Weed Control and Fertility in Organic Blueberry Production Systems

Dr. Bernadine Strik, Professor of Horticulture
Oregon State University
Presented on December 15, 2015

2003: 480 acres (Strik & Yarborough, 2005)

2008: 1950 a (USDA, 2010)

2011: 4115 a (Strik, 2014)

Western region (WA, OR, CA)
- Accounts for 26% of total area
- Has 64% of total organic area (2620 acres)

Organic blueberry area in the U.S.A.

2003: 480 acres (Strik & Yarborough, 2005)

2008: 1950 a (USDA, 2010)

2011: 4115 a (Strik, 2014)
Advantages to organic berry production in western USA

- Dry summers reduce incidence of weeds
- Diseases promoted by humid, rainy summers are reduced
- Some major insect pests are not present in this region
- Strong industry support and opportunities for grant funding through industry levied funds

California
(Courtesy Brenna Benevidez)
Weeds are widespread issue as organically approved herbicides very limited

Studies on mulches for control done in SE and in Oregon

Organic Production of Blueberries in the Southeastern US: Development of Best Management Practices

M. Tertuliano, P. Andersen, H. Scherm, G. Krewer, O. Liburd and G. Fonsah, Univ. of Florida and Univ. Georgia

Dr. Gerard Krewer, retired, Univ. Georgia
 Mulches studied
(Krewer et al., 2009; Tertuliano et al., 2012)

- Wheat straw
- Landscape fabric (non woven)
- Landscape fabric (Weed mat – woven)
- Peanut shells

 Mulches studied
(Krewer et al., 2009; Tertuliano et al., 2012)

- Pine straw
- White plastic
- Pine bark
- Unmulched control
White plastic to repel leaf beetles

Yield of ‘Brightwell’ rabbiteye blueberry in organic production
(Krewer et al., 2009; Tertuliano et al., 2012)

- Raised bed vs. flat
- Duke & Liberty
- Mulch (3 types)
- Fertilizer source & rate

April 2012
Organic Research from planting (2006) through 8\textsuperscript{th} growing season (2014)

- Raised bed vs. flat
- Duke & Liberty
- Mulch (3 types)
- Fertilizer source & rate

0.4 ha Organic Blueberry Production Systems Trial
June 2007 (first growing season)
Certified Organic Blueberry Trial
7th growing season

Weed management

1) Sawdust mulch .................. Hand weeding
2) Compost + sawdust mulch .... Organic herbicide (hand weeding if needed)
3) Weed mat with sawdust ....... Hand weeding around plants

<table>
<thead>
<tr>
<th>Component</th>
<th>pH</th>
<th>C:N ratio</th>
<th>N (%)</th>
<th>P (ppm)</th>
<th>K (ppm)</th>
<th>B (ppm)</th>
<th>Mn (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Willows</td>
<td>4.2</td>
<td>441</td>
<td>0.1</td>
<td>255</td>
<td>46</td>
<td>2.1</td>
<td>61</td>
</tr>
<tr>
<td>Ponderosa</td>
<td>7.3</td>
<td>21</td>
<td>1.1</td>
<td>2356</td>
<td>562</td>
<td>7.8</td>
<td>540</td>
</tr>
</tbody>
</table>
Sawdust layer

Yard debris compost layer
Spot spraying with 20% acetic acid was effective on young weeds in warm weather (Larco et al., 2013; Julian et al., 2012)
Compost, when added to mulching program, has increased weed presence & management costs (Julian et al., 2012)

<table>
<thead>
<tr>
<th>Cumulative 2007-2014</th>
<th>Compost topped with sawdust mulch</th>
<th>Sawdust mulch</th>
<th>Weed mat with sawdust in “planting hole” area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labor hours per acre</td>
<td>530</td>
<td>440</td>
<td>110</td>
</tr>
</tbody>
</table>

One day after application

May 17, 2012

May 7, 2012
Erosion of upper sawdust layer exposing compost layer
Yield averaged over cultivar, raised/flat & fertilizer

- Larger differences when plants were young
- Cumulative yield slightly higher with weed mat

Landscape fabric or “weed mat” with organic mulch in planting hole area has offered nearly full weed control (Larco, 2010; Julian et al., 2012)
Weed growth may be a problem under white colored weed mat – check thickness/quality
- Granular fertilizer must be placed under weed mat (e.g. feather meal)
- Drip line should be under weed mat; then use fertigation

Use of compost

Douglas fir sawdust
- pH: 4.2
- C:N ratio: 441
- N (%): 0.1
- P (ppm): 255
- K (ppm): 46
- B (ppm): 2.1
- Mn (ppm): 61

Yard debris compost
- pH: 7.3
- C:N ratio: 21
- N (%): 1.1
- P (ppm): 2356
- K (ppm): 562
- B (ppm): 7.8
- Mn (ppm): 540
**Pre-plant incorporation & mulch type**

