The Englishman's Grape

Sambucus (Elderberry and Elderflower)

May 18, 2023

Topics for today

- The Farm
- Cultivation in Florida
- Importation
- The History of Elder and Wine
- Nutraceutical Quality
- NIFA SBIR Grant Project
- Elderberry Wine

The Farm

The Farm

30 acres

The Farm

1st 13 varieties (SARE)

2018 (October)

The Farm

2 acres (NIFA)
4 focus, + 8 additional

2022 (December 10th)

The Farm

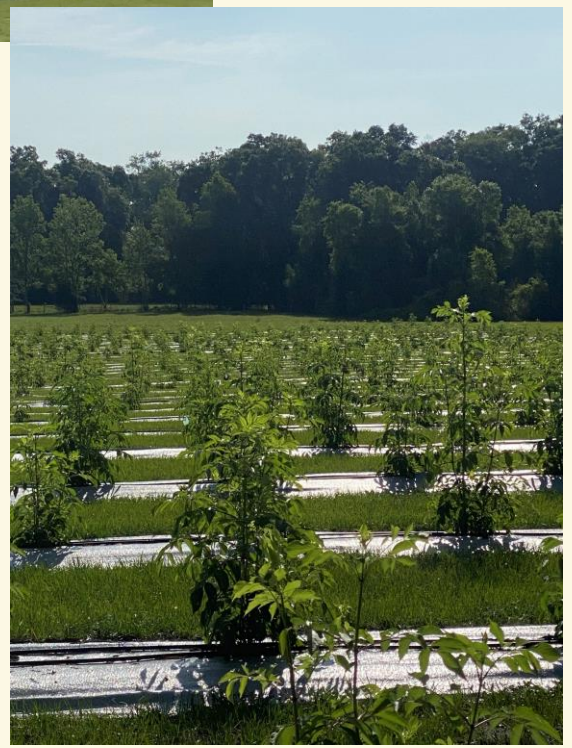
Minimal till and
minimal equipment

The Farm

The Farm

The Farm

- 6,000 linear feet of row / 1,200 plants / 2 acres
- 12 varieties + 20 - 24 seedlings from each variety



Cultivation in Florida

Cultivation in Florida

www.HyldemoerFarms.com

"Research and Publications"

Elderberry and Elderflower (Sambucus spp.):
A Cultivation Guide for Florida

https://edis.ifas.ufl.edu/pdf\HS\HS139000.pdf

Cultivation in Florida

UF IFAS Extension

HS1390

Elderberry and Elderflower (*Sambucus* spp.): A Cultivation Guide for Florida[1]

David Jarnagin, Ali Sarkhosh, Juanita Popenoe, Steve Sargent, and Kevin Athearn[2]

Elderberry, *Sambucus* spp., has long been cultivated or collected from the wild by humans for both food and medicine. Europeans have used the flowers and fruit of *Sambucus nigra* for thousands of years, while Native Americans and European immigrants used *Sambucus nigra* ssp. *canadensis*, native to the New World (Figure 1).

Figure 1. Elderberry and elderflower cymes.
Credits: Hyldemoer + Co, Florida

The purpose of this paper is to provide information on growing American elderberry in Florida as an alternative crop for commercial growers as well as homeowners. Although elderberry has been historically grown at commercial scale in some world regions, especially throughout Europe, in the New World it has not found meaningful commercial acceptance until recently. It has typically been more of a small-scale or backyard crop in the United States, possibly because of the challenges of harvest and postharvest processing and reports of the toxic nature of parts of the plant.

Pushes for commercial cultivation were initiated in various regions of North America in the 1920s and again in the 1960s, but the most recent iteration of commercial cultivation over the last 10 to 15 years has outpaced the previous attempts considerably. The high levels of antioxidants and health benefits of the fruit have created new demand for the fruit and flowers, and this new demand may provide an alternative crop opportunity for Florida growers with many value-added possibilities. A native species grows wild throughout Florida, indicating that this may be a perennial crop that can be sustainably grown on marginal land. However, the native Florida plants have many drawbacks compared to the more commonly cultivated forms originating from farther north, and these drawbacks are an important consideration for proper establishment on a commercial scale. The fruit and flowers of the elder are used for wine, preserves, tinctures, teas, brewing and distilled spirits, and dyes for both food and textiles. The anthocyanins in the fruit have been found to have higher antioxidant properties than vitamin E or C as well as antiviral activity owing to a variety of phytochemical compounds. Different growing conditions may cause more variability in fruit and flower compositional quality than varietal differences, making cultivation techniques and environment important factors.

1. This document is HS1390, one of a series of the Horticultural Sciences Department, UF/IFAS Extension. Original publication date October 2020. Visit the EDIS website at https://edis.ifas.ufl.edu for the currently supported version of this publication.

2. David Jarnagin, Hyldemoer + Co.; Ali Sarkhosh, assistant professor and Extension specialist, Horticultural Sciences Department; Juanita Popenoe, multicounty commercial fruit production agent IV, UF/IFAS Extension Lake County; Steven Sargent, professor and postharvest Extension specialist, Horticultural Sciences Department; Kevin Athearn, regional Extension specialized agent, UF/IFAS North Florida Research and Education Center - Suwannee Valley; UF/IFAS Extension, Gainesville, FL 32611.

Economics

www.HyldemoerFarms.com

"Research and Publications"

Elderberry and Elderflower (Sambucus spp.):
Markets, Establishment Costs, and Potential Returns

https://edis.ifas.ufl.edu/pdf/FE/FE109300.pdf

Economics

- 3 acres,
- organic,
- minimum of equipment,
- no previously established operational capacity.

