Performance of Fire Blight–Resistant Pears

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PSU Fruit Research & Extension Ctr.

Advent of the Ironclads?
1. European varieties are fire blight susceptible
2. Large, non-precocious trees
   - Blight susceptible seedling rootstocks
   - “Plant pears for your heirs”. 
Fire Blight

- Devastating disease of pear
- Contributor to declines in eastern US pear acreage
- 1 control option: strep
- High risk crop
Fire Blight Resistant Varieties

- New blight resistant varieties available
  - USDA breeding program at Kearneysville, WV,
  - Canadian breeding program at Vineland.
- Fruit maturity range: August – October
  - Reported to be dessert quality
  - Winter varieties reported to store well
- Performance in Pennsylvania?
**Varieties in Trial:**

<table>
<thead>
<tr>
<th>Variety</th>
<th>Blight resistance</th>
<th>No. of trees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anjou</td>
<td>no</td>
<td>15</td>
</tr>
<tr>
<td>Bartlett</td>
<td>no</td>
<td>20</td>
</tr>
<tr>
<td>Harrow Sweet</td>
<td>yes</td>
<td>14</td>
</tr>
<tr>
<td>Sunrise</td>
<td>yes</td>
<td>15</td>
</tr>
<tr>
<td>Blakes Pride</td>
<td>yes</td>
<td>15</td>
</tr>
<tr>
<td>Magness</td>
<td>yes</td>
<td>12</td>
</tr>
<tr>
<td>Gem</td>
<td>yes</td>
<td>10</td>
</tr>
<tr>
<td>Harrow Delight</td>
<td>yes</td>
<td>14</td>
</tr>
<tr>
<td>US84907–069</td>
<td>yes</td>
<td>15</td>
</tr>
<tr>
<td>Shenandoah</td>
<td>yes</td>
<td>18</td>
</tr>
<tr>
<td>US84907–166</td>
<td>yes</td>
<td>15</td>
</tr>
<tr>
<td>US84909–391</td>
<td>yes</td>
<td>15</td>
</tr>
<tr>
<td>Potomac</td>
<td>yes</td>
<td>15</td>
</tr>
</tbody>
</table>
- OHxF 87: best all-around pear rootstock in Pacific Northwest trials:
  - Some tree size control
  - Good precocity
  - Total yield, fruit size
  - Freedom from suckering
  - Resistant to fire blight.
- WSU Extension recommends 6’ x 14’ spacing
W. NY trials:

- Pears successfully managed in intensive plantings
- Smaller trees at close spacing than at wide spacing
- Tree densities: 518, 908, or 2178 trees / A
- OHxF 87 again among best rootstocks in trials.
Pear Systems

- Similar growth habit to apple
  - Strong apical dominance
  - Upright branch angles
- Adapts well to cone shaped canopy
  - Central leader/ vertical axis/ spindle
  - Limb spreading beneficial
- Two systems demonstrated:
Spacing: 6’ x 14’
  ◦ 518 TPA
Familiar: same tree training as apple
Moderate size control:
  ◦ rootstock,
  ◦ early cropping
**Bi Axis**

- **Spacing:** 4’ x 12’
  - 908 TPA
- **Two leaders per tree**
- **Easy to create a narrow tree wall**
- **Size control from**
  - Rootstock
  - Early cropping
  - Splits vigor / 2 leaders
  - Close spacing
Objectives:

1. Demonstrate feasibility of intensive pear production
   - Vertical axis at 6’ x 14’ (518 trees / A)
   - Bi axis at 4’ x 12’ (908 trees / A)
   - Simple 4–wire vertical trellis is used for both systems.

2. Assess survival, precocity, yield, fruit quality and fruit size of 11 fire blight resistant pear varieties
   - On FB–resistant & semi–dwarf OHxF 87
   - Compared to fresh market standards: Bartlett, Anjou
   - Sensory panel, chemical and physical analysis.
2011 Pear Variety Trial at FREC
OHxF87 Rootstock
6’ x 14’ spacing
4’ x 12’ spacing
4–wire trellis
Yield per tree (lb)

Vertical Axis Yield

- 5th Leaf
- 4th Leaf
- 3rd Leaf

Shenandoah
HarrowSweet
US84909-391
US84907-166
Gem
Bartlett
US84907-069
BlakesPride
Anjou
HarrowDelight
Sunrise
Potomac
Magness
Cumulative Yield:

