Producing raspberries and blackberries out-of-season
(using high tunnels and greenhouses)
Why use high tunnels and greenhouses?

• Overwintering is improved
• Season is extended so fruits are worth more
• Fruit quality is higher
• Yields are greater
Thornless blackberries

Red raspberries
Prices range from $2.00 - $13.00/lb
Scotland
California
Advantages of tunnels in the Northeast

- Reduction in wind damage
- Protection from the rain
- Season extension late
Fall raspberries fruit on their primocanes
Typical fall raspberry season in the North

% of total yield

Weeks after August 20th

Frost
Accelerate development and fruiting
Strategy #1:

• Plant late cultivars or delay harvest, protect fruit, and capitalize on high prices
Caroline in mid-October
Cultivar Yields Under Tunnels

Weeks (Aug 22 = 1)

170 g per ½ pint
5 plants per plot
<table>
<thead>
<tr>
<th>Cultivar</th>
<th>2005 Yield (kg/plot)</th>
<th>2006 Yield (kg/plot)</th>
<th>2005 Size (g)</th>
<th>2006 Size (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Autumn Britten</td>
<td>12.1</td>
<td>11.1</td>
<td>3.40</td>
<td>3.46</td>
</tr>
<tr>
<td>Caroline</td>
<td>21.5</td>
<td>18.4</td>
<td>2.94</td>
<td>3.26</td>
</tr>
<tr>
<td>Heritage</td>
<td>21.5</td>
<td>15.5</td>
<td>2.27</td>
<td>2.33</td>
</tr>
<tr>
<td>Josephine</td>
<td>11.3</td>
<td>14.3</td>
<td>4.11</td>
<td>4.47</td>
</tr>
</tbody>
</table>
Heritage was also the favorite for flavor.
Treatments

• Five manipulations of Heritage (applied in the second year)
  – Straw mulch
  – Mowing
  – Early pinching
  – Late pinching
  – Control
First year at planting –
light mulch for establishment
Beginning of treatments:

Middle of February of first year
Old canes are cut to the ground.  

Here we removed snow on certain plots to freeze the soil.
After several days, mulch is applied to keep soil cold
High tunnel prior to covering
Mid-August
High tunnels are a haven for bumblebees.
Mid-October
Fruit quality on November 5, 2005
Cultural manipulations of Heritage 2005

Normal season ends here

Weeks after Aug. 22
2006 data

Yield (g/3.75 m plot/wk)

Week (Aug 22 = 1)

- Control
- Mow
- Pinch early
- Pinch late
- Mulch
<table>
<thead>
<tr>
<th>Treatment</th>
<th>2005 Yield</th>
<th>2006 Yield</th>
<th>2005 Size</th>
<th>2006 Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>19.3 a</td>
<td>15.5 a</td>
<td>2.2 bc</td>
<td>2.3 b</td>
</tr>
<tr>
<td>Tip early</td>
<td>16.7 a</td>
<td>11.5 b</td>
<td>2.1 c</td>
<td>2.2 b</td>
</tr>
<tr>
<td>Tip late</td>
<td>18.6 a</td>
<td>8.0 bc</td>
<td>2.1 c</td>
<td>2.2 b</td>
</tr>
<tr>
<td>Mulch</td>
<td>13.8 a</td>
<td>9.2 c</td>
<td>2.3 b</td>
<td>2.7 a</td>
</tr>
<tr>
<td>Mow</td>
<td>0.1 b</td>
<td>6.6 c</td>
<td>3.4 a</td>
<td>2.7 a</td>
</tr>
</tbody>
</table>

Yield = kg per 3.75 m or 12 ft plot. 20 kg/plot is 21,000 lbs/acre
Strategy #2:

• Early primocane-fruiting raspberry production
  – Early covering of the tunnel
  – Covering individual rows
    • Row cover
    • Plastic
Early season extension of primocane-fruiting Heritage

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Size (g)</th>
<th>Yield (meter)</th>
<th>% marketable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control (8/23-10/29)</td>
<td>2.02</td>
<td>5,353</td>
<td>86.4</td>
</tr>
<tr>
<td>Plastic (8/23-11/05)</td>
<td>1.98</td>
<td>6,474</td>
<td>84.1</td>
</tr>
<tr>
<td>Row cover (8/23-10/29)</td>
<td>1.98</td>
<td>5,692</td>
<td>81.7</td>
</tr>
<tr>
<td>Tip (8/29-11/05)</td>
<td>2.04</td>
<td>4,677</td>
<td>82.9</td>
</tr>
<tr>
<td>Field (9/4-10/25)</td>
<td>2.00</td>
<td>5,694</td>
<td>74.4</td>
</tr>
</tbody>
</table>
Yield comparison