UF IFAS Extension

FE1093

Elderberry and Elderflower (*Sambucus* spp): Markets, Establishment Costs, and Potential Returns[1]

Kevin Athearn, David Jarnagin, Ali Sarkhosh, Juanita Popenoe, and Steven Sargent[2]

Introduction

This publication is part of a series on elderberry production in Florida. Other publications in the series cover cultivation practices and phytochemical research. The focus of this document is on markets, establishment costs, and potential returns for commercial elderberry production in Florida. Cost and return estimates are based on a 3-acre elderberry orchard following organic standards. The information is intended to assist farmers in evaluating elderberry as a possible alternative crop and to aid in financial planning for an elderberry enterprise.

Wild and cultivated varieties of the elderberry plant grow in many parts of the world. The American elderberry, *Sambucus nigra* ssp. *canadensis*, is native to eastern North America (Charlebois et al. 2010). The native Florida type was formerly separated as its own species *S. simpsonii* and exhibits substantial differences from commonly cultivated varieties of *S. nigra* ssp. *canadensis* and European *S. nigra*. Varietal differences can include growth habit, fruiting habit, harvest time, disease resistance, fruit and flower quality, and other factors affecting crop management and commercial potential (Jarnagin et al. 2020). Prospective growers are encouraged to seek advice from specialists or experienced growers in Florida regarding varietal selection.

Elderberry products have established commercial value, but Florida production is currently limited to a small, cottage industry. Elderberry is an alternative crop that holds promise for further commercial development in Florida. This publication reviews information on markets for elderberries and elderflowers (Figure 1) and estimates establishment costs and potential returns for a 3-acre elderberry orchard managed organically in Florida. Information about cultural practices can be found in another publication, *Elderberry and Elderflower (Sambucus spp): A Cultivation Guide for Florida*.

Figure 1. Elderflower and elderberry cymes.
Credits: Hyldemoer + Co., Florida

Market Potential

The elderberry plant can provide numerous marketable products. Berries and flowers are the two primary products sold, but leaves, bark, roots, wood, and cuttings from

1. This document is FE1093, one of a series of the Food and Resource Economics Department, UF/IFAS Extension. Original publication date March 2021. Visit the EDIS website at https://edis.ifas.ufl.edu for the currently supported version of this publication.

2. Kevin Athearn, UF/IFAS Extension regional specialized agent, UF/IFAS North Florida Research and Education Center, Suwannee Valley; David Jarnagin, Hyldemoer + Co.; Ali Sarkhosh, assistant professor and Extension specialist, Horticultural Sciences Department; Juanita Popenoe, UF/IFAS Extension multi-county commercial fruit production agent, UF/IFAS Extension Lake County; Steven Sargent, professor and Extension postharvest specialist, Horticultural Sciences Department; UF/IFAS Extension, Gainesville, FL 32611.

Cultivation in Florida

Genus: *Sambucus*
within family: *Viburnaceae* or *Adoxaceae*

formerly *Caprifoliaceae* (honeysuckle)

Cultivation in Florida

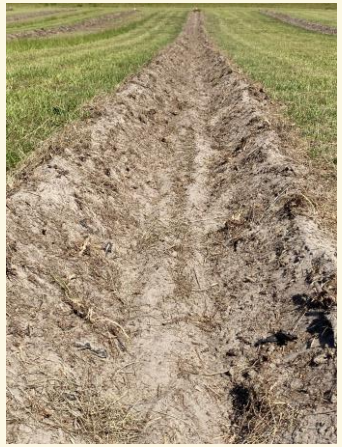
S. canadensis, S. simpsonii, S. nigra,... others?

