td>
<td>1.36</td>
<td>0.55</td>
<td>0.74</td>
</tr>
<tr>
<td>Pitted</td>
<td>37</td>
<td>68</td>
<td>1764</td>
<td>0.76</td>
<td>1.15</td>
<td>0.46</td>
<td>0.57</td>
</tr>
</tbody>
</table>

¹ Differences between normal and pitted for calcium both dry weight and fresh weight significant at 1% level. Other differences do not reach significance at 5% level.

Where possible, normal and affected fruits were collected from the same trees. The fruits were peeled, cored and halved, and the calyx ends were dry ashed and analyzed for Ca, Mg, K, Zn, Fe, Mn, and Cu by atomic absorption flame spectrophotometer (Aztec AA3).

There were marked differences in the Ca concn ranging from 40 to 66 ppm in the normal fruits and from 33 to 42 ppm in the pitted fruit on a fresh wt basis (Table 1). The ranges on a dry wt basis were from 244 to 453 for normal fruit and from 187 to 255 ppm for pitted fruit.

These data suggest strongly that cork spot is associated with reduced supply of calcium to the fruits. This corresponds closely to correlations that have been made between calcium levels and the incidence of bitter pit of apple (1), a disorder characterized by very similar breakdown of fruit flesh. The factors that have been reported to affect incidence of cork spot in Washington (2,3) may well exert their effect by interfering with calcium metabolism.

Literature Cited


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