Elderberry Possibilities

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Outline

- Introduction
- Elderberry research and development in Missouri
- Elderberry culture
- Missouri's industry
- Challenges

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)

Missouri

Introduction

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

Introduction

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

Introduction

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

Elderberry Research

- Justification for elderberry research in Missouri:
  - Native, adapted plant
  - Growing market for fruit, juice and flowers
  - Commercial cultivars were developed elsewhere – New York and Canada; native midwestern germplasm is underutilized
  - Numerous opportunities for cultural studies

Elderberry Research

- Elderberry Development Program was established in 1997 as a collaborative project; cooperators include:
  - University of Missouri
    - Patrick Byers
    - Andrew Thomas
    - Faculty/staff from MU Center for Agroforestry
  - Missouri State University
    - John Avery
    - Martin Kaps
  - Lincoln University
    - Sanjun Gu
    - Jaime Pinero
    - Hwei-Ying Johnson
  - USDA-ARS
    - Chad Finn
    - Bob Martin
  - Penelope Perkins-Veazie, NCSU
  - John Brewer and Margaret Milliken, Wyldewood Cellars
  - Terry Durham, Eridu Farm

Pat

Andy

Chad

Elderberry Research

Our research sites

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Elderberry Research

- The project has several components:
  - Development of improved cultivars
  - Cultural studies
  - Pest management studies
  - Antioxidant content studies and genetic relationship studies
  - Economics and marketing
- The project cooperates with several programs that are investigating elderberry and human health

Elderberry Research

- Development of improved cultivars
  - Collection and evaluation of germplasm and cultivars
  - Replicated evaluation of superior germplasm
  - Release of improved cultivars
    - “Wyldewood” (2010)
    - “Bob Gordon” (2011)
    - “Marge” (2013)

Elderberry Research

- The elderberry collection – two sites (Mtn. Grove and Mt. Vernon)
  - Named cultivars: 6
  - Missouri: 35
  - Kansas: 2
  - Nebraska: 2
  - Oklahoma: 7
  - Arkansas: 5
  - Tennessee: 1
  - North Carolina: 3
  - New York: 1
  - *S. nigra* selections - 6
  - Total: 68 selections and cultivars

Elderberry Research

- Replicated evaluation of superior native germplasm
  - Superior selections are further tested at multiple sites
  - Planting 1: 2003-2006
    - 10 advanced selections, 2 commercial cultivars (‘Johns’ and ‘Adams 2’)
    - 3 sites – MV, MG, Corvallis
  - Two superior selections released
    - ‘Wyldewood’
    - ‘Bob Gordon’

‘Wyldewood’ Elderberry

- Tall shrub reaching 225 cm, with a spreading to upright growth habit.
- Timing of spring budbreak is similar to that of ‘Adams 2’.
- Blossoms in June; florets are easily removed from the cyme for use as a dried product or as a flavoring.
- We have not investigated the pollination requirements for ‘Wyldewood’; however, fruit set is reliable and prolific.

‘Wyldewood’ Elderberry

- Harvest season generally 14-26 days later than ‘Adams 2’ and ‘Bob Gordon’; late July in Missouri.
- Primary shoots ripen fruit over a 3-week period; three harvests at 7-day intervals.
- Unpruned plants ripen fruit for a 4-week period

‘Wyldewood’ Elderberry

- The fruit cymes presented in an upright position at ripening.
- The cymes at harvest are medium to large compared to ‘Adams 2’
  - somewhat loose
  - 33.6 g on unpruned plants
  - 83.1 g on plants that are pruned to the ground
- Yield over 3 years at two sites averaged 2.1 kg/plant
- Secondary cymes often form from the axils below the main cymes, a characteristic that increases bearing potential of each shoot.

‘Wyldewood’ Elderberry

- Berries
  - dark purple
  - ripen uniformly in the cymes
  - resistant to shattering
- Berry weight ranges from 52-111 mg
- Yield variability was noted between the Mountain Grove and Mount Vernon sites, with Mountain Grove plots producing higher yields but smaller berries than the Mount Vernon plots.

‘Bob Gordon’ Elderberry

- Medium shrub to 217 cm, with a spreading to upright growth habit.
- Spring budbreak is later than ‘Adams 2’
- Blossoms in late May-mid June
- Florets are easily removed from the cyme for use as a dried product or as a flavoring.
- We have not investigated the pollination requirements for ‘Bob Gordon’.