Cultivation in Florida

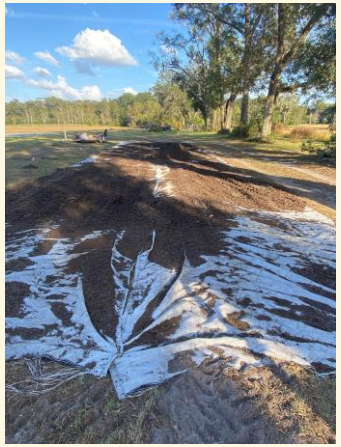
Propagation

Furrow / media method



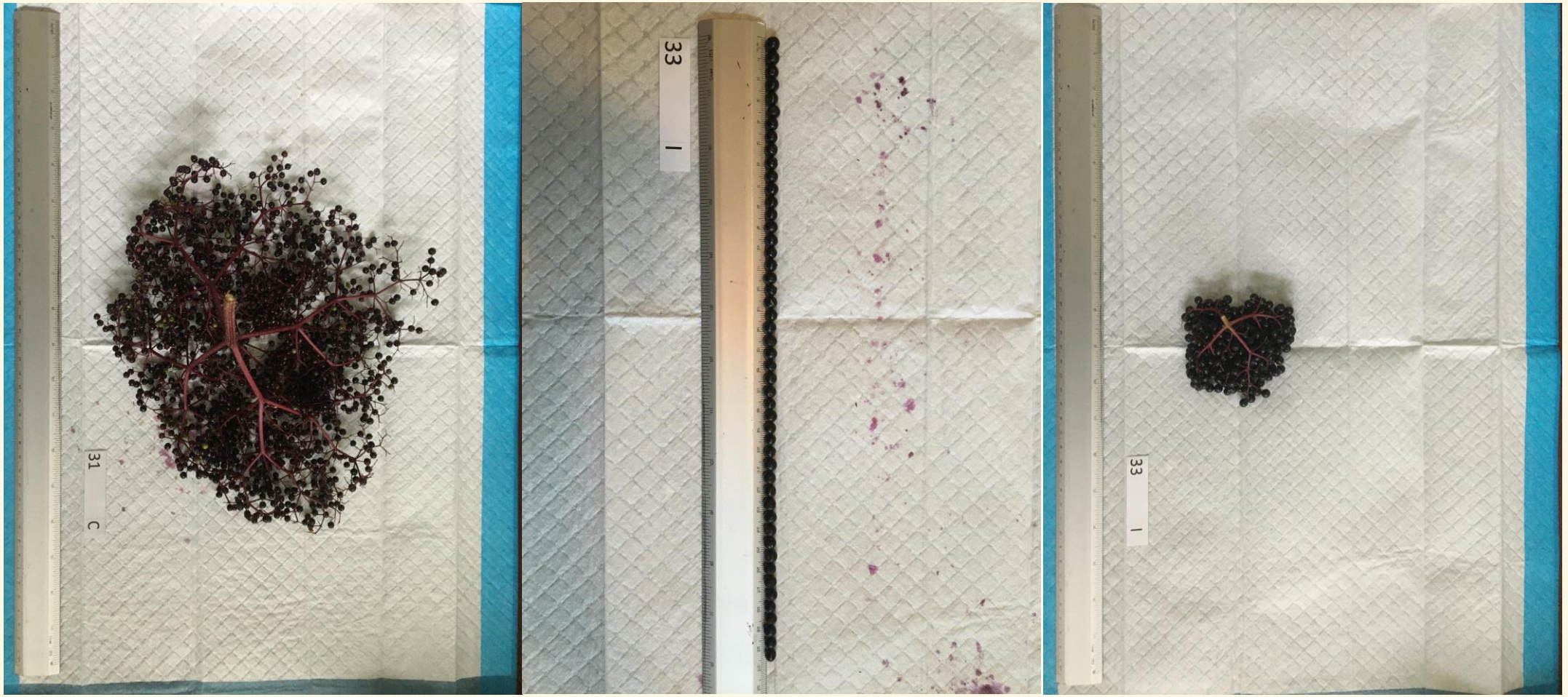





Cultivation in Florida

Harvest (and postharvest)

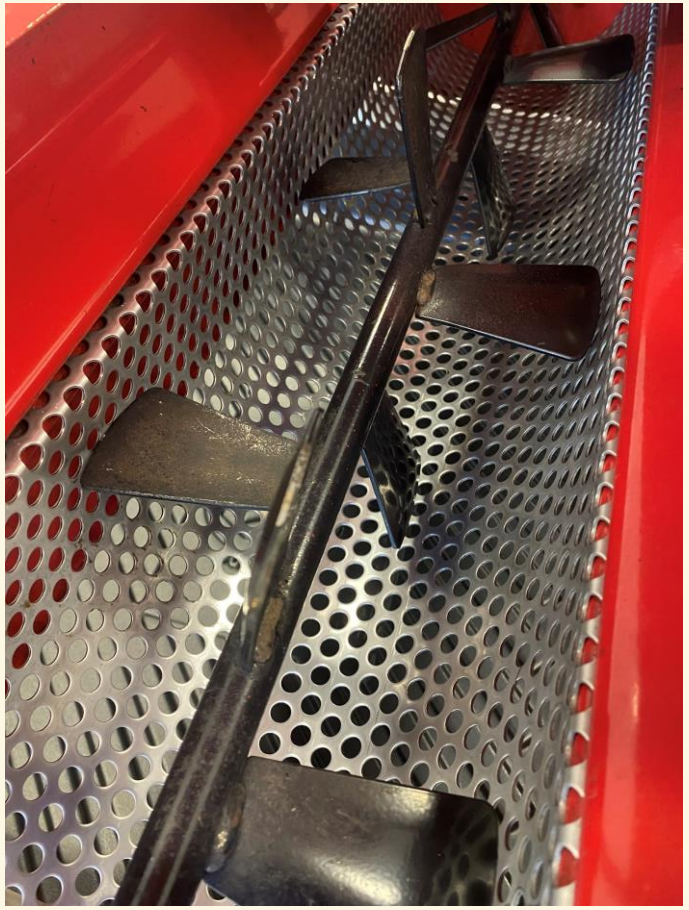


Cultivation in Florida

Harvest (and postharvest)

Cultivation in Florida

Harvest (and postharvest)



Cultivation in Florida

Harvest (and postharvest)




Importation

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+95% of the elderberry consumed in the US is imported

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Approximately 11% of samples failed to be identified as pure elderberry in recent investigations ~ *American Botanical Council 2021*

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~~Approximately 11% of samples failed to be identified as pure elderberry in recent investigations ~ *American Botanical Council 2021*~~

ONLY 32% of samples were authenticated as pure elderberry in a more recent investigation! ~ https://www.sciencedirect.com/science/article/abs/pii/S0889157522002022 July, 2022

