Pawpaw - Unique Native Fruit

Patrick Byers
MU Extension – Greene County
University of Missouri
byerspl@missouri.edu
Introduction to the Pawpaw

• Today’s presentation:
  – Native habits
  – Improved cultivars
  – Propagation
  – Basic growing practices
  – Marketing opportunities
Native Habits

- Botanically speaking, *Asimina triloba* (L) Dunal
- Native to much of eastern US
- Found across Missouri
Native Habits

- Pawpaw is a small, deciduous tree that may attain 5 to 10 m in height and tends to be found in patches due to root suckering.
- In sunny locations, trees typically assume a pyramidal habit, with a straight trunk and lush, dark green, long, drooping leaves.
- The blossoms occur singly on the previous year's wood, reaching up to 5 cm in diameter, emerging before leaves in mid spring (April in Missouri).
- The flowers are strongly protogynous, self-incompatible and require cross-pollination, although some trees may be self-compatible.
- Pollination may be by flies and beetles.
Native Habits

• Pawpaw pollination

Source: [http://bugguide.net/node/view/526080](http://bugguide.net/node/view/526080)
Native Habits

- Fruit ripens in late summer

- Fruit quality variable from wild trees
- Important wildlife food
Improved Pawpaw Cultivars

• What is the origin of today’s pawpaw cultivars?
  – Historically – wild trees were utilized, by native Americans, settlers, and later farmers
  – Early superior selections from wild trees
  – Recent developments – Neal Peterson (1981) and other breeding programs
  – Pawpaw cultivar trials
Improved Pawpaw Cultivars

• Desired tree characteristics
  – Small tree size, easier harvest
  – Precocious bearing, 4 years or less
  – Vigorous growth with low to medium inputs
  – Open branching with strong crotch angles
  – High flower density
  – High fruit set under natural pollination
  – Consistently high fruit yields
  – Cold hardiness and drought tolerance
Improved Pawpaw Cultivars

• Desired fruit characteristics
  – Fruitfulness: over 40 fruit per tree
  – Flavor: sweet, firm texture, delicate blend of flavors, rich but not cloying, no bitter aftertaste
  – Fleshiness: visually: mostly flesh. By weight: less than 5% of the fruit is seed
  – Fruit size: over 10 ounces
  – Seeds: over 45 seeds per oz., av. seeds as small as 3/4" (2 cm) long
  – Appearance: bright clear colors, no brown/mottling (ripe); even, symmetrical
Improved Pawpaw Cultivars

• 1995-99 regional pawpaw cultivar trials
• 2003 Missouri pawpaw cultivar trials
  – Sunflower
  – PA Golden
  – Wells
  – NC-1
  – Overleese
  – Shenandoah
  – Susquehanna
  – 10-35
# Improved Pawpaw Cultivars

Average yield (lbs) per tree, Mtn Grove, 2008-2010

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>PA Golden</td>
<td>35</td>
<td>65</td>
<td>88</td>
</tr>
<tr>
<td>10-35</td>
<td>16</td>
<td>38</td>
<td>57</td>
</tr>
<tr>
<td>Overleese</td>
<td>14</td>
<td>24</td>
<td>28</td>
</tr>
<tr>
<td>NC-1</td>
<td>13</td>
<td>27</td>
<td>38</td>
</tr>
<tr>
<td>Shenandoah</td>
<td>26</td>
<td>56</td>
<td>61</td>
</tr>
<tr>
<td>Sunflower</td>
<td>24</td>
<td>50</td>
<td>48</td>
</tr>
<tr>
<td>Susquehanna</td>
<td>15</td>
<td>37</td>
<td>23</td>
</tr>
<tr>
<td>Wells</td>
<td>23</td>
<td>36</td>
<td>45</td>
</tr>
</tbody>
</table>
# Improved Pawpaw Cultivars

