Organic High Tunnel Production of Raspberries in a Humid Region

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Annemiek Schilder, Plant Pathology

Why would you be interested in organic production?
Why would you use high tunnels?

Sponsors:
Ceres Trust and MSU AgBioResearch, USDA Organic Research Initiative, Michigan State Horticulture Society, NIFA-SCRI and NARBA
Average Monthly Raspberry Retail Price per Pound in Midwestern Stores (July 2011 – October 2016)

<table>
<thead>
<tr>
<th>Month</th>
<th>Organic MEAN</th>
<th>Conventional MEAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>J</td>
<td>$7.97</td>
<td>$6.02</td>
</tr>
<tr>
<td>A</td>
<td>$7.85</td>
<td>$5.98</td>
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<td>S</td>
<td>$8.00</td>
<td>$6.12</td>
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<td>O</td>
<td>$8.15</td>
<td>$6.25</td>
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Organic price is on average $1.95 higher than conventional with a 32% margin.
High demand for organically and locally produced fresh red raspberries.

**Michigan climate:**
- Cold winters
- Short frost free period: 120-200 days
- Humid, rainy growing season

**Challenges to organic production that tunnels may help:**
- Low plant vigor and yields
- Short marketing season
- High incidence of fruit rot and other fungal diseases
- Spotted winged drosophila*
Certified organic site in East Lansing MI. three 26x200 ft tunnels. Covered with Luminance THB plastic from May - Oct.

End doors and side panels in place (usually) in late Sep- Oct.
Nutrient Management in Tunnels

Tunnels exclude rain and limit N mineralization and movement. Raspberries have a high demand for N from May to October. Nutrients are applied conventionally via fertigation. Organic liquid fertilizers (mostly fish based) are expensive.
Fertility Treatments; applied in March

Dairy compost, 5 or 10 tons/acre
Organic fertilizer (McGeary 8-1-1) 1,250 or 2,500 lb/A

Treatments in 2010-2012 did not affect plant growth or yields. By 2012, leaf N levels were marginally deficient in plants treated with compost, and K was deficient in plants treated with 8-1-1.
Organic raspberry yields (lb/acre) in high tunnels, East Lansing, MI.

<table>
<thead>
<tr>
<th>Variety</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>MEAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Himbo Top</td>
<td>9,000&lt;sup&gt;b&lt;/sup&gt;</td>
<td>7,500&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7,200</td>
<td>7,900</td>
</tr>
<tr>
<td>Joan J</td>
<td>11,500&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6,800&lt;sup&gt;b&lt;/sup&gt;</td>
<td>6,700</td>
<td>8,300</td>
</tr>
<tr>
<td>Polka</td>
<td>9,500&lt;sup&gt;b&lt;/sup&gt;</td>
<td>6,600&lt;sup&gt;b&lt;/sup&gt;</td>
<td>6,200</td>
<td>7,400</td>
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</tbody>
</table>

Himbo Top  Joan J  Polka
Economics – 1 acre organic raspberries under tunnels

COSTS
Amortized costs (depreciation + interest): $8,000 per yr
  Tunnels (15 yr), plastic (3), plants (10), trellis (10)
Annual growing costs: management and harvest
  Year 1: $9,200
  Year 2 and after: $22,800

REVENUES
Yields: Year 1: 1,500 lb (4,000 ½ pints)
  Year 2 and after: 8,000 lb (22,330 ½ pints)

<table>
<thead>
<tr>
<th>Effect of selling price on cumulative profit or (loss)</th>
<th>$2.00/half pint</th>
<th>$3.00/half pint</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td>($9,150)</td>
<td>($5,146)</td>
</tr>
<tr>
<td>Year 2</td>
<td>$2,720</td>
<td>$28,080</td>
</tr>
<tr>
<td>Year 3</td>
<td>$14,580</td>
<td>$61,310</td>
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<tr>
<td>Year 4</td>
<td>$26,450</td>
<td>$94,530</td>
</tr>
<tr>
<td>Year 5</td>
<td>$38,320</td>
<td>$127,760</td>
</tr>
<tr>
<td>Year 6</td>
<td>$50,180</td>
<td>$160,990</td>
</tr>
<tr>
<td>Year 7</td>
<td>$62,050</td>
<td>$194,210</td>
</tr>
</tbody>
</table>
2014-2016


May-September: Injected 2-2-0 fish hydrolysate (Schafer Fisheries, Thomson, IL) at 2-6 gal/acre per week between. Total: 30-60 gal/acre or 6-12 lb N per acre per year.