Importation

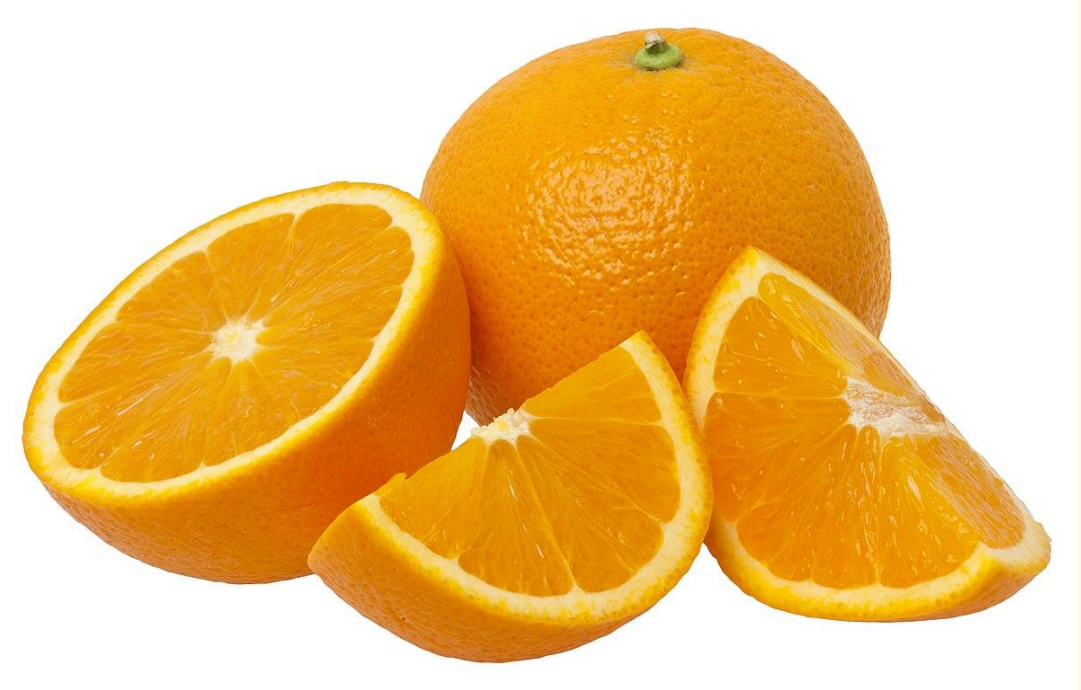
Austria, Germany, Hungary and Bulgaria...
(90% or more of Hungary's elderberry goes to the production of red food colorants used in the EU)

Denmark, Turkey, Romania, UK (elderflower)

Importation

Extracts. What's the difference?

Importation



Importation

The History of Elder and Wine

The History of Elder and Wine

Arsenic and Old Lace, 1944 starring Cary Grant

The History of Elder and Wine

Elderberry Wine from Elton John's 1973 album *Don't Shoot Me I'm Only the Piano Player*

The History of Elder and Wine

3000 B.C.E – 30 B.C.E: Egypt: Recipes for elderberry-based preparations appear in records of Ancient Egypt. Egyptians included medicinal herbs in wines up to 5,000 years ago.

2000 B.C.E: Stone Age: Seeds from elderberry found in Neolithic dwellings in Switzerland suggest that the plant was in cultivation.

The History of Elder and Wine

400 B.C.E: Hippocrates – Greece: The "father of medicine", Hippocrates (460 B.C.E – 375 B.C.E.) referred to elder as the "medicine chest" of all herbs because of its endless benefits and the usability of all aspects of the plant.

370 B.C.E – 285 B.C.E: Greco-Roman Period: Theophrastus (300's B.C.E) described elder in *Historia Plantarum*.

77 C.E: Italy: Pliny the Elder, the medicinal qualities of elder were widely known and written on.

The History of Elder and Wine

1600's C.E: Britain: Over the centuries, elderberry has been used to treat colds, flu, fever, burns, cuts, and more than 70 other maladies, from toothache to the plague.

John Evelyn, a British researcher, declared, "If the medicinal properties of its leaves, bark, and berries were fully known, I cannot tell what our country man could ail for which he might not fetch a remedy from it, either for sickness or wounds."

The History of Elder and Wine

“Scandals” involving commercial wineries discovered to have adulterated their grape wines by adding elderberry to improve their color and flavor have occurred throughout the ages and into modern times.

Example: Judiciously flavored with vinegar and sugar and small quantities of port wine, Elder is often the basis of spurious ‘clarets’ and ‘Bordeaux.’ ‘Men of nice palates,’ says Berkeley (Querist, 1735), ‘have been imposed on by Elder Wine for French Claret.’

The History of Elder and Wine

“Scandals…”

Cheap port is often faked to resemble tawny port by the addition of elderberry juice, which forms one of the least injurious ingredients of factitious port wines. Doctoring port wine with Elderberry juice seems to have assumed such dimensions that in 1747 this practice was forbidden in Portugal, and even the cultivation of the Elder was forbidden.