- **Shenandoah**
- **H. Sweet**
- **US391**
- **US166**
- **Gem**
- **Bartlett**
- **US69**
- **BlakesPrade**
- **Anjou**
- **H. Delight**
- **Sunrise**
- **Potomac**
- **Magness**
Volunteers evaluating pears.
5 varieties yielded enough to test
Fruits harvested at maturity and held in cold storage before evaluation
Physical and chemical characteristics were measured
Sensory Panel
4th Leaf Preference Ranking

# of ratings

Preference rank

1 2 3 4 5

Bartlett
Harrow Sweet
Shenandoah
US84907-166
Gem
### 4th Leaf Taste Panel Ratings

Likert Scale 1 = dislike extremely, 9 = like extremely

<table>
<thead>
<tr>
<th>Variety</th>
<th>Visual Appearance</th>
<th>Texture</th>
<th>Flavor</th>
</tr>
</thead>
<tbody>
<tr>
<td>US84907–166</td>
<td>6.7</td>
<td>5.4</td>
<td>4.4</td>
</tr>
<tr>
<td>Shenandoah</td>
<td>7.0</td>
<td>7.2</td>
<td>6.3</td>
</tr>
<tr>
<td>Harrow Sweet</td>
<td>4.6</td>
<td>7.3</td>
<td>7.8</td>
</tr>
<tr>
<td>Bartlett</td>
<td>6.1</td>
<td>5.6</td>
<td>5.9</td>
</tr>
<tr>
<td>Gem</td>
<td>7.1</td>
<td>6.6</td>
<td>7.4</td>
</tr>
<tr>
<td>Cultivar</td>
<td>Sol. Solids (% Brix)</td>
<td>pH</td>
<td>% Malic Acid</td>
</tr>
<tr>
<td>---------------</td>
<td>----------------------</td>
<td>--------</td>
<td>--------------</td>
</tr>
<tr>
<td>Bartlett</td>
<td>12.7</td>
<td>3.85</td>
<td>0.32</td>
</tr>
<tr>
<td>Blakes Pride</td>
<td>11.4</td>
<td>3.76</td>
<td>0.28</td>
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<tr>
<td>Gem</td>
<td>16.2</td>
<td>3.88</td>
<td>0.34</td>
</tr>
<tr>
<td>Harrow Sweet</td>
<td>16.0</td>
<td>4.03</td>
<td>0.30</td>
</tr>
<tr>
<td>Shenandoah</td>
<td>15.0</td>
<td>3.41</td>
<td>0.68</td>
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<tr>
<td>Sunrise</td>
<td>12.0</td>
<td>4.03</td>
<td>0.26</td>
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<tr>
<td>US84907–069</td>
<td>11.8</td>
<td>4.32</td>
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<tr>
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<td>3.86</td>
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<tr>
<td>US84909–391</td>
<td>16.6</td>
<td>3.85</td>
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</table>
Harrow Sweet and Gem scored well in flavor.
Harrow Sweet and Shenandoah scored well in texture.
166 was ranked least preferred by 10 of 18 taste panelists.
Shenandoah, 166, and Gem had good visual appearance ratings, while Harrow Sweet did not.
11 varieties produced enough fruit for sensory evaluation

Fruits were harvested at maturity and held in cold storage before evaluation

Physical and chemical characteristics were measured

The pears were evaluated in two tastings. Early pears were tasted first, then later pears. Bartlett in both flights.

Sensory panel.
Early Tasting, 5th Leaf

Preference Ranking (1 = most preferred; 5 = least preferred)
5th Leaf Tasting Evaluations

Likert Scale 1 = dislike extremely, 9 = like extremely

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Visual</th>
<th>Texture</th>
<th>Flavor Intensity</th>
<th>Flavor Balance</th>
<th>Juiciness</th>
</tr>
</thead>
<tbody>
<tr>
<td>391</td>
<td>7.4</td>
<td>6.6</td>
<td>7.3</td>
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<tr>
<td>Gem</td>
<td>8.1</td>
<td>6.7</td>
<td>6.4</td>
<td>6.6</td>
<td>6.2</td>
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<tr>
<td>Bartlett</td>
<td>7.1</td>
<td>6.3</td>
<td>5.6</td>
<td>5.7</td>
<td>5.4</td>
</tr>
<tr>
<td>69</td>
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<td>5.9</td>
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<tr>
<td>166</td>
<td>7.0</td>
<td>5.8</td>
<td>5.0</td>
<td>4.9</td>
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Late Tasting, 5th Leaf