‘Bob Gordon’ Elderberry

- The harvest season for ‘Bob Gordon’ is similar to ‘Adams 2’.
- Harvest usually begins in mid-late July in Missouri.
- Primary shoots ripen fruit over a 3 week period, allowing for the harvest of the majority of the fruit in 3 harvests at 7 day intervals.
- Unpruned plants ripen fruit for a 4 week period

‘Bob Gordon’ Elderberry

- The fruit cymes of present in a decumbent position at ripening, which may make the berries less attractive to birds
- The cymes at harvest are large compared to ‘Adams 2’ and somewhat loose
  - Average size of 67.5 g on unpruned plants
  - Average size of 126.6 g on plants that are annually pruned to the ground.
- Yield in two studies averaged 2.3 kg/plant

‘Bob Gordon’ Elderberry

- Berries
  - dark purple,
  - ripen uniformly in the cymes
  - resistant to shattering.
- Berry size averaged 91.6 mg and 88.5 mg in two studies.
- Yield variability was noted between the Mountain Grove and Mount Vernon sites, with Mountain Grove plots producing higher yields but smaller berries than the Mount Vernon plots.


8/23/04
GORDON B 8-4

Elderberry Research

- Replicated evaluation of superior native germplasm
  - Planting 2: 2008-2011
    - 6 advanced selections, 3 commercial selections (York, Wyldewood, Bob Gordon)
      - Dallas (MO)
      - Ozark (AR)
      - Marge (OK)
      - Ocoee (TN)
      - Ozone (AR)
      - Sperandio (MO)
    - 3 sites – MG, MV, and Lincoln University

‘Marge’ Elderberry

- Selected near Eufaula, Oklahoma, by Marge Millican
- Original plant was an open pollinated seedling of ‘Haschberg’; ‘Marge’ is considered to be *Sambucus nigra,* though the male parent is unknown
- Provided to the project on 4/19/07

Marge Millican

‘Marge’ Elderberry

- Characteristics of ‘Marge’
  - Upright to spreading growth habit
  - Plant is tall, to 3 m
  - Plant has a vigorous growth habit
  - Plant appears hardy and adapted to Midwestern growing conditions

‘Marge’ Elderberry

- Characteristics of ‘Marge’
  - Produces flowers and fruit on 1 year and older shoots; does not produce on new shoots from the crown
  - Plant is productive
  - Ripe fruit cymes present in a decumbent position at harvest

‘Marge’ Elderberry

- Characteristics of ‘Marge’
  - Flower and fruit cymes are abundant and small in size

‘Marge’ Elderberry

‘Marge’

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‘Marge’ Elderberry

- Compared to American elderberry germplasm in the trial:
  - Significantly later in budbreak and earlier in full bloom
  - Significantly less damaged by mites – virtually untouched
  - Significantly larger berry weight
  - Significantly lower juice pH
  - Significantly higher total yield and # cymes
  - Exhibits desirable biochemical properties
- Compared to European elderberry germplasm previously evaluated, ‘Marge’ appears to be better adapted to Midwestern growing conditions
- ‘Marge’ is under consideration for cultivar release as a European elderberry with desirable characteristics for Midwestern USA production

Future Cultivars

- Potential future cultivar releases
  - ‘Ozark’
    - High yielding
    - Interesting biochemical profile
- Other cultivars
  - ‘Ranch’

Elderberry Research

Characteristics of Nine Elderbery Cultivars at 3 Missouri Sites, 2009 - 2011

Genotype	Mites	pH	Brix	Berry weight (mg)	Total yield (kg)	Total # cymes
Bob Gordon	2.5 c	4.68 de	10.4 ab	88 cd	1.54 bc	84 b
Dallas	1.9 d	4.86 bc	9.8 b	95 c	1.60 bc	45 b
Marge	1.0 e	4.57 e	10.2 ab	176 a	4.47 a	289 a
Ocoee	2.0 d	4.63 de	10.0 b	84 cd	1.92 bc	49 b
Ozark	2.8 bc	4.71 cde	11.3 a	86 cd	2.38 b	82 b
Ozone	3.1 ab	4.78 bcd	10.1 b	76 d	1.11 c	52 b
Sperandio	3.5 a	5.04 a	7.9 c	86 cd	1.25 c	27 b
Wyldewood	3.1 ab	4.92 ab	8.3 c	83 cd	1.10 c	44 b
York	2.8 bc	4.75 bcd	7.9 c	139 b	1.46 bc	82 b

Elderberry Research

- Cultural studies
  - Pruning studies
  - Elemental content of leaf foliar samples
  - Nitrogen fertilization

Elderberry foliar samples

Elderberry Research

Pruning Studies, 2000-2006

Table 1. Mean yield, cyme production, plant height, and pest response from American elderberry pruning study at Mountain Grove (MG) and Mt. Vernon (MV), MO.

