Elderberry Possibilities

Patrick Byers
Regional Horticulture Specialist
University of Missouri Extension
Marshfield, MO

Upcoming Programs of Interest

• Blackberry Workshops, 1-4pm;
  – 6/21, 7/26, 11/15; Southwest Research Center, Mount Vernon
  – 6/28; St Louis area
• Hops Workshops, Bradford Farm, Columbia – stay tuned!
• Winter Vegetable Production Training Farm, Rocky Comfort – Twilight walks, 4th Thursday, 6pm; April-September
• Tomato School, August
• Garlic Festival, Sept 6, 6-8pm, Botanical Center, Springfield
• Great Plains Growers Conference, Jan 11-13 2018, St Joseph
• Bringing Back the American Small Farm, Mar 8-9 2018, West Plains

Outline

• Introduction
• Elderberry culture
• Elderberry pest management
• Elderberry harvest

Introduction

• American elderberry (Sambucus canadensis)
• European or black elderberry (S. nigra)
• Blue elderberry (S. caerulea)

Introduction

• South-central United States
• Climate (Mtn. Grove)
  – Avg min temp: -7.2°C (19°F) (Jan)
  – Avg max temp: 30.5°C (87°F) (Jul)
  – Avg rainfall: 1143 mm (45 in)
  – USDA Zone 5b-6a
• Soils – silt loam, fragipan
• Growing season – April 12 to October 30 (200 frost free days)
Introduction

- Elderberry is of growing commercial interest
  - Juice products
  - Jelly, jam
  - Wine, spirits
  - Health supplements
  - Flower products
  - Food colorant
  - Other plant parts?

Elderberry Phenology

- Budbreak – February-March
- Blossoming – Late May-June
- Fruit ripening – late July-early September

Elderberry Culture

- Cultivars with origins in New York
  - ‘Adams 1’, ‘Adams 2’ (1926)
    - Selected from the wild by William Adams
    - Fruit clusters and berries described as large
    - ‘Adams 1’ has greenish stems; ‘Adams 2’ has reddish stems
    - Cross-pollination required
  - ‘York’ (1964)
    - Originated as a cross of ‘Adams 2’ x ‘Ezyoff’
    - Clusters heavy, berries large
    - Lower soluble solids than ‘Johns’, ‘Scotia’, or ‘Victoria’
    - Ripens after ‘Adams 1’ and ‘Adams 2’
    - Plant large, productive

- Cultivars with origins in Kentville, Nova Scotia
  - ‘Johns’ (1954) – parentage unknown
  - ‘Kent’ (1957) – seedling of ‘Adams 1’; earlier than ‘Adams 1’
  - ‘Nova’ (1959) – seedling of ‘Adams 2’; large fruit, ripens early, sweeter than ‘Kent’ and ‘Victoria’
  - ‘Scotia’ (1959) – seedling of ‘Adams 2’; large fruit, ripens early, sweeter than ‘Kent’ and ‘Victoria’
  - ‘Victoria’ (1957) – seedling of ‘Adams 2’; earlier than ‘Adams 2’

- Midwestern cultivars
  - ‘Bob Gordon’ (2011)
  - ‘Wyldewood’ (2010)
  - ‘Marge’ (2013)
  - ‘Ranch’
  - ‘Ozark’

- Cultivars with origins in Kentville, Nova Scotia
  - ‘Johns’ (1954) – parentage unknown
  - ‘Kent’ (1957) – seedling of ‘Adams 1’; earlier than ‘Adams 1’
  - ‘Nova’ (1959) – seedling of ‘Adams 2’; large fruit, ripens early, sweeter than ‘Kent’ and ‘Victoria’
  - ‘Scotia’ (1959) – seedling of ‘Adams 2’; large fruit, ripens early, sweeter than ‘Kent’ and ‘Victoria’
  - ‘Victoria’ (1957) – seedling of ‘Adams 2’; earlier than ‘Adams 2’

- Propagation
  - Root cuttings
  - Sprouted hardwood cuttings
  - Softwood cuttings
  - Tissue culture
  - Seeds
  - Dormant hardwood cuttings
    - 1, 2, or 3 node cuttings
    - Rooting hormone?
Elderberry Culture

- Establishment - plants
  - Bare root or container plants
  - Berms
  - Spacing
    - 3-4 feet between plants
    - 10-12 feet between rows

Elderberry Culture

- Establishment - hardwood cuttings
  - Stick directly in the soil
  - Percentage of success can vary

Elderberry Culture

- Growth habit
  - Fruiting on old wood
  - Produces suckers, which also fruit in many cases

Elderberry Culture

- Pruning
  - Annual removal of all shoots
**Elderberry Culture**

- **Pruning**
  - Annual removal of all shoots can improve harvest efficiency
    - Larger, fewer flower cymes
    - Concentrated ripening period
    - Implications for SWD management?