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Weed mat + sawdust</td>
<td>4.9</td>
<td>5.35</td>
<td>5.10</td>
</tr>
<tr>
<td>Compost + sawdust (pre-plant &amp; as mulch)</td>
<td>4.9</td>
<td>6.85</td>
<td>(after 300 lb S/a) 5.85</td>
</tr>
</tbody>
</table>

Sawdust+compost incorporated before planting & as mulch
No incorporation of organic matter before planting sawdust+weed mat mulch

Strik and Vance (in progress)

‘Duke’, high soil pH symptoms caused by using high pH compost prior to planting
Effect of soil management on cumulative yield of 10 blueberry cultivars (years 2-7)

2008-13 Cumulative Yield (tons/acre)

- Mulch: p=0.03
- Cultivar: p=0.0001
- M x C: p=0.02

Strik and Vance (in progress)


- Raised bed vs. flat
- Duke & Liberty
- Mulch (3 types)
- Fertilizer source & rate

April 2012
Fertilizer Source

**Feather meal**
- Granular, pH 5.7; EC 1.7 dS/m
- Applied as a granular
- Split 2x …. March & mid-May
  [Nature Safe 13-0-0]

**Fish emulsion**
- Liquid, pH 3.7; EC 20.4 dS/m
- Applied as a split 7x …. mid-April through early-July
- Diluted 1:10
  [Fish Agra 4-1-1; True Organics 4-0-2]
- Fertigated when at full canopy

Nitrogen Rate

Feather meal & fish emulsion each applied at two targeted N rates (based on %N listed on fertilizer label):

- **Low rate** 25 lb N/a in 2007-09; 50 lb in 2010-12; 65 lb in 2013-
- **High rate** 50 lb N/a in 2007-09; 90 lb in 2010-12; 125 lb in 2013-
Applying granular products under weed mat

Riverbend Organic Farms, Oregon
Voles – populations higher with weed mat

Organic Fertigation

Fish emulsion

Mix tank

Injector
### Liquid Organic Fertilizers

<table>
<thead>
<tr>
<th>Product</th>
<th>Price ($/gal)</th>
<th>N cost ($/lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Converted Organics 521 5-1-1</td>
<td>$1.45</td>
<td>$5.00</td>
</tr>
<tr>
<td>Alaska Salmon Fish Fertilizer</td>
<td>$3.00</td>
<td>$6.67</td>
</tr>
<tr>
<td>Phytamin 801</td>
<td>$6.25</td>
<td>$8.00</td>
</tr>
<tr>
<td>Eco-Hydro Fish 2-4-0.2</td>
<td>$3.50</td>
<td>$19.50</td>
</tr>
<tr>
<td>Aqua Power 100 % Fish Emulsion</td>
<td>$11.98</td>
<td>$24.80</td>
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<tr>
<td>Liquid Fish Soluble Fertilizer 5-1-1</td>
<td>$20.00</td>
<td>$43.40</td>
</tr>
<tr>
<td>Converted Organics NC 0.4-1-0</td>
<td>$1.65</td>
<td>$45.00</td>
</tr>
<tr>
<td>Liquid Fish Fertilizer 2-4-0.2</td>
<td>$9.99</td>
<td>$50.00</td>
</tr>
<tr>
<td>Drammatic ONE 4-4-0.5</td>
<td>$37.20</td>
<td>$77.60</td>
</tr>
<tr>
<td>BioFert BioFish 3-1-2</td>
<td>$2.59/lb</td>
<td>$86.33</td>
</tr>
<tr>
<td>Organic Gem 3-3-3</td>
<td>$27.95</td>
<td>$109.67</td>
</tr>
<tr>
<td>Neptune Harvest Liquid Fish 2-4-1</td>
<td>$30.00</td>
<td>$136.50</td>
</tr>
</tbody>
</table>

*From Miles et al. (2009) Fertigation applications and costs in organic vegetables.*

### Fertilizer Nutrients Applied in 2014

#### Based on fertilizer nutrient analysis

**Note:** target N rates were 65 and 125 lb N/acre

<table>
<thead>
<tr>
<th>Source</th>
<th>Macronutrients (lbs/acre)</th>
<th>Micronutrients (oz/acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>P</td>
</tr>
<tr>
<td>Feathermeal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low N rate</td>
<td>58</td>
<td>1.5</td>
</tr>
<tr>
<td>High N rate</td>
<td>112</td>
<td>2.9</td>
</tr>
<tr>
<td>Fish emulsion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low N rate</td>
<td>60</td>
<td>13</td>
</tr>
<tr>
<td>High N rate</td>
<td>115</td>
<td>25</td>
</tr>
</tbody>
</table>
Summary

- Organic blueberry area in Oregon & Washington has increased from 2% (2006) to 15% (2011) of the total [now > 20%]
- Use of weed mat in new plantings has increased from 20% to 85% (2006-2012)
- Many cultivars performed best with lower rates of N
- Impact of fertilizer source varied with cultivar in blueberry
- Cultivars differ in adaptation to organic systems
- Yields in the best systems have been comparable to conventional
- We are now studying nutrient uptake and losses and development of nutrient standards for organic systems
Acknowledgements

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  – Javier Fernandez-Salvador (in progress)

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