		Mean fruit yield per plant (g)	Mean no. of cymes per plant	Mean wt per cyme (g)	Single berry wt (mg)	Plant ht (cm)	Eriophyid mites[y]	Bacterial leafspot[y]
Site	MG	1,400 a[z]	36.6 a	51 b	67.4 b	184 a	3.8 b	3.5 b
	MV	606 b	13.6 b	67 a	90.0 a	152 b	4.4 a	4.8 a
Cultivar	Bob Gordon	1,856 a	37.1 a	87 a	86.0 a	175 a	4.3 a	4.1 a
	Adams II	647 b	21.6 b	36 c	63.2 c	145 b	3.6 b	3.8 b
	Netzer	414 c	14.5 c	53 b	80.2 b	175 a	4.2 a	4.1 a
Pruning treatment	Annual	855 b	10.4 c	86 a	77.5 a	159 b	4.0 a	4.1 a
	Biannual	1,085 a	26.7 b	61 b	75.1 a	158 b	4.0 a	4.1 a
	Selective	1,086 a	31.6 a	48 c	76.9 a	169 a	4.1 a	3.9 a
	Unpruned	940 b	30.1 ab	42 c	76.1 a	174 a	4.1 a	3.9 a
Year	2002	423 d	5.9 d	95 a	—	—	—	—
	2003	1,034 b	33.2 b	41 c	—	—	—	—
	2004	1,369 a	22.6 c	68 b	76.5 b	175 a	4.8 a	3.9 b
	2005	1,307 a	39.0 a	41 c	79.8 a	146 c	4.2 b	4.3 a
	2006	822 c	24.2 c	49 c	72.8 c	164 b	3.6 c	3.8 b

[z]Values within subcolumns having similar letters are not statistically different ($P \leq 0.05$).
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Elderberry Research

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Elderberry Research

Pruning and Pest Management

Eriophyid mite

Bacterial leaf spot

Elderberry Research

Pruning Studies, 2000-2006

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Elderberry Research

- **Annual pruning to the ground**
  - All shoots arise from crown or root system
  - Shoots are typically unbranched and produce a single large cyme at the tip; cyme production at a uniform height
  - concentrated harvest over 2-3 weeks

Elderberry Research

- Advantages of annually pruning to the ground vs. other pruning practices
  - Shorter plants
  - Development of fruiting cymes at uniform height in the plant
  - More concentrated harvest
  - Fewer and larger cymes

Elderberry Research

Leaf Elemental Study, 2006

Table 1. Elemental status of foliar tissue of three American elderberry genotypes, collected at three growth stages at two Missouri sites

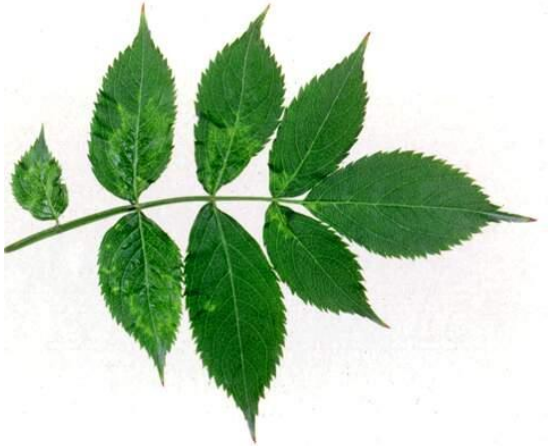
Site (S)		N (%)	P (%)	K (%)	Ca (%)	Mg (%)	Fe (ppm)	Cu (ppm)	Zn (ppm)	Mn (ppm)	B (ppm)
	Mount Vernon	3.80a	0.307b	2.50b	1.125b	0.452b	65.99a	7.33a	22.47a	122.67a	41.29b
	Mountain Grove	3.50b	0.320a	2.70a	1.245a	0.491a	65.02a	7.10a	19.32b	107.30b	44.45a
Genotype (G)											
	Bob Gordon	3.79b	0.334a	2.66a	1.296a	0.483a	68.41a	7.79a	24.96a	163.48a	51.18a
	Netzer	3.87a	0.329a	2.61a	1.118b	0.457b	65.35b	6.88a	18.58b	97.60b	43.92b
	Adams 2	3.28c	0.277b	2.52b	1.142b	0.474a	62.76c	6.97a	19.16b	83.88c	39.50c
Collection Stage (C)											
	Spring flush	4.47a	0.386a	2.82a	0.979b	0.379c	71.78a	7.060b	24.23a	147.29a	32.20c
	Anthesis	3.58b	0.312b	2.87a	0.981b	0.432b	61.41c	8.818a	19.64b	89.54c	39.58b
	Fruit ripening	2.90c	0.242c	2.10b	1.596a	0.604a	63.33b	5.768c	18.83b	108.13b	62.81a
Tissue (T)											
	New shoots	3.80a	0.330a	2.71a	1.172a	0.470a	65.39a	7.22a	22.04a	122.15a	44.41a
	Old shoots	3.50b	0.296b	2.48b	1.198a	0.473a	65.62a	7.21a	19.76b	107.82b	45.32a

Means within columns with the same letters are not significantly different at the P≤0.05 level

Elderberry Research

- Pest management studies
  - Eriophyid mite (Michele Warmund)
  - Japanese beetle (Jaime Pinero)
  - Rust and other diseases (Michele Warmund)
  - Virus issues (Bob Martin)