The History of Elder and Wine

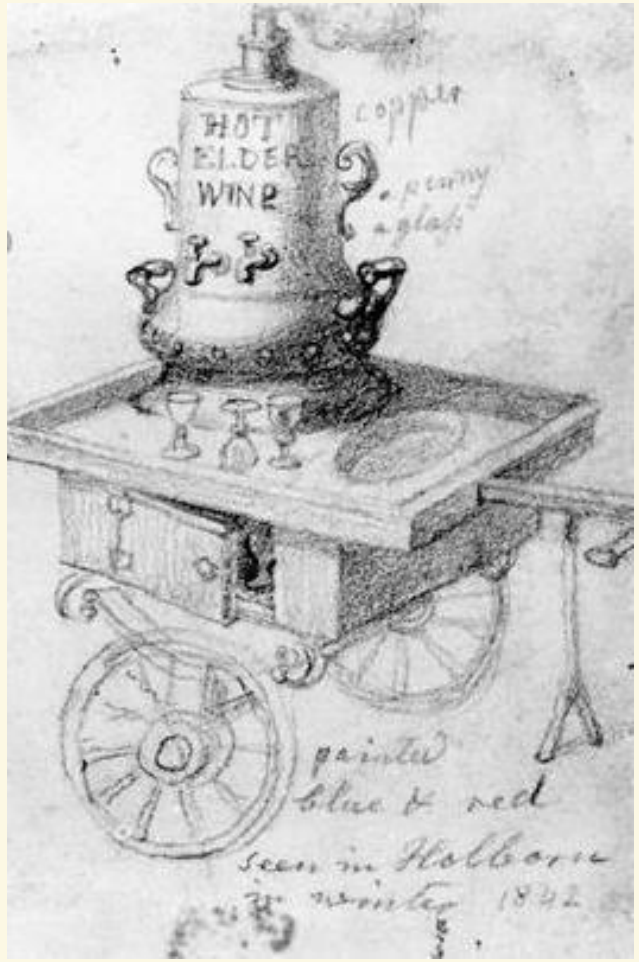
In 1899 an American sailor informed a physician of Prague that getting drunk on genuine, old, dark-red port was a sure remedy for rheumatic pains. This started a long series of investigations ending in the discovery that while genuine port wine has practically no anti-neuralgic properties, the cheap stuff faked to resemble tawny port by the addition of elderberry juice may relieve the pain of sciatica and other forms of neuralgia. Cases of the cure have been tested by leading doctors in Prague and elsewhere abroad, the dose recommended being 30 grams of Elderberry juice mixed with 10 grams of port wine.

The History of Elder and Wine

London: In the Gregorian Period (1714-1837) in the winter, elder wine heated in copper vessels was sold for a penny per wine glass from portable wood stands that contained glassware.

This is likely one origin of the pairing of cinnamon and cloves in elderberry beverage recipes.

The History of Elder and Wine



Nutraceutical Quality

SARE Grant Analysis 2019-2021

www.HyldemoerFarms.com

"Research and Publications"

Elderberry and Elderflower (Sambucus spp.): Nutraceutical quality analysis of several genotypes of Sambucus spp. grown in Florida

https://hyldemoerfarms.com/sare-nqa-2022

SARE Grant Analysis 2019-2021

About 60 elderberry genotypes were evaluated for productivity.

22 genotypes were eventually selected for postharvest quality analyses.

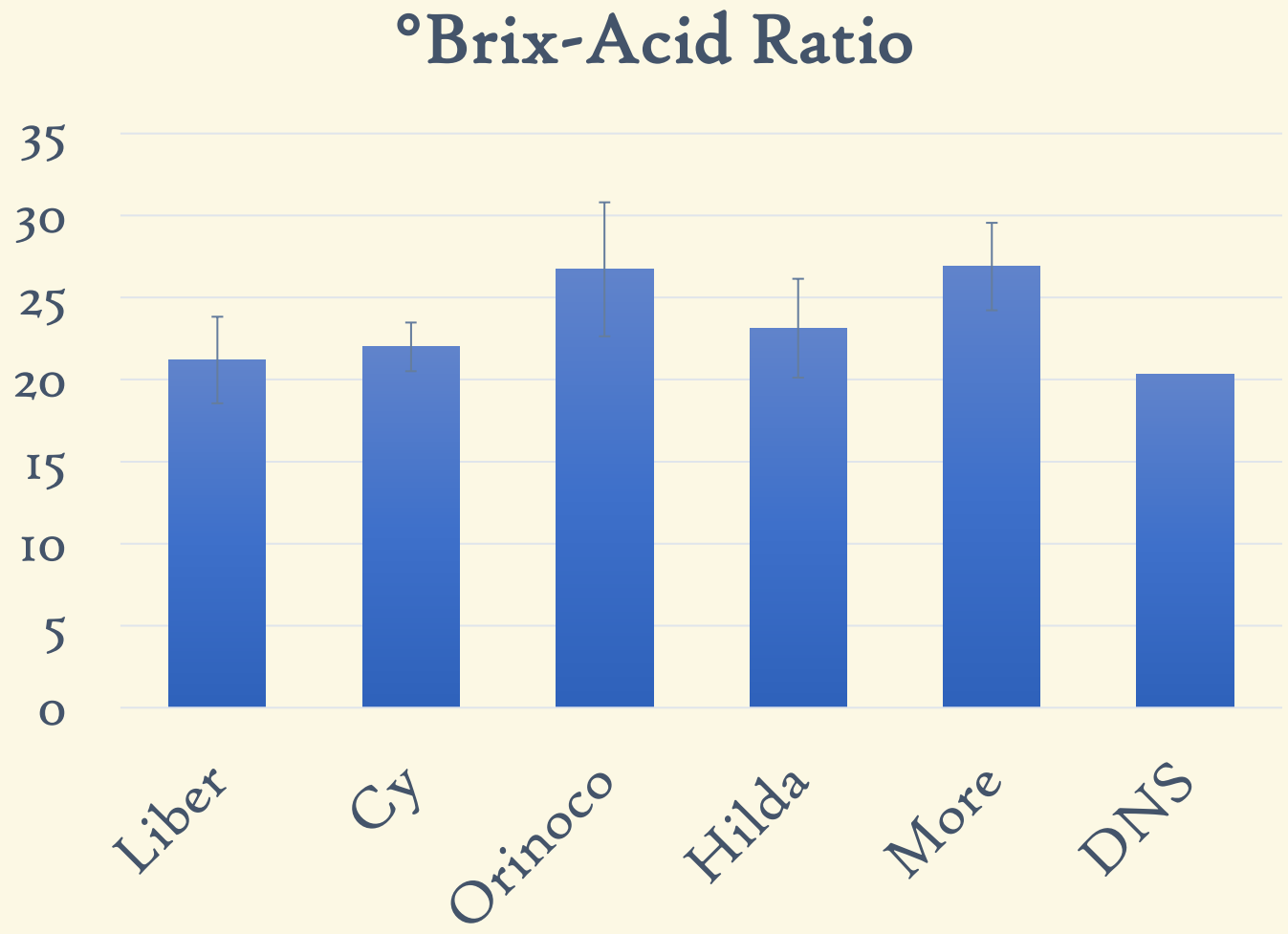
- 2019 - 9 genotypes
- 2020 - 8 genotypes
- 2021 - 22 genotypes