### Average number of fruit per tree, Mtn Grove, 2008-2010

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>PA Golden</td>
<td>103</td>
<td>254</td>
<td>415</td>
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<tr>
<td>10-35</td>
<td>42</td>
<td>127</td>
<td>202</td>
</tr>
<tr>
<td>Overleese</td>
<td>42</td>
<td>64</td>
<td>73</td>
</tr>
<tr>
<td>NC-1</td>
<td>28</td>
<td>62</td>
<td>111</td>
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<tr>
<td>Shenandoah</td>
<td>50</td>
<td>147</td>
<td>201</td>
</tr>
<tr>
<td>Sunflower</td>
<td>64</td>
<td>142</td>
<td>159</td>
</tr>
<tr>
<td>Susquehanna</td>
<td>28</td>
<td>70</td>
<td>51</td>
</tr>
<tr>
<td>Wells</td>
<td>79</td>
<td>138</td>
<td>168</td>
</tr>
</tbody>
</table>
# Improved Pawpaw Cultivars

Average fruit size (g), Mtn Grove, 2008-2010

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>PA Golden</td>
<td>152</td>
<td>120</td>
<td>97</td>
</tr>
<tr>
<td>10-35</td>
<td>173</td>
<td>112</td>
<td>128</td>
</tr>
<tr>
<td>Overleese</td>
<td>183</td>
<td>118</td>
<td>172</td>
</tr>
<tr>
<td>NC-1</td>
<td>211</td>
<td>195</td>
<td>154</td>
</tr>
<tr>
<td>Shenandoah</td>
<td>234</td>
<td>189</td>
<td>138</td>
</tr>
<tr>
<td>Sunflower</td>
<td>173</td>
<td>168</td>
<td>138</td>
</tr>
<tr>
<td>Susquehanna</td>
<td>236</td>
<td>241</td>
<td>208</td>
</tr>
<tr>
<td>Wells</td>
<td>133</td>
<td>117</td>
<td>120</td>
</tr>
</tbody>
</table>
# Improved Pawpaw Cultivars

Pulp percentage of fruit weight, Mtn Grove, 2008

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Pulp Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>PA Golden</td>
<td>49.5%</td>
</tr>
<tr>
<td>10-35</td>
<td>61.1%</td>
</tr>
<tr>
<td>Overleese</td>
<td>42.9%</td>
</tr>
<tr>
<td>NC-1</td>
<td>76.8%</td>
</tr>
<tr>
<td>Shenandoah</td>
<td>74.8%</td>
</tr>
<tr>
<td>Sunflower</td>
<td>80.2%</td>
</tr>
<tr>
<td>Susquehanna</td>
<td>63.3%</td>
</tr>
<tr>
<td>Wells</td>
<td>58.6%</td>
</tr>
</tbody>
</table>
Improved Pawpaw Cultivars

• Ripening order
  – Early ripening – PA Golden, 10-35
  – Mid season ripening – Overleese, NC-1, Shenandoah, Sunflower
  – Late ripening – Susquehanna, Wells
Improved Pawpaw Cultivars

• Recommended cultivars for Missouri, based on fruit size, yield, and tree availability:
Improved Pawpaw Cultivars

- Neal Peterson cultivars
Improved Pawpaw Cultivars

• ‘PA Golden’
Improved Pawpaw Cultivars

• ‘Sunflower’

Improved Pawpaw Cultivars

• ‘NC-1’

Pawpaw Propagation

• Seedling vs grafted trees
  – Seedling trees are variable in production and fruit quality; grafted named cultivars are better choices for commercial production
  – Seedling trees take longer to come into production (5-7 years) than grafted trees (3-4 years)
  – Seedling trees are cheaper than grafted trees
  – Seedlings are useful as rootstocks
Pawpaw Propagation

• Seed germination
  – Don’t dry or freeze seed
  – Clean seed, place in moist peatmoss
  – Stratify at 32-40°F for 4 months
  – Sow seeds in spring in containers
Pawpaw Propagation

• Propagation
  – Several methods of grafting are used: chip bud, cleft, whip/tongue, other

Source: forums2.gardenweb.com
Basic Growing Practices

• Establishment and production
  – Pawpaw is adapted to USDA Hardiness Zones 5-8
  – Choose a site that has full sun and a well drained soil, with a pH of 5.5-7.0
  – Usual site preparation for orchard
  – Plant in spring (some trials suggest that fall planting is less successful); container grown plants work well
  – Spacing – 6-8’ between trees, 18-20’ between rows
  – Provide shelter for the first growing season; grafted nursery trees do not need shelter
  – First crop in year 3-4.
  – Full production in year 7-8
Basic Growing Practices