Eriophyid mites on elderberry



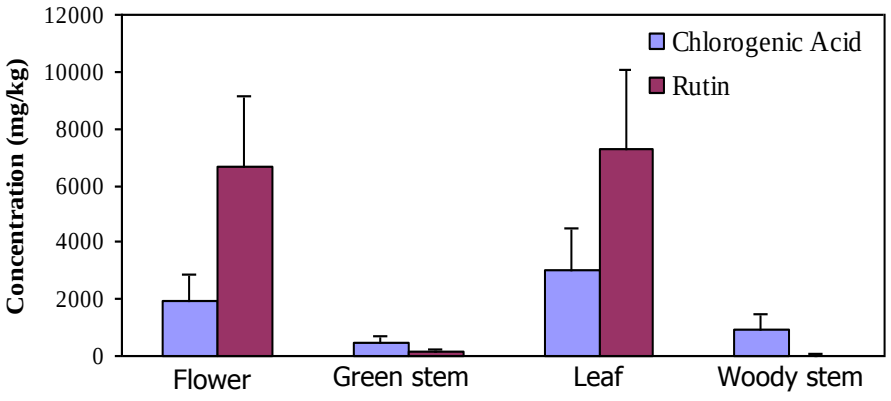
Virus symptoms on elderberry

Elderberry Research

- Elderberry antioxidant studies
  - Juice studies
  - Antioxidants in plant parts
  - Others looking at a range of human ailments and elderberry
- DNA analysis of elderberry species, cultivars, and wild selections

Elderberry Research

Figure 1. Concentrations of Chlorogenic Acid and Rutin in Various Elderberry Tissues



Concentrations of Chlorogenic Acid and Rutin in Green Stem and Leaf Collected at Two Harvest Times

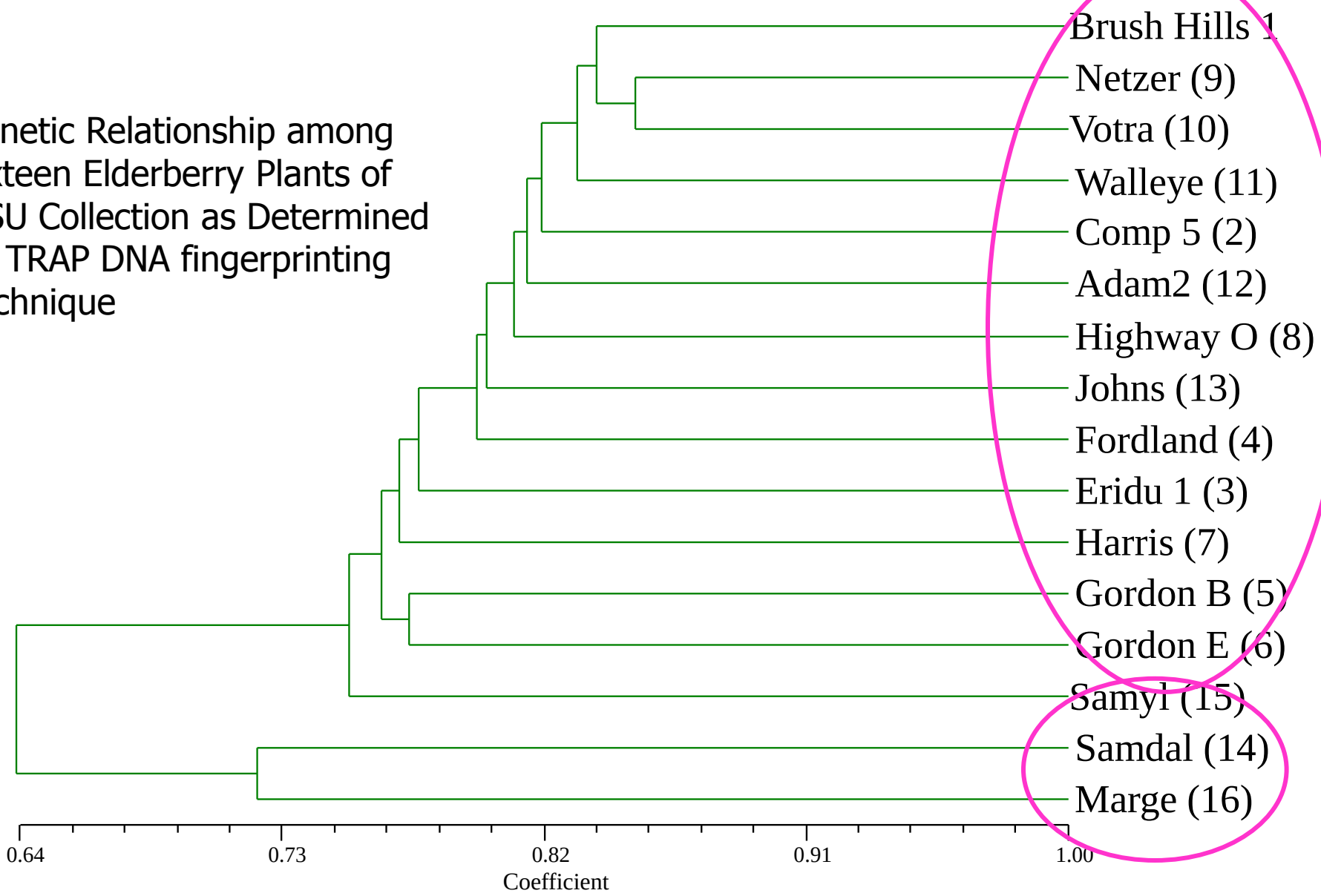
	Chlorogenic Acid (mg/kg)		Rutin (mg/kg)	
Green Stem	Mean	SD	Mean	SD
Early June	461	233	169	100
Early August	414	190	125	95
Leaf				
Early June	3422	1124	7614	1673
Early August	2608	1379	6953	1495