Immediately after harvest, berries were vacuum-sealed and frozen at -20 °C until transported to the University of Florida Postharvest Lab then kept frozen (-30 °C) for later analysis.

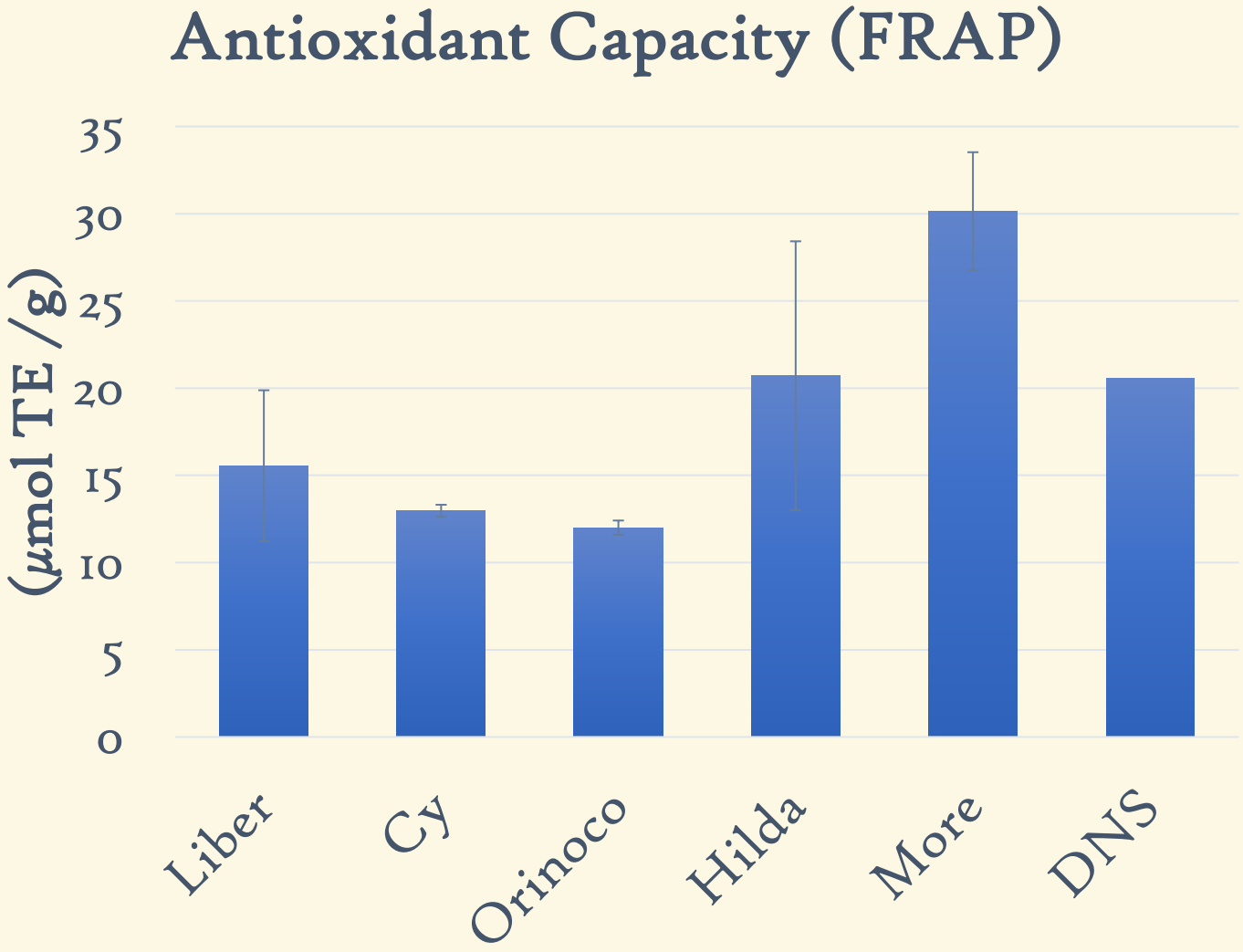
SARE Grant Analysis 2019-2021

- Soluble solids content (SSC)
- Total titratable acidity (TTA) & pH
- Total anthocyanin content
- Total antioxidant capacity (FRAP)