- **Fertilization**
  - Nitrogen
    - 80-100 lb/acre (4x12 spacing)
    - Apply as growth begins
  - Other nutrients?
  - Foliar sampling to monitor nutrition?

- **Irrigation**
  - Elderberries are not drought tolerant plants
  - Drip or trickle irrigation systems work well
  - Water needs: 1.5-2” per week

- **Weed management**
  - Control perennial weeds before planting
  - Plastic mulch for young plantings
  - Weed barrier fabric for older plantings?
  - Mulching
  - Hand removal
  - Herbicides
    - Labeled herbicides: Casoron, Surflan, Gallery, Snapshot, Aim, Roundup Max, Rely, Reglone, Gramoxone

---

**Elderberry Culture**

- **Pruning**
  - Selective removal of older shoots
  - European elderberry pruning

---

**Elderberry Culture**

- **Fertilization**
  - Nitrogen
  - 80-100 lb/acre (4x12 spacing)
  - Apply as growth begins
  - Other nutrients?
  - Foliar sampling to monitor nutrition?

- **Irrigation**
  - Elderberries are not drought tolerant plants
  - Drip or trickle irrigation systems work well
  - Water needs: 1.5-2” per week

- **Weed management**
  - Control perennial weeds before planting
  - Plastic mulch for young plantings
  - Weed barrier fabric for older plantings?
  - Mulching
  - Hand removal
  - Herbicides
    - Labeled herbicides: Casoron, Surflan, Gallery, Snapshot, Aim, Roundup Max, Rely, Reglone, Gramoxone
Elderberry Culture

- Pest management
  - Eriophyid mite

Eriophyid mite

- Pest management – Eriophyid mites
  - Two species of mites discovered in MO
  - Overwinter in elderberry buds
  - Cultivar differences in susceptibility?
  - Control measures
    - Removal of woody plant parts?
    - Delayed dormant lime sulfur spray?
    - Timing of sprays?

Elderberry Culture

- Pest management
  - Japanese beetle

Elderberry Culture

- Pest management – Japanese beetle
  - Insecticide applications
  - Mass trapping

1,120,745 beetles killed in 2012 in 4 traps!

Elderberry Culture

- Pest management – Spotted Wing Drosophila
  - SWD is a new elderberry pest for Missouri
  - SWD numbers appear to build in May and June, and reach damaging levels in June-Sept in MO
  - SWD management in elderberry
    - Baited monitoring traps – place in advance of fruit ripening and monitor regularly
    - Use cultural methods (pruning) to concentrate ripening
    - Exclusion?
    - Spray program
      - Beginning at first ripe fruit and repeated as necessary
      - At present, pyrethroid, spinosyn, and pyrethrum class insecticides are labeled on elderberry for JB and SWD

Elderberry Culture

- Pest management – Spotted Wing Drosophila
**Elderberry Culture**

- **Pest management – Spotted Wing Drosophila**

<table>
<thead>
<tr>
<th>Class</th>
<th>Trade Name</th>
<th>Active Ingredient</th>
<th>PHI (days)</th>
<th>Days Residual</th>
</tr>
</thead>
<tbody>
<tr>
<td>pyrethroid</td>
<td>Mustang Max (RU)</td>
<td>zeta-cypermethrin</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Danitol (RU)</td>
<td>fenpropathrin</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Brigade (RU)</td>
<td>bifenthrin</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>spinosyn</td>
<td>Delegate (2G)</td>
<td>spinetoram</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Entrust (organic)</td>
<td>spinosad</td>
<td>3</td>
<td>3-5</td>
</tr>
<tr>
<td>pyrethrum</td>
<td>Pyganic (organic)</td>
<td>pyrethrum</td>
<td>0</td>
<td>2</td>
</tr>
</tbody>
</table>


**Elderberry Culture**

- **Pest management – Insect problems**
  - Stem borer
  - Elder borer
  - Sawfly
  - Stink bug, including BMSB
  - Green June bug

**Elderberry Culture**

- **Pest management – Bacterial leaf spot**
  - (Pseudomonas)

**Elderberry Culture**

- **Pest management – Fungal leaf spot**

**Elderberry Culture**

- **Pest management – Elderberry rust**

Source: http://plantpathology.uark.edu/Number_15-2010.pdf
Elderberry Culture

- Harvest - blossoms
  - June
  - Harvest when all florets are open
  - Florets may be removed by rubbing over a screen
  - Use immediately, freeze fresh blossoms, or dry for future use

Elderberry Culture

- Harvest - fruit
  - July-August
  - Harvest cymes when all berries fully colored
  - Usually 2-3 pickings
  - Mechanization?