Elderberry Research

Levels of Anti-oxidants from Nine Elderberry Genotypes at Two Missouri Sites across Three Growing Seasons

Genotype	Chlorogenic acid (ppm)	Neo-chlorogenic acid (ppm)	Crypto-chlorogenic acid (ppm)	Rutin (ppm)	Isoquercitrin (ppm)	Kaempferol 3-rutinoside (ppm)	Isorhamnetin 3-rutinoside (ppm)	Isorhamnetin 3-glucoside (ppm)
Bob Gordon	47.2 bc	33.6 ab	4.46 b	212.7 bc	25.59 ab	18.26 a	62.34 d	0.50 a
Dallas	32.5 cd	22.3 bcd	7.54 b	180.4 bcd	25.91 ab	25.98 a	42.22 d	13.32 a
Marge	76.4 b	22.5 bcd	2.89 b	392.2 a	29.97 a	23.25 a	236.29 a	2.50 a
Ocoee	78.9 b	23.0 bc	8.05 b	260.7 b	8.44 cd	16.91 a	60.70 d	0.83 a
Ozark	135.7 a	51.8 a	20.35 a	133.7 cd	24.82 ab	20.61 a	117.33 c	4.55 a
Ozone	33.9 cd	12.7 bcd	4.86 b	188.6 bcd	7.20 cd	29.60 a	175.98 b	2.81 a
Sperandio	7.6 d	0.0 d	0.09 b	98.6 d	4.20 d	10.00 a	44.77 d	0.00 a
Wyldewood	38.0 cd	19.3 bcd	4.70 b	198.0 bc	20.49 abc	11.87 a	19.70 d	0.00 a
York	6.14 d	0.1 cd	1.11 b	138.5 cd	12.62 bcd	23.68 a	123.25 c	4.95 a
Mean	51.8	21.7	6.19	201.0	18.39	19.95	95.44	3.31

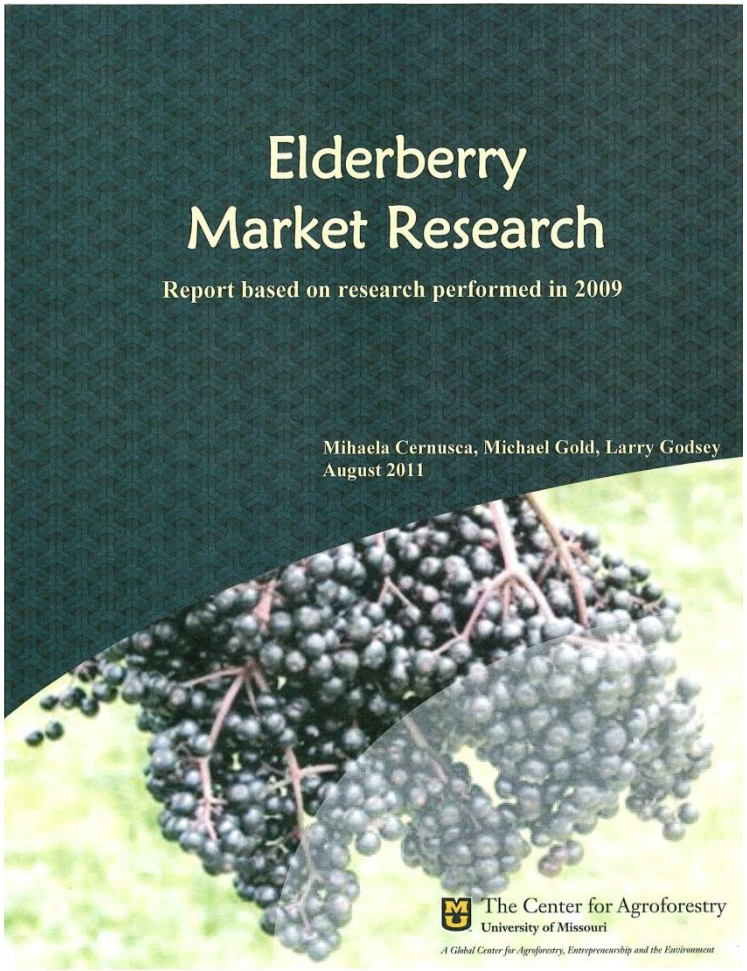
Genetic Relationship among Sixteen Elderberry Plants of MSU Collection as Determined by TRAP DNA fingerprinting Technique