- Applying the plastic in September for extended fall harvest

  2,860 half-pints per tunnel

- Applying the plastic in early spring for accelerated harvest

  2,855 half-pints per tunnel
<table>
<thead>
<tr>
<th>Cane Management</th>
<th>Crop</th>
<th>Size (g/berry)</th>
<th>Yield (g/meter)</th>
<th>Marketable (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field Double-cropped</td>
<td>Summer</td>
<td>1.90</td>
<td>1,637</td>
<td>63.2</td>
</tr>
<tr>
<td></td>
<td>Fall</td>
<td>2.26</td>
<td>4,761</td>
<td>66.8</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>2.20</td>
<td>6,399</td>
<td>65.9</td>
</tr>
<tr>
<td></td>
<td>Single-cropped</td>
<td>Fall</td>
<td>2.19</td>
<td>3,510</td>
</tr>
<tr>
<td>Tunnel Double-cropped</td>
<td>Summer</td>
<td>1.69</td>
<td>2,371</td>
<td>72.2</td>
</tr>
<tr>
<td></td>
<td>Fall</td>
<td>2.16</td>
<td>5,685</td>
<td>83.5</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>2.09</td>
<td>8,056</td>
<td>80.1</td>
</tr>
<tr>
<td></td>
<td>Single-cropped</td>
<td>Fall</td>
<td>2.16</td>
<td>5,585</td>
</tr>
</tbody>
</table>
Strategy #3:

- Overwinter tender blackberries and raspberries in a high tunnel
# Black Raspberries

<table>
<thead>
<tr>
<th>Treatment</th>
<th>First harvest</th>
<th>Last harvest</th>
<th>Size (g/plant)</th>
<th>Yield (g/plant)</th>
<th>Marketable (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field</td>
<td>7/20</td>
<td>8/06</td>
<td>3.74</td>
<td>101</td>
<td>63</td>
</tr>
<tr>
<td>Tunnel</td>
<td>7/18</td>
<td>8/13</td>
<td>3.97</td>
<td>128</td>
<td>77</td>
</tr>
</tbody>
</table>
# Blackberries

<table>
<thead>
<tr>
<th>Location</th>
<th>Type</th>
<th>Season length</th>
<th>Size (g)</th>
<th>Yield (g/plant)</th>
<th>% marketable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doyle Field</td>
<td>Field</td>
<td>12</td>
<td>4.30</td>
<td>146</td>
<td>42</td>
</tr>
<tr>
<td>Tunnel</td>
<td></td>
<td>52</td>
<td>6.13</td>
<td>4,591</td>
<td>85</td>
</tr>
<tr>
<td>Ouachita Field</td>
<td>Field</td>
<td>44</td>
<td>5.33</td>
<td>267</td>
<td>30</td>
</tr>
<tr>
<td>Tunnel</td>
<td></td>
<td>51</td>
<td>7.90</td>
<td>1,092</td>
<td>72</td>
</tr>
<tr>
<td>Triple Crown Field</td>
<td>Field</td>
<td>36</td>
<td>6.31</td>
<td>460</td>
<td>59</td>
</tr>
<tr>
<td>Tunnel</td>
<td></td>
<td>50</td>
<td>9.57</td>
<td>5,046</td>
<td>86</td>
</tr>
</tbody>
</table>
Doyle Blackberry 2007

Week (Week 1 = July 8 - 14)

Yield (g/plant)

- Purple squares represent Doyle - field
- Purple circles represent Doyle - tunnel
Ouachita Blackberry 2007

Week (Week 1 = July 8 - 14)

Yield (g/plant)

- **Ouachita - field**
- **Ouachita - tunnel**
Triple Crown Blackberry
2007

Week (Week 1 = July 8 - 14)
Chester blackberry 2008

Week (Week 1 = July 13 - 19)
Doyle blackberry 2008

Week (Week 1 = July 13 - 19)

- Doyle - field
- Doyle - tunnel
Ouachita blackberry 2008

Week (Week 1 = July 13 - 19)
## 2008 Yield Data

<table>
<thead>
<tr>
<th></th>
<th>Size (g/ berry)</th>
<th>Yield (g/ plant)</th>
<th>Marketable (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chester*</td>
<td>---</td>
<td>0</td>
<td>---</td>
</tr>
<tr>
<td>Chester*</td>
<td>3.76</td>
<td>134</td>
<td>76.7</td>
</tr>
<tr>
<td>Doyle</td>
<td>5.38</td>
<td>5,333</td>
<td>66.1</td>
</tr>
<tr>
<td>Doyle</td>
<td>5.48</td>
<td>13,901</td>
<td>81.2</td>
</tr>
<tr>
<td>Ouachita</td>
<td>7.70</td>
<td>2,879</td>
<td>51.9</td>
</tr>
<tr>
<td>Ouachita</td>
<td>6.84</td>
<td>5,748</td>
<td>85.3</td>
</tr>
<tr>
<td>Triple Crown</td>
<td>8.24</td>
<td>8,563</td>
<td>72.5</td>
</tr>
<tr>
<td>Triple Crown</td>
<td>8.72</td>
<td>13,002</td>
<td>86.8</td>
</tr>
</tbody>
</table>