To avoid plugging: Injected at 200:1 ratio and ran for 30 minutes after injections. Flushed ends of lines every 1-2 weeks. Cleaned filters regularly.
Weed Management

Weeds are most troublesome early in the season and in the raspberry rows (where the water is).
Weed Management

Tilled in May and June-July
6 hr/season per acre

Hand-weed rows in May and June-July
220 hr/season per acre
Weed barrier fabric helps control weeds in the leg rows, where they receive rain and grow well.
Two spotted spider mites  
* (Tetranychus urticae)  

2011 - moderate:  
Normal summer temperatures, released predatory mites (*Phytoseiulus persimilis*)

2012 – very severe:  
very hot summer, multiple sprays of spinosyn (Entrust) and pyrethrum (Pyganic) for SWD control.

2013 – minor:  
cool season, limited pyrethrum use, released *Amblyseius californicus*

2014-2016 – minor:  
cool to moderate seasons, no pyrethrum, released *P. persimilis* + *A californicus* in 2015
Other Pests (and friends)

Japanese beetle

Potato leafhopper

Raspberry sawfly
Primocane and floricane raspberry harvest times, E.L.

- Himbo Top
- Joan J
- Polka

Cumulative yield (kg/ha)

1st SWD trapped 7 Aug

Harvest times:
- 25-Jun
- 9-Jul
- 23-Jul
- 6-Aug
- 20-Aug
- 3-Sep
- 17-Sep
- 1-Oct
- 15-Oct
Primocane and floricanne raspberry harvest times, E.L.

Cumulative yield (lb/acre)

- Himbo Top
- Joan J
- Polka

1st SWD trapped 9 July

Dates:
- 22-Jun
- 6-Jul
- 20-Jul
- 3-Aug
- 17-Aug
- 31-Aug
- 14-Sep
- 28-Sep
- 12-Oct

Year: 2015
Spotted Wing Drosophila Management

Trap and scout for damage

Sanitation:
Timely, thorough harvest
Narrow, well trellised rows

Insecticides (Entrust):
Timely sprays, thorough coverage
Watch label limits
Double –cropped 1 acre organic raspberries in tunnels

COSTS
Amortized costs (depreciation + interest): $8,000 per yr
   Tunnels (15 yr), plastic (3), plants (10), trellis (10)
Annual costs: management and harvest
   Year 1: $9,200
   Year 2 and after: $22,800

REVENUES
Yields:   Year 1:   1,500 lb (4,000 ½ pints)
         Year 2-7: 12,000 lb (32,000 ½ pints)
Selling price: $5.33/lb ($2.00/½ pint)

Effect of selling price on cumulative profit or (loss)

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<td>Year 1</td>
<td>($9,964)</td>
<td>($5,959)</td>
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<tr>
<td>Year 2</td>
<td>$12,246</td>
<td>$48,291</td>
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<tr>
<td>Year 3</td>
<td>$34,456</td>
<td>$102,541</td>
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<tr>
<td>Year 4</td>
<td>$56,666</td>
<td>$156,791</td>
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<tr>
<td>Year 5</td>
<td>$78,875</td>
<td>$211,040</td>
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<tr>
<td>Year 6</td>
<td>$101,085</td>
<td>$265,290</td>
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<tr>
<td>Year 7</td>
<td>$123,295</td>
<td>$319,540</td>
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</table>
Physical Exclusion of SWD

Rufus Isaacs, Heather Leach, Department of Entomology

ProtekNet netting (Dubois Agrinovation, 1x0.6 mm mesh)

Delayed the first appearance of flies and greatly reduced population growth
Weak areas in 2016 contained tomato ringspot virus and high populations of dagger nematodes. Annemiek Schilder started trials of several soil treatments, but:

*viruses and soil pathogens (nematodes, fungi) are a long-term risk to high tunnel profitability.*
Summary
Organic raspberries under tunnels can be profitable. Primary questions/risks are:

1. Manage of SWD.
2. Soil born diseases that may limit plant longevity.

Organic raspberry budget spreadsheet: hansone@msu.edu