Elderberry Research

- 2013 First International Elderberry Symposium
  - June 9-14, 2014 in Columbia, MO
  - Scientists and farmers from 13 countries
  - 205 attendees: Scientists, Processors, Farmers

Elderberry Research



- Economics and marketing http://www.centerforagroforestry.org/profit/elderberrymarketreport.pdf

Elderberry Outreach

AGROFORESTRY IN ACTION

University of Missouri Center for Agroforestry

AF1017 - 2012

Growing and Marketing Elderberries in Missouri

By Patrick L. Byers, Andrew L. Thomas, Mihaela M. Cernusca, Larry D. Godsey and Michael A. Gold; University of Missouri.

The American elderberry (*Sambucus canadensis*, also known as *Sambucus nigra* subsp. *canadensis*) is native to much of eastern and midwestern North America. The plant is a medium to large multiple-stemmed shrub, bush or small tree (Fig. 1). Elderberry

Figure 1: The American Elderberry plant

is commonly found growing in a range of habitats throughout Missouri, but it prefers moist, well-drained, sunny sites and is often found along roadside ditches and streams. Elderberry is a beautiful plant with showy flat cymes of white flowers in June followed by bright purple to black berries in late summer (Figures 2 and 3). Ornamental forms are important landscape plants, and elderberry has been grown for generations as a backyard fruit. Based on identified market size and demand, opportunities exist to increase both the production and processing of elderberry across the value chain. At present, usage of both fruit and flowers for wine, juice, jelly, colorant and dietary supplement

Figure 2: The blossoms of the American elderberry

products is on the rise. European elderberry (*Sambucus nigra*) is grown as a commercial fruit crop in Europe and elsewhere. The American elderberry, however, appears to be a better candidate for commercial production in Missouri. This guide outlines production practices and market information for American elderberry based on research and growers' experiences in Missouri.

Figure 3: The fruit of the American elderberry

1 www.centerforagroforestry.org

- Growing and Marketing Elderberries in Missouri http://extension.missouri.edu/explorepdf/agguides/agroforestry/af1017.pdf
- Video: http://www.youtube.com/watch?v=ebYtzcnbVoE

Elderberry Research

- Future directions
  - Continue collection of superior native germplasm
  - Name and release superior selections
  - Additional cultural studies – fertility management, insect and disease management
  - Additional DNA studies
  - Mechanization of elderberry production
  - Economic analyses
  - Cooperative work with elderberry and health research
  - Identify funding sources for comprehensive breeding project
  - Identify additional collaborators

Bacterial leaf spot

Eriophyid mite

Elderberry Research

- We appreciate funding from:
  - 2004. $15,000. USDA – NPGS
  - 2004. $16,150. USDA – NWCSFR
  - 2005. $17,765. USDA – NWCSFR
  - 2005. $9,300. MU College of Agriculture
  - 2010. $29,611. MDA Specialty Crops
  - 2010. $105,427. SARE
  - 2010. $7.7 million. NIH
  - 2011. $25,000. USDA / AFRI (Symposium)
  - 2011. $30,000. MDA Specialty Crops (Symposium)
  - 2011. $5,000. Mizzou Advantage (Symposium)
  - $$ MU Agroforestry Center

Elderberry Phenology

- Budbreak – February-March
- Blossoming – 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

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’

Elderberry Culture

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

‘Bob Gordon’

‘Wyldewood’

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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?

Collecting elderberry hardwood cuttings

Field nursery production

Bed nursery production


Hardwood cuttings in cell packs

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


Newly established elderberry planting

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?

Elderberry Culture

- Pruning
  - Selective removal of older shoots

Elderberry Culture

- Fertilization
  - Nitrogen
    - 60-80 lb/acre (4x12 spacing)
    - Apply as growth begins
  - Other nutrients?
  - Foliar sampling to monitor nutrition?

Elderberry Culture

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

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

Elderberry Culture

- Pest management
  - Eriophyid mite

Eriophyid mite

Borer

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?

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

Elderberry Culture

- Pest management
  - Spotted Wing Drosophila

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, but not for SWD (except for Delegate)

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 (2ee)	spinetoram	1	7
	Entrust (organic)	spinosad	1	3-5
pyrethrum	Pyganic (organic)	pyrethrum	0	2
combination	Azera			

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#
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.
Estimated residual activity from experience with other insect pests in Michigan and from SWD studies in Oregon.

