

## Elderberry Possibilities

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## 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, 4<sup>th</sup> 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


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## Outline

- Introduction
- Elderberry culture
- Elderberry pest management
- Elderberry harvest



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## 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)



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## Introduction

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







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## Introduction

- American elderberry *Sambucus canadensis* L. (or *Sambucus nigra* L. ssp. *canadensis* (L.) R. BOLL)
- Native to much of North America
- Medium to large shrub to small tree

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## Introduction

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




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## Elderberry Phenology

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







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## 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





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## Elderberry Culture

- 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'





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## Elderberry Culture

- Midwestern cultivars
  - 'Bob Gordon' (2011)
  - 'Wyldeewood' (2010)
  - 'Marge' (2013)
  - 'Ranch'
  - 'Ozark'






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## Elderberry Culture

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

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### Elderberry Culture

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

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### Elderberry Culture

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

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### Elderberry Culture

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

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### Elderberry Culture

- Pruning
  - Annual removal of all shoots


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## Elderberry Culture



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



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## Elderberry Culture




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





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## Elderberry Culture



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



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## Elderberry Culture




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



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## Elderberry Culture



- 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

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## Elderberry Culture




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## Elderberry Culture

- Pest management
  - Eriophyid mite

Eriophyid mite





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## Elderberry Culture

- 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?

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## Elderberry Culture

- Pest management
  - Japanese beetle






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## Elderberry Culture

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

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






Source: Dr. Jaime Pinero, Lincoln University

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## Elderberry Culture

- Pest management
  - Spotted Wing Drosophila

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## 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 repeat as necessary
      - at present pyrethroid, spinosyn, and pyrethrum class insecticides are labeled on elderberry for JB and SWD

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## Elderberry Culture

- Pest management – Spotted Wing Drosophila

Class	Trade Name	Active Ingredient	PHI (days)	Days Residual
pyrethroid	Mustang Max (RU)	zeta-cypermethrin	1	7
	Danitol (RU)	fenpropathrin	3	7
	Brigade (RU)	bifenthrin	3	7
spinosyn	Delegate (Zee)	spinetoram	1	7
	Entrust (organic)	spinosad	1	3-5
pyrethrum	Pyganic (organic)	pyrethrum	0	2
combination	Azera (organic)			

Source: <http://www.ipm.msu.edu/uploads/files/SWD/ManagementRecommendations-RaspberryBlackberrySep2012.pdf>

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## Elderberry Culture

- Pest management – Spotted Wing Drosophila

### Insecticides for SWD control in raspberry and blackberry

Class	Trade name	Active ingredient	PHI (days)	Days of residual activity <sup>#</sup>
Organophosphate	Malathion	malathion	1*	5-7
Pyrethroid	Mustang Max	zeta-cypermethrin	1	7
	Danitol	fenpropathrin	3	7
	Asana	esfenvalerate	7	7
	Brigade	bifenthrin	3	7
Spinosyn	Delegate	spinetoram	1	7
	Entrust (organic)	spinosad	3	3-5
Pyrethrum	Pyganic (organic)	pyrethrum	0	2

\*Check the label for the specific Malathion formulation you are using for the correct rate and PHI. Some may allow 0.5 day PHI.  
<sup>#</sup> Estimated residual activity from experience with other insect pests in blackberries and blue SWD studies in Oregon.

Source: <http://www.ipm.msu.edu/uploads/files/SWD/ManagementRecommendations-RaspberryBlackberrySep2012.pdf>

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## Elderberry Culture

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






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## Elderberry Culture

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




Bacterial leaf spot

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## Elderberry Culture




- Pest management
  - Fungal leaf spot




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## Elderberry Culture

- Pest management
  - Elderberry rust

Source: [http://plantpathology.uark.edu/Number\\_15-2010.pdf](http://plantpathology.uark.edu/Number_15-2010.pdf)

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## 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




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## Elderberry Culture



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




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## Elderberry Culture

- Let's discuss the harvest decision process...


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## Elderberry Culture


- 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



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## 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

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## Elderberry Culture



- Stem removal
  - Can remove berries from stems by freezing



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## Elderberry Culture




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## Harvest and Sanitation




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## Elderberry Culture

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

Site	# Samples	<sup>o</sup> Brix	pH	TA (ml)
Mt. Vernon	34	11.44	4.72	0.85
Mtn. Grove	26	12.59	4.56	0.92
Combined	60	11.94	4.65	0.88



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## 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 - ?



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## Any Questions?

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



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## Overview of Elderberry Nutrition in Missouri

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## Outline

- Introduction
- Elderberry foliar testing research
- Elderberry fertilization

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## Introduction



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

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source: omalra.gov.on.ca

## AVOIDANCE AND CORRECTION OF NUTRIENT DEFICIENCIES

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## 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

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## 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

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## 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

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## 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

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## 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

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## Elderberry Plant Tissue Analysis



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## Materials and Methods



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

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## 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

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## Materials and Methods

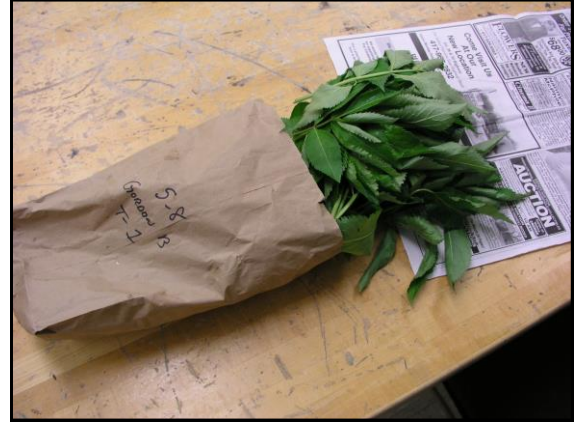


- Fully expanded leaves collected from mid shoot; each sample consisted of 25 leaves
- Leaves dried, ground, and analyzed for nutrient content
- Nutrients analyzed - N, P, K, Ca, Mg, Zn, Fe, Mn, Cu, and B

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## 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.

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## 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

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## 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

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## 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

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## Plant Tissue Analysis




Estimated elderberry leaf nutrient sufficiency levels

Macronutrients	%	Micronutrients	mg·kg <sup>-1</sup>
Nitrogen	4.47	Iron	71
Phosphorus	0.39	Manganese	147
Potassium	2.82	Boron	63
Calcium	1.60	Copper	8
Magnesium	0.60	Zinc	24

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## Plant Tissue Analysis



Grape petiole nutrient sufficiency levels


Macronutrients	%	Micronutrients	ppm
Nitrogen	1.70-3.00	Iron	40-300
Phosphorus	0.15-0.50	Manganese	30-150
Potassium	1.50-2.00	Boron	30-100
Calcium	1.30-3.00	Copper	5-50
Magnesium	0.30-1.50	Zinc	25-100

Source: MU Soil and Plant Testing Laboratory

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## 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

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## 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

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## Any Questions?



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