• Shelter for new plantings
  – First year seedlings – yes
  – Grafted nursery trees, taller than 45cm - no
Pawpaw orchard in year 2
Pawpaw orchard in year 5
Basic Growing Practices

• Mature pawpaw tree
  – 15-30 feet in height
  – 8-10 feet in spread

• Trees may have a productive life of 25 years or more
Basic Growing Practices

• General care
  – Irrigation is critical during dry periods
  – Fertilization
  – Weed control
  – Sucker management
Basic Growing Practices

• Pruning
  – Central leader system is commonly used
  – Remove narrow angled branches, spread branches to ensure strong crotches
Basic Growing Practices

• Pollination, fruit set and development
  – Pollination issues may limit fruit set; hand pollination can help
    • Lack of pollinators
    • Flowering characteristics
  – Fruit may develop as singles, or in groups of 2-9
  – Growers may thin clusters to improve fruit size and to reduce loss of fruit
Flowers are strongly protogynous; female organs are receptive before pollen is mature.
Hand pollination

Pollen collection

Pollen transfer to pistil
Basic Growing Practices

• Disease issues
  – Pawpaw leaf spot
    Mycocentrospora asiminae Ellis & Kellerm.,
    Rhopaloconidium asiminae Ellis & Morg.,
    and Phyllosticta asiminae Ellis & Kellerm
Basic Growing Practices

- Insect issues
  - Pawpaw peduncle borer
  - Japanese beetle
  - Leafroller
  - Zebra swallowtail
  - Asian ambrosia beetle
  - Spotted wing drosophila – listed as a host
  - Brown marmorated stink bug – listed as a host
Asian ambrosia beetle

Leaf roller

Peduncle borer

Zebra swallowtail
Basic Growing Practices

• Fruit ripening
  – Ripening season in Missouri is August-September
  – When ripe, the fruit softens and has a powerful aroma
  – In some cultivars, there is a skin color change from green to green-yellow when the fruit ripens
  – Flesh color of ripe fruit ranges from creamy white through bright yellow to shades of orange.
  – In the fruit, there are two rows of seeds (12 to 20 seeds) that are brown and bean-shaped and may be up to 3 cm long.
  – Fruit ripens over several weeks on a given tree
Basic Growing Practices

• Harvest/postharvest management
  – Harvest when fruit softens and releases from the stem (skin color is not a good indicator of ripeness)
  – Harvest frequently (3-4 day intervals), handle carefully as the fruit bruises easily when ripe
  – Shelf life of 2-3 days at room temperature
  – Prompt refrigeration (4°C (39°F)) will extend storage to 3 weeks while maintaining quality
Marketing Opportunities

• Pawpaw realities
  – Fruit is fragile, with a short shelf life unless refrigerated
  – Fruit does not ship well
  – Limited consumer awareness of the delights of pawpaw
  – Processing market is not well developed
Marketing Opportunities

• Why the buzz about pawpaw...
  – Delicious
  – Unusual
  – Native fruit
  – Antioxidant-rich
  – Superbly nutritious
  – Versatile in the kitchen
Tasting ripe pawpaws...
Marketing Opportunities

• Fresh fruit
  – Direct market opportunities for farmers
  – Pricing information
    • Local fresh fruit
      – $4.50/lb (Rhode Island)
    • Internet sales
      – $10.66/lb
Marketing Opportunities

• Pulp
  – Separate seeds and skin from pulp of ripe fruit
  – Freeze the pulp for storage
  – Pricing information
    • Local frozen pulp
      – $6.25/lb (Rhode Island)
    • Internet sales
      – $9.75/lb
Marketing Opportunities

• Value added products
  – Frozen products – ice cream
  – Cooked products – custard, cookies, breads
  – Fermented products – beer, wine
Pawpaw Resources

- Ames, G and L. Greer. 2010. Pawpaw – A “tropical” fruit for temperate climates. ATTRA
- Kentucky State University's Pawpaw Project
  147 Atwood Research Facility
  Kentucky State University
  Frankfort, KY 40601-2355
Any Questions?

• Patrick Byers
• Byerspl@missouri.edu
• 417-881-8909