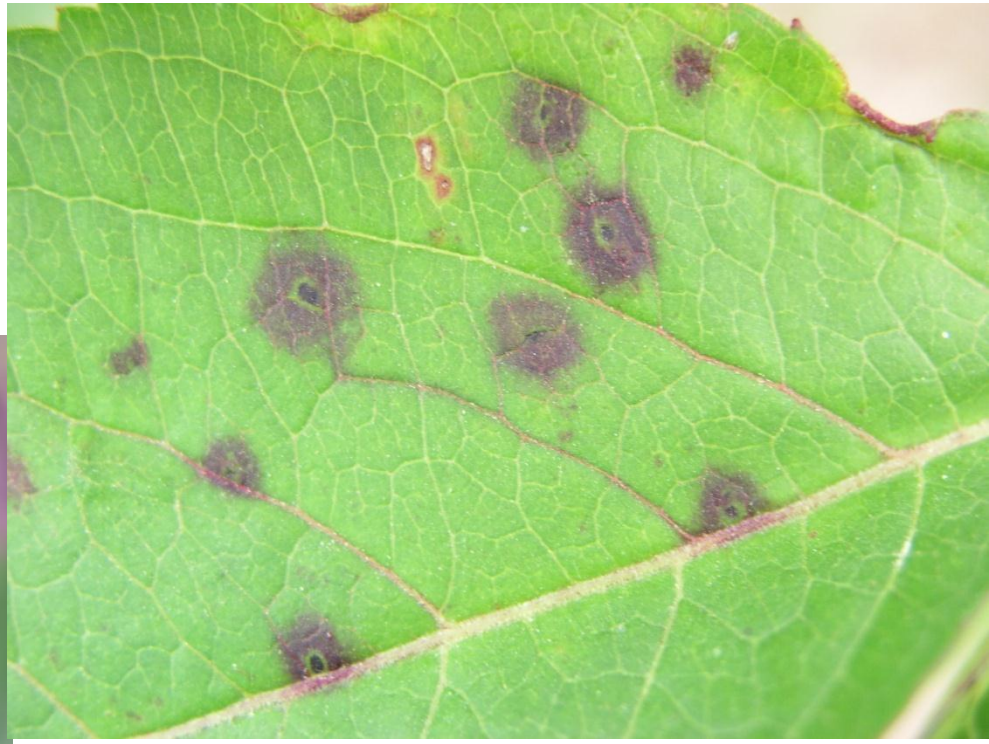
Source: http://www.ipm.msu.edu/uploads/files/SWD/ManagementRecommendations-RaspberryBlackberrySep2012.pdf

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*)



Bacterial leaf spot

Elderberry Culture

- Pest management
  - Fungal leaf spot

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?

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

Postharvest Handling

- 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

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Elderberry Culture

Terry Durham's Destemmer

Elderberry Culture

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

Site	# Samples	°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

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 - ?

Development of Missouri's Elderberry Industry

- Snapshot
  - 1997 – no known commercial elderberry production in Missouri
  - 2013 – estimated 100+ acres of commercial elderberry in Missouri
  - 2013 - conservative estimated value of over $140,000 annually for the raw fruit alone

Development of Missouri's Elderberry Industry

- Where do our elderberries go?
  - Health supplements
  - Wine
  - Jelly and jam
  - Juice
  - Other uses
- Do we need more fruit? The general thought is yes, but…

Industry Development

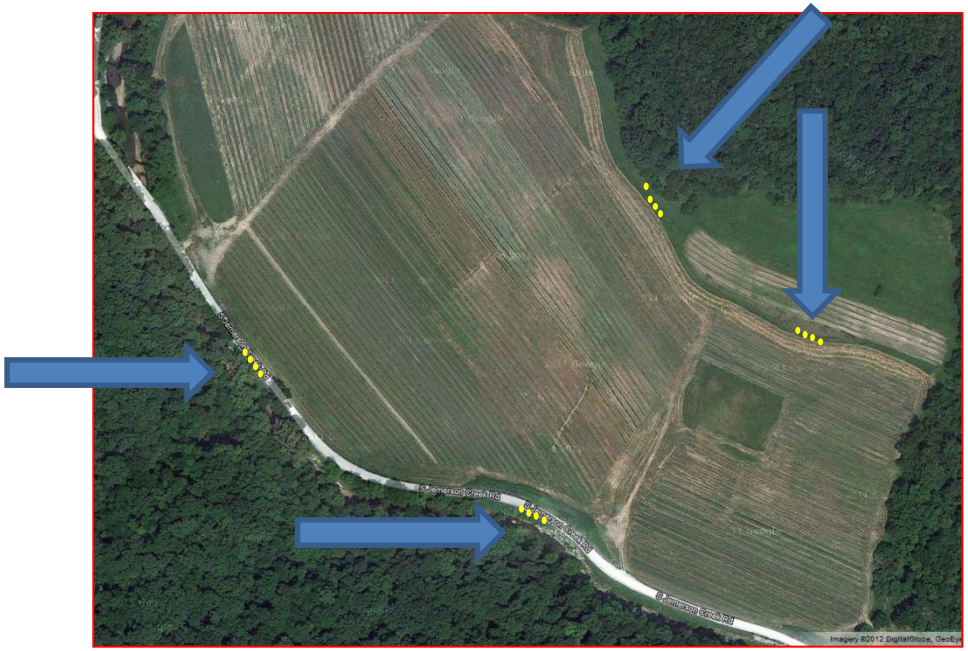
- Growth of the elderberry industry in Missouri is the result of a partnership among innovative farmers/processors and researchers, with a common goal…to build an industry where none was before!