Let’s discuss the harvest decision process...

Yields
- Year 1:
  - MO: 1226 lb/acre
  - IL: 1214 lb/acre
- Year 2
  - MO: 3338 lb/acre
  - IL: 8677 lb/acre
- Year 3
  - MO: 5621 lb/acre
  - IL: 8582 lb/acre
- High yields
  - MO: 11352 lb/acre
  - IL: 13846 lb/acre
Postharvest Handling

• Handling harvested fruit
• Fruit is destemmed
  – 4-10% of fresh weight is stem
• Storage
  – Fresh destemmed – fruit held at 4°C
  – Frozen destemmed – fruit held at -20°C
  • Storage time – up to 2 years without loss of quality

Elderberry Culture

• Stem removal
  – Can remove berries from stems by freezing

Terry Durham’s destemmer at Bob McCord’s farm

Harvest and Sanitation
Elderberry Culture

Means of juice characteristics from 2002 elderberry harvest at two locations:

<table>
<thead>
<tr>
<th>Site</th>
<th># Samples</th>
<th>Brix</th>
<th>pH</th>
<th>TA (ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mt. Vernon</td>
<td>34</td>
<td>11.44</td>
<td>4.72</td>
<td>0.85</td>
</tr>
<tr>
<td>Mtn. Grove</td>
<td>26</td>
<td>12.59</td>
<td>4.56</td>
<td>0.92</td>
</tr>
<tr>
<td>Combined</td>
<td>60</td>
<td>11.94</td>
<td>4.65</td>
<td>0.88</td>
</tr>
</tbody>
</table>

Elderberry Marketing

- Pricing
  - Fruit
    - On the stem - $0.50 to $1.95/lb
    - Destemmed and frozen - $1.00 to $2.00/lb
    - Fresh, frozen or dried blossoms - ?

Any Questions?

Patrick Byers
MU Extension-Webster Co
417-859-2044
byerspl@missouri.edu

http://extension.missouri.edu/greene/ElderberryDevelopmentProject.aspx

Overview of Elderberry Nutrition in Missouri

Patrick Byers
Regional Horticulture Specialist
Southwest Region- MU Extension
ByersPL@missouri.edu

Upcoming Programs of Interest

- Blackberry Workshops, 1-4pm:
  - 6/21, 7/26, 11/15; Southwest Research Center, Mount Vernon
  - 6/28, St Louis area
- Hops Workshops, Bradford Farm, Columbia – stay tuned!
- Winter Vegetable Production Training Farm, Rocky Comfort – Twilight walks, 4th Thursday, 6pm; April-September
- Tomato School, August
- Garlic Festival, Sept 6, 6-8pm, Botanical Center, Springfield
- Great Plains Growers Conference, Jan 11-13 2018, St Joseph
- Bringing Back the American Small Farm, Mar 8-9 2018, West Plains

Outline

- Introduction
- Elderberry foliar testing research
- Elderberry fertilization
**Introduction**

- There is much that we don’t know with precision regarding elderberry nutritional management.
- Models developed for other crops may be useful.

**AVOIDANCE AND CORRECTION OF NUTRIENT DEFICIENCIES**

**Soil Analysis**

- Detailed soil analysis must be made prior to elderberry establishment, and at intervals during the life of the planting
  - soil pH
  - soil nutrient content
- Collect and submit a representative sample
- Submit top 8 inches and second 8 inches separately

**Soil Analysis**

- Recommended soil test results (Missouri) – based on grape and blackberry
  - soil pH – 5.5 to 6.5
  - soil organic matter – 2-5%
  - phosphorus – 40-80 lbs/A = medium
  - potassium – 110-220 lbs/A = medium
  - magnesium – 200-250 lb/A = medium

**Soil Analysis**

- Adjusting soil pH with liming materials
  - extremely important to do this before establishment
  - very difficult to change soil pH in all but the top few inches of soil once plants are planted
  - lime is most effective if incorporated deeply and thoroughly

**Soil Analysis**

- Liming existing plantings
  - monitor soil pH with regular soil testing
  - remember problems with limited effectiveness of surface lime applications; consider routine applications of high quality lime
  - rescue applications – if soil pH has dropped below 5.5
    - broadcast recommended rate and chisel plow 8-10 inches deep
    - do alternate row middles in alternate years to minimize the effects of root damage
    - do in late winter and cultivate prior to bud break
Plant Tissue Analysis