SARE Grant Analysis 2019-2021



SARE Grant Analysis 2019-2021



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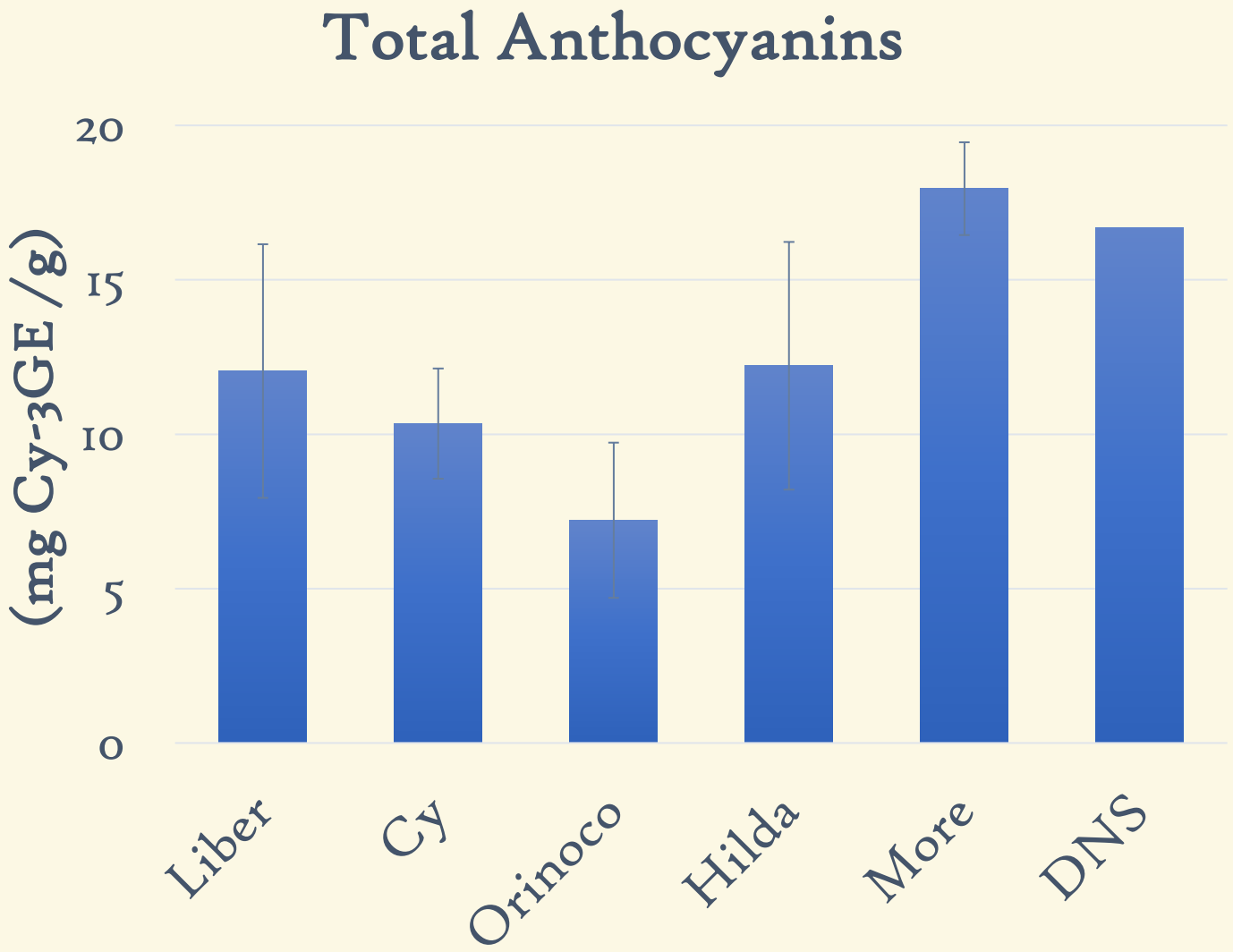


Ongoing Analysis 2022-2023…

- *S. nigra* is known to contain 4 major anthocyanins.
- *S. canadensis* is known to contain between 5 and 7 additional anthocyanins.
- *S. canadensis* contains “acylated” anthocyanins not found in *S. nigra*.
- Long term color stability and aging potential are important in maximizing the wine’s value.