Terry Durham

Industry Development

- Contributions from researchers
  - Answer basic questions of interest to farmers:
    - Cultural practices
    - Pest management
    - Economics
  - Develop cultivars adapted to Missouri conditions
  - Publications – research and outreach
  - Provide outreach activities to promote elderberry

Japanese beetle mass trapping study

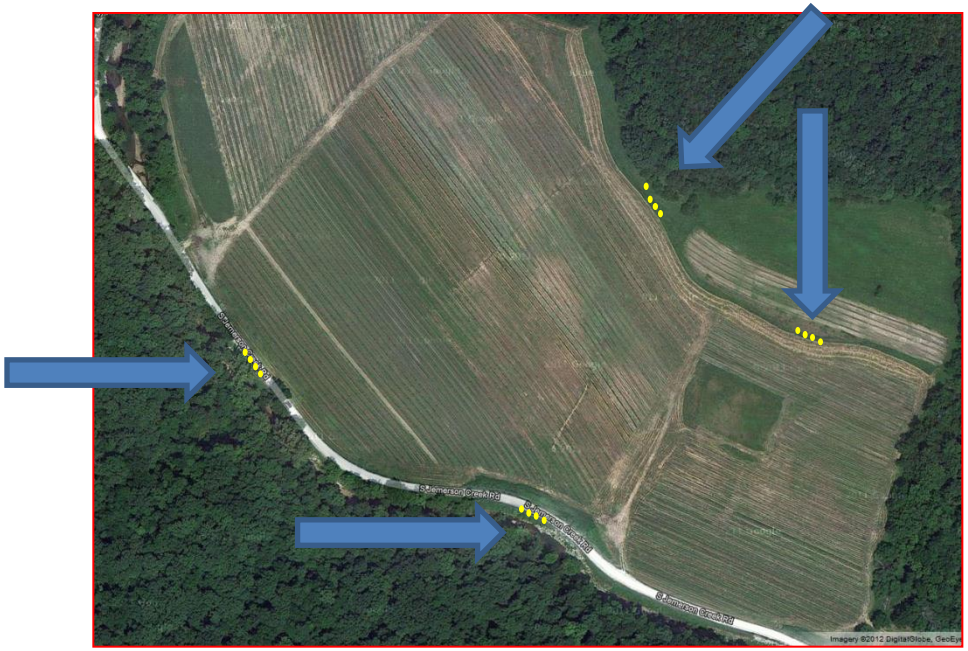


JB trap locations at Eridu Farm

Industry Development

- Contributions from growers
  - Research support
    - Providing expertise to advisory and planning committees
    - Providing letters of support for research proposals
    - Offering farms as research sites
    - Reviewing publications
  - Outreach support
    - Hosting educational workshops
    - Reviewing publications
  - Promotion
    - Hosting elderberry festivals
  - Pursuing grant funding
  - Sharing expertise

Japanese beetle mass trapping study



JB trap locations at Eridu Farm


2013 International Elderberry Symposium

Industry Development

- Elderberry growers' organizations
  - Voice for elderberry industry
  - Voice for elderberry research
  - Tool for sharing information and experiences
  - Mutual support

Challenges to Missouri's Elderberry Industry

- Additional research is urgently needed
  - Cultivar development
  - Cultural management
  - Weed control
  - Pest management, especially eriophyid mites, SWD, rust and BMSB
  - Mechanization
- Additional economic research is needed

Challenges to Missouri's Elderberry Industry

- Standardization of the elderberry nursery industry is needed
  - Critical to develop a consistent supply of uniform plants
  - Important for processed products, especially health supplements

Challenges to Missouri's Elderberry Industry

- Market development is critical – at present Missouri's elderberry production is small scale, and is sold to a handful of small scale processors…
  - Growers are vulnerable to market changes
  - Processors have a limited supply of fruit
  - Fruit supply is not consistent
    - Need quality standards
    - Need universally accepted descriptors

Challenges to Missouri's Elderberry Industry

- Promotion of all aspects of elderberry is an ongoing need
  - Necessary to build interest in elderberry as a viable crop
  - Necessary to build markets for elderberry products

Comments or Questions?

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