- Reveals the concentration of elements in tissue
- To be meaningful, analysis must entail:
  - standardized tissue sample procedure
  - accurate and precise analytical methods
  - standard references to compare diagnostic sample values
  - means of interpreting diagnostic data and making fertilizer recommendations
- Useful for:
  - Routine nutrient status evaluation
  - Troubleshooting suspected nutrient problems

Materials and Methods

- Study conducted at two sites
  - MSU State Fruit Experiment Station
  - MU Southwest Center
- 3 cultivars/selections
  - ‘Bob Gordon’
  - ‘Adams 2’
  - ‘Netzer’

Materials and Methods

- Fully expanded leaves collected from mid shoot; each sample consisted of 25 leaves
- Leaves dried, ground, and analyzed for nutrient content
- Nutrients analyzed - N, P, K, Ca, Mg, Zn, Fe, Mn, Cu, and B

Materials and Methods

- Two types of tissue collected
  - Leaves from new shoots that arise from crown
  - Leaves from shoots that arise from old shoots
- Three collection times
  - After spring flush
  - At bloom time (anthesis)
  - At harvest time
Results

- N, P, Fe, Zn, and Mn were highest during the spring flush collection period
- Cu was highest at anthesis
- Ca, Mg, and B were highest at fruit ripening
- As a general trend, the elements N, P, K, Fe, Zn, and Mn were at higher levels early in the season (spring flush to anthesis), while the elements Ca, Mg, and B were higher later in the season.

Discussion

- How do we evaluate a fertility program?
  - plant appearance
  - plant growth
  - productivity
- What about foliar analysis?
  - measuring actual elemental uptake by the plant
  - predicting elemental disorders in advance of visible symptoms
  - diagnosing visible elemental disorders

Discussion

- Leaf elemental content measurements are made at times during the growth cycle when these elements are at maximum or stable levels
- A tissue type is selected that consistently contains high elemental levels

Discussion

- Based on this study:
  - Foliar collection times following spring growth flush for N, P, K, Fe, Zn, and Mn
  - Foliar collection times at fruit ripening for Ca, Mg, and B
  - Sample leaves from new shoots originating at the crown
- For troubleshooting, collect samples at any time
### Plant Tissue Analysis

**Estimated elderberry leaf nutrient sufficiency levels**

<table>
<thead>
<tr>
<th>Macronutrients</th>
<th>%</th>
<th>Micronutrients</th>
<th>mg·kg⁻¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen</td>
<td>4.47</td>
<td>Iron</td>
<td>71</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>0.39</td>
<td>Manganese</td>
<td>147</td>
</tr>
<tr>
<td>Potassium</td>
<td>2.82</td>
<td>Boron</td>
<td>63</td>
</tr>
<tr>
<td>Calcium</td>
<td>1.60</td>
<td>Copper</td>
<td>8</td>
</tr>
<tr>
<td>Magnesium</td>
<td>0.60</td>
<td>Zinc</td>
<td>24</td>
</tr>
</tbody>
</table>

**Grape petiole nutrient sufficiency levels**

<table>
<thead>
<tr>
<th>Macronutrients</th>
<th>%</th>
<th>Micronutrients</th>
<th>ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen</td>
<td>1.70–3.00</td>
<td>Iron</td>
<td>40–300</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>0.15–0.50</td>
<td>Manganese</td>
<td>30–150</td>
</tr>
<tr>
<td>Potassium</td>
<td>1.50–2.00</td>
<td>Boron</td>
<td>30–100</td>
</tr>
<tr>
<td>Calcium</td>
<td>1.30–3.00</td>
<td>Copper</td>
<td>5–50</td>
</tr>
<tr>
<td>Magnesium</td>
<td>0.30–1.50</td>
<td>Zinc</td>
<td>25–100</td>
</tr>
</tbody>
</table>

Source: MU Soil and Plant Testing Laboratory

---

### When to Apply a Fertilizer

- Nitrogen containing fertilizers
  - During periods of active uptake (based on grape)
    - Shoot development to post-bloom
    - Can split the application
    - Post harvest applications useful to address current season problems
  - Annual rate – 80–100 lb/acre (based on blackberry)
  - Research is underway to further define elderberry nitrogen needs
- Phosphorus, potassium, other nutrients – anytime as indicated

### Other Considerations

- Apply fertilizers over the root system
  - Sodded row middles – band under plants
  - Clean cultivation – broadcast over floor
- Foliar applications (no experience)
  - Generally short term correction of problems
  - Use soluble forms
  - Use caution when mixing with pesticides

---

### Any Questions?

Patrick Byers  
MU Extension-Webster Co  
417-859-2044  
byerspl@missouri.edu

[http://extension.missouri.edu/greene/ElderberryDevelopmentProject.aspx](http://extension.missouri.edu/greene/ElderberryDevelopmentProject.aspx)