* First fruiting season
Strategy #4:

- Grow primocane-fruting blackberries under tunnels to obtain a fall harvest.
Primocane-fruiting blackberries
Treatments

- Control
- Early pinching
- Late pinching
- Cane bending
Trellising Systems

Designing trellising systems for tight spaces that are exceptionally strong yet flexible.
About Us

Trellis Growing Systems LLC (TGS) was founded in 2007 by Richard Barnes. Barnes has more than 30 years experience in product design and manufacturing. In addition, Barnes founded Tanglewood Berry Farm in 2000. This small operation (8,000 row feet) is located in Wells County, Indiana with seven varieties of raspberries and blackberries.

The need for more sophisticated trellising methods at Tanglewood Berry Farm evolved into TGS.

TGS developed a fiber reinforced round profile shape which can be used for trellis post and cross members. These profiles are connected with fiber reinforced brackets and secured with set screws. This modular concept enables the grower to economically construct trellis systems to their desired requirements. Profiles can be supplied to customer's required lengths. The TGS trellis system has many features such as weather ability and strength for long life, labor savings in installation and maintenance, adjustability of cross members, and adjustable wire stays for...
## Costs per tunnel (2 yrs)

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preplant preparation</td>
<td>$120</td>
</tr>
<tr>
<td>Tunnel construction</td>
<td>$9,632</td>
</tr>
<tr>
<td>Plant establishment</td>
<td>$547</td>
</tr>
<tr>
<td>Irrigation system</td>
<td>$220</td>
</tr>
<tr>
<td>Trellis system</td>
<td>$577</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>$11,096</strong></td>
</tr>
</tbody>
</table>
Production and Harvesting

Production $621

Harvesting $2,659 (0.50/half-pint + containers and lids)

Total $3,280

Yield = 4,000 half-pints X $2.50 = $10,000
<table>
<thead>
<tr>
<th>Year</th>
<th>Expenses</th>
<th>Gross sales</th>
<th>Net profit (Excluding marketing costs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>$11,983</td>
<td>$0</td>
<td>-$11,983</td>
</tr>
<tr>
<td>1</td>
<td>$4,501</td>
<td>$10,000</td>
<td>- $6,484</td>
</tr>
<tr>
<td>2</td>
<td>$3,799</td>
<td>$10,000</td>
<td>- $283</td>
</tr>
<tr>
<td>3</td>
<td>$3,303</td>
<td>$10,000</td>
<td>$6,697</td>
</tr>
</tbody>
</table>
Equivalents

- 20,000 lbs/acre in tunnels vs. 2,000 in field
  - row spacing (2X)
  - harvest season (2.5X)
  - physiology (2X)

- Price is $5.00/pt in fall vs. $2.50 in season

- Gross revenues: $150,000 per acre equivalent
Winter production of summer-bearing raspberries in greenhouses
Greenhouse Raspberries

For winter or year around production

Greenhouse Raspberry Production Guide
[Entire guide, 38 pages, 4,505 KB .pdf file]

With slower connections, you may want to download individual sections:

- Part 1 [8 pages, 1,210 KB .pdf file] Includes introduction, biology, choosing production types, preparing the greenhouse, container spacing, plant selection, plant types.

- Part 2 [8 pages, 1,067 KB .pdf file] Includes more on plant establishment, potting mediums, first season
Winter Fresh Fruit

Fresh raspberries grown during winter — in our Michigan greenhouse
Michigan Greenhouse-Grown Raspberries

Winter Fresh Fruit

Net Wt 4.4oz / 125g
Strategy:

Fertigation in peat-filled poly bags.

Use cultivars that tend to produce primocanes more-or-less continuously. Remove primocanes when they complete fruiting in order to stimulate new primocane growth.
• John Cooper, Simcoe, Ontario

• Moves potted primocane-fruiting raspberries inside greenhouse in late fall for fruiting. They go out again after fruiting to make way for tobacco plants.
Canada
• Happy Valley Berry Farm, Bridgeton, New Jersey.

• Shirley Kline uses a combination of greenhouses, high tunnels, and field production, and primocane and floricane-fruiting raspberries, to produce raspberries year-around.
Conclusions

- Raspberries can be manipulated in different ways to fruit over a very long period of time
- Coolers, row covers, tunnels, and greenhouses, coupled with cultural manipulations, can extend the season to year around, even in cold climates.
High Tunnel Raspberries and Blackberries

Authors: Cathy Heidenreich, Marvin Pritts, Mary Jo Kelly, and Kathy Demchak
On line at: http://www.fruit.cornell.edu/berry.html