

Elderberry Research and Development in Missouri



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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



Elderberry Uses



- Fruit
 - Culinary uses
 - Dried in energy bars, fruit mixes
- Juice
 - Colorant
 - Medicinals - concentrate, extract, tincture and syrup
 - Jams, jellies
 - Vinegar
 - Wines, meads and spirits
 - Enhanced waters, juice blends, other drinks
- Blossoms
 - Flavoring for wines, enhanced waters
 - Teas
- Wildlife habitat



Elderberry Uses



- Ornamental/landscape uses



Sambucus nigra "Black Lace"

Elderberry



- Previous work
 - Improved cultivars
 - New York cultivars
 - Adams 1 (1926)
 - Adams 2 (1926)
 - Ezyoff (1938)
 - York (1964)
 - Canada cultivars
 - Johns (1954)
 - Nova (1960)
 - Scotia (1960)
 - Kent (1960)
 - Victoria (1960)
 - Cultural studies



Adams 2

Elderberry



- Justification for the project
 - 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 Improvement Project initiated in 1997
- Cooperators:
 - Patrick Byers, University of Missouri
 - Andrew Thomas, University of Missouri
 - John Avery, Missouri State University
 - Chad Finn, USDA-ARS, Oregon
 - Penelope Perkins-Weazie, NCSU
 - Hwei-Yiing Johnson, Lincoln University
 - Sanjun Gu, Lincoln University
 - Jaime Pinero, Lincoln University
 - Bill Reid, Kansas State University
 - Bob Martin, USDA-ARS, Oregon
 - Martin Kaps, Missouri State University
 - Staff of the MU Center for Agroforestry
 - John Brewer and Margaret Milliken, Wyldewood Cellars
 - Terry Durham, Eridu Farm



Elderberry Research



- The project has three components:
 - Collection of native elderberry germplasm, replicated evaluation of superior native germplasm, and development of improved cultivars
 - Cultural studies
 - Antioxidant content studies and genetic relationship studies
- The project has several research sites:
 - Mount Vernon, MO (University of Missouri)
 - Mountain Grove, MO (Missouri State University)
 - Jefferson City, MO (Lincoln University)
 - Corvallis, OR (USDA-ARS)
 - Additional cooperators

Elderberry Research and Development in Missouri



Elderberry Research



- Collection of native germplasm: 1997 to present
 - Gathered available commercial cultivars
 - Obtained selections from KSU and John Brewer
 - Publicized the project, and asked for superior plants from the public
 - Collection trips

Elderberry Research



- The elderberry collection – 2010 – 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



- Investigations with native elderberry germplasm: 1998 to present
 - Phenology and plant growth
 - Harvest date
 - Yield, cyme size, berry size
 - Fruit quality
 - Disease and insect problems



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
 - Planting 2: 2008-2011
 - 6 advanced selections, 3 commercial selections (York, Wyldewood, Bob Gordon)
 - 3 sites – MG, MV, and Lincoln University



Elderberry Research



- Replicated evaluation of superior native germplasm
 - Data collection
 - Phenology and plant growth
 - Insect and disease problems
 - Cyme yield, cyme size, berry yield, berry size
 - Juice parameters
 - Antioxidant levels



Elderberry Research



- Replicated evaluation of superior native germplasm
 - 2 named cultivars described and released
 - 'Bob Gordon'
 - 'Wyldewood'



Elderberry Research

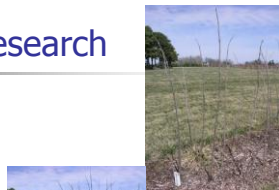


- Replicated evaluation of superior native germplasm
 - Genotype x environment study of performance at 3 sites
 - Elderberry is sensitive / responsive to environment, including year, and interactions
 - Cultivars must be tested at locations



Elderberry Research

- Cultural studies
 - Pruning (2000-06)
 - Annual removal of all shoots
 - Removal of all shoots every 2 years
 - Horticultural pruning
 - No pruning



No pruning

Elderberry Research

Table 1. Elderberry yields and pest response from plantings at Mountain Grove (MG) and Mt. Vernon, MO, 2002 to 2006

		Mean fruit yield per plant (g)	Mean # cymes per plant	Mean weight per cyme (g)	Single berry weight (mg)	Eriophyid mites ^y	Bacterial leafspot ^y
Site	MG	1400 a ^z	36.6 a	51 b	67.4 b	3.82 b	3.51 b
	MV	806 b	13.6 b	67 a	90.0 a	4.43 a	4.76 a
Cultivar	Gordon B	1856 a	37.1 a	87 a	86.0 a	4.33 a	4.14 a
	Adams 2	647 b	21.6 b	36 c	63.2 c	3.63 b	3.76 b
	Netzer	414 c	14.5 c	53 b	80.2 b	4.20 a	4.12 a
Pruning Trt	Annual	855 b	10.4 c	86 a	77.5 a	3.99 a	4.05 a
	Bi-annual	1085 a	26.7 b	61 b	75.1 a	4.02 a	4.14 a
	Selective	1086 a	31.6 a	48 c	76.9 a	4.11 a	3.92 a
	Unpruned	940 b	30.1 ab	42 c	76.1 a	4.12 a	3.91 a
Year	2002	423 d	5.9 d	95 a	--	--	--
	2003	1034 b	33.2 b	41 c	--	--	--
	2004	1369 a	22.6 c	68 b	76.5 b	4.83 a	3.94 b
	2005	1307 a	39.0 a	41 c	79.8 a	4.16 b	4.27 a
	2006	822 c	24.2 c	49 c	72.8 c	3.57 c	3.78 b