Preference Ranking (1 = most preferred; 5 = least preferred)
## 5th Leaf Tasting Evaluations

Likert Scale 1 = dislike extremely, 9 = like extremely

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Visual</th>
<th>Texture</th>
<th>Flavor Intensity</th>
<th>Flavor Balance</th>
<th>Juiciness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shenandoah</td>
<td>8.0</td>
<td>6.9</td>
<td>7.3</td>
<td>6.5</td>
<td>7.6</td>
</tr>
<tr>
<td>Anjou</td>
<td>5.9</td>
<td>5.6</td>
<td>6.1</td>
<td>6.2</td>
<td>6.6</td>
</tr>
<tr>
<td>Bartlett</td>
<td>6.8</td>
<td>6.9</td>
<td>6.3</td>
<td>6.7</td>
<td>6.0</td>
</tr>
<tr>
<td>Blake’s Pride</td>
<td>7.0</td>
<td>6.2</td>
<td>6.3</td>
<td>6.3</td>
<td>6.0</td>
</tr>
<tr>
<td>Harrow Sweet</td>
<td>7.2</td>
<td>5.4</td>
<td>5.2</td>
<td>5.2</td>
<td>4.0</td>
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### Chemical Characteristics

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Soluble Solids (Brix %)</th>
<th>pH</th>
<th>Malic Acid (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shenandoah</td>
<td>14.2</td>
<td>3.52</td>
<td>0.59</td>
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<tr>
<td>Anjou</td>
<td>14.6</td>
<td>3.81</td>
<td>0.27</td>
</tr>
<tr>
<td>BlakesPride</td>
<td>13.4</td>
<td>3.88</td>
<td>0.22</td>
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<tr>
<td>166</td>
<td>12.4</td>
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<td>0.22</td>
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<tr>
<td>Bartlett</td>
<td>13.0</td>
<td>3.74</td>
<td>0.30</td>
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<tr>
<td>Gem</td>
<td>15.5</td>
<td>4.03</td>
<td>0.22</td>
</tr>
<tr>
<td>69</td>
<td>13.1</td>
<td>4.03</td>
<td>0.17</td>
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<tr>
<td>Potomac</td>
<td>16.4</td>
<td>3.46</td>
<td>0.53</td>
</tr>
<tr>
<td>HarrowSweet</td>
<td>15.9</td>
<td>4.05</td>
<td>0.20</td>
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<tr>
<td>HarrowDelight</td>
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<td></td>
</tr>
<tr>
<td>Sunrise</td>
<td>14.6</td>
<td>3.81</td>
<td>0.24</td>
</tr>
<tr>
<td>391</td>
<td>15.2</td>
<td>3.93</td>
<td>0.24</td>
</tr>
</tbody>
</table>
391 scored well in the early tasting.
Gem scored highest in visual appearance and was one of the highest ranking early pears.
Shenandoah

- Largest pear
- “Juiciest”
- Most intensely flavored
- Highest malic acid
- Most highly preferred in late tasting
Conclusions

- Several of the fire blight resistant pears ranked higher than Bartlett
- US84909–391 was ranked 1st in preference among the early ripening pears based on its flavor and juiciness
- Gem scored highest in visual appearance and was among the most preferred both years
- Shenandoah ranked highest in the 2nd tasting and had among the highest scores of all the pears
- Fire blight resistant pears show great promise for revitalizing the Eastern pear industry
Pennsylvania fruit growers should plant high quality, blight resistant pear varieties
  ◦ On OHxF 87 rootstock, and in
  ◦ Intensive production systems.

We can re-establish European pears as a profitable crop
  ◦ Contributing to diversity of fruit crops offered for sale to local consumers.
Thank You!

SHAP Extension Advisory Committee for providing funding
Dr. Richard Bell, USDA–ARS Kearneysville provided budwood
Adams County Nursery provided budwood and propagated the trees