^z Values within sub-columns having similar letters are not statistically different ($P \leq 0.05$)

^y Scale 1 to 5: 1 = severe damage; 5 = no damage

Elderberry Research

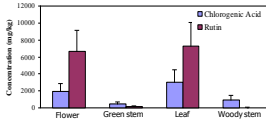
- Cultural studies
 - Leaf foliar nutrient content (2006)
 - Nitrogen fertilization (2007-09)



Elderberry foliar samples

Elderberry Research

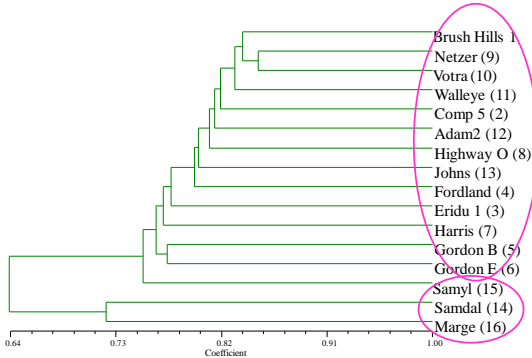
Figure 1. Concentrations of Chlorogenic Acid and Rutin in Various Elderberry Tissues



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

	Chlorogenic Acid (mg/kg)		Rutin (mg/kg)	
	Mean	SD	Mean	SD
Green stem				
Early June	200	210	140	200
Early August	110	190	120	150
Leaf				
Early June	1400	1100	1600	1600
Early August	2000	1700	1900	1800

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

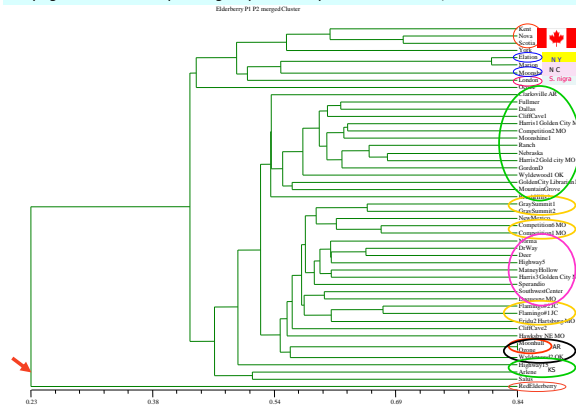


Elderberry Research

- Elderberry antioxidant studies
 - Juice studies (Dr. Perkins-Veazie)
 - Non-fruit studies
- DNA analysis of elderberry species, cultivars, and wild selections
 - TRAP studies (Dr. Johnson)



Phylogenetic Relationship among Fifty Elderberry Plants Based on 1,135 TRAP Markers



Elderberry Research

- New projects (funded)
 - Elderberry pest complex studies
 - Mite studies
 - Virus studies
 - Elderberry fertility management

Elderberry Research

- Future directions
 - Continue collection of superior native germplasm
 - Name and release superior selections
 - Enter superior selections into the germplasm repository system
 - Additional cultural studies – fertility management, insect and disease management
 - Additional DNA studies
 - Mechanization of elderberry production
 - Economic analyses
 - Identify funding sources for comprehensive project
 - Identify additional collaborators



Bacterial leaf spot



Eriophyid mite



Elderberry Research

- We appreciate the support of:
 - University of Missouri
 - Missouri State University
 - Lincoln University
 - USDA-ARS
 - Kansas State University

Elderberry Research

- We appreciate funding from:
 - USDA National Plant Germplasm System
 - Northwest Center for Small Fruit Research
 - MSU Office of Environmental Safety
 - MU Center for Agroforestry
 - Missouri Department of Agriculture



Elderberry Research

- We also appreciate the support of the staff at MSU State Fruit Experiment Station and the MU Southwest Center



2004 Elderberry harvest crew



Elderberries in Missouri

- River Hills Elderberry Growers Association



Terry Durham



Elderberries in Kansas

- John Brewer and Marge Milliken
 - Wyldewood Cellars, Mulvane, KS



John Brewer and Marge Milliken



Elderberry Interest Sites

- North American Elderberry Alliance
 - Mission to "increase the awareness of elderberry through research and promotion"
 - Website for North American Elderberry Alliance <http://elderberryalliance.org/> (under development)
- Riverhills Elderberry Producers <http://riverhillsharvest.com/>
- ElderberryNic site http://www.msue.msu.edu/portal/default.cfm?pageset_id=260250&page_id=429827&msue_portal_id=25643

Elderberry Summits/Meetings

- Elderberry Summits
 - 2008: Quebec
 - 2009: Maine
 - 2010: Missouri
- Eridu Farm Field Days
 - June 9-12, 2011

Elderberry

- Any Questions?
- To contact us:
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Elderberry Research

Publications

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