Ongoing Analysis 2022-2023…

J Lee, CE Finn

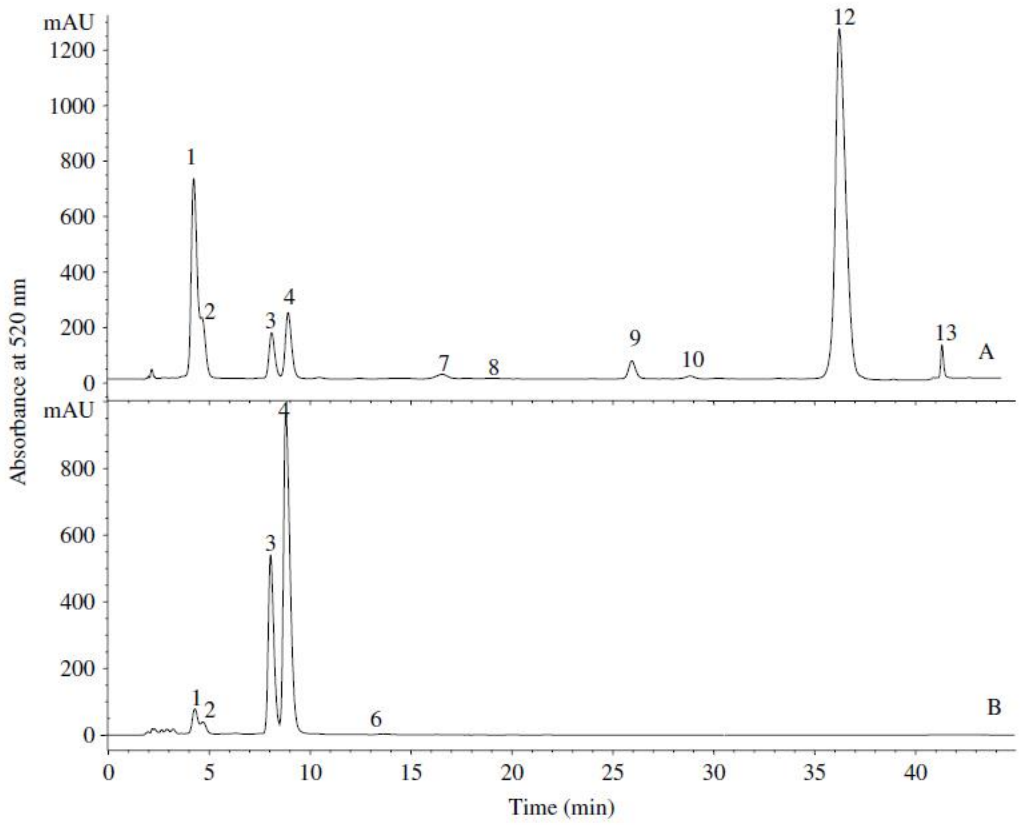


Figure 1. Anthocyanin separation of *Sambucus canadensis* 'Adams 1' (A) and *S. nigra* 'Korsør' (B) monitored at 520 nm. Corresponding peak assignments are in Table 3.

Ongoing Analysis 2022-2023…

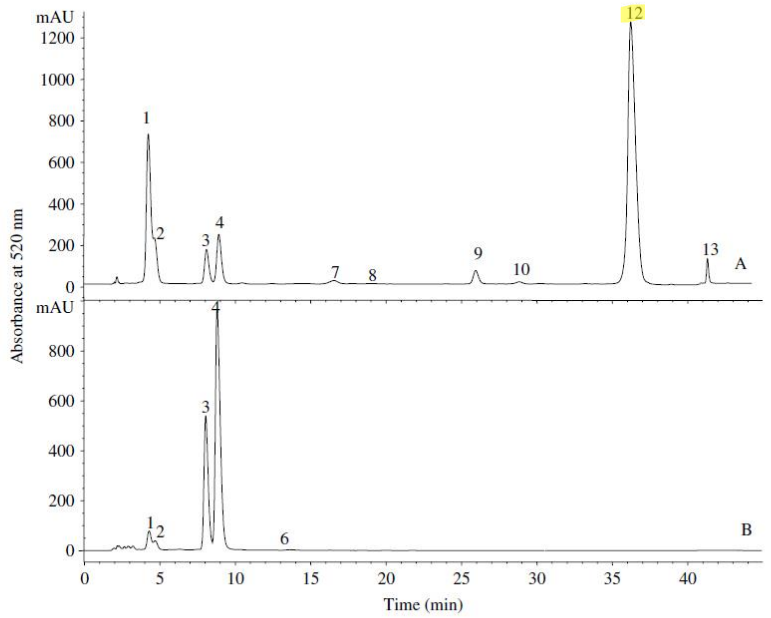
Table 3. Distribution of individual anthocyanins present in *Sambucus* samples obtained by HPLC. 'Korsor' and 'Haschberg' had unique anthocyanin profiles (cyanidin 3-glucoside and cyanidin 3-sambubioside were the major anthocyanin present) compared to the other elderberry samples (cyanidin 3-(E)-*p*-coumaryl-sambubioside-5-glucoside was the major pigment). Anthocyanins are listed in the order of elution. Units for all values are mg cyanidin 3-glucoside $100\,g^{-1}$ berries. Masses of the molecular ions and their fragments of the identified anthocyanins are listed

Identified compound ($[M+H]^+$ ion, fragments)	Cyanidin 3-sambubioside-5-glucoside (743, 581, 449, 287)	Cyanidin 3,5-diglucoside (611, 449, 287)	Cyanidin 3-sambubioside (581, 287)	Cyanidin 3-glucoside (449, 287)	Cyanidin 3-rutinoside (595, 449, 287)	Pelargonidin 3-glucoside (433, 271)	Cyanidin-based anthocyanin (785, 623, 449, 287)	Delphinidin 3-rutinoside (611, 465, 303)	Cyanidin 3-(Z)-*p*-coumaroyl-sambubioside-5-glucoside (889, 727, 449, 287)	Cyanidin 3-*p*-coumaroyl-glucoside (595, 449, 287)	Petunidin 3-rutinoside (625, 479, 317)	Cyanidin 3-(E)-*p*-coumaroyl-sambubioside-5-glucoside (889, 727, 449, 287)	Cyanidin 3-*p*-coumaroyl-sambubioside (727, 287)	
Peak	1	2	3	4	5	6	7	8	9	10	11	12	13	Sum
2004 growing season														
Adams 1	134.6 (13.6)	37.3 (2.8)	27.5 (2.3)	42.9 (3.2)	ND	ND	5.2 (0.3)	tr	26.4 (2.0)	2.4 (0.5)	ND	341.4 (20.4)	9.0 (0.6)	626.6 (36.4)d–f
Adams 2	108.1 (11.5)	32.2 (3.5)	26.2 (2.4)	37.3 (4.0)	ND	ND	4.6 (0.5)	tr	17.7 (1.7)	2.7 (0.2)	tr	324.2 (29.4)	8.7 (0.8)	561.7 (52.4)c–f
Johns	102.2 (10.2)	26.2 (2.0)	10.7 (0.9)	7.7 (0.4)	ND	ND	3.2 (0.3)	tr	18.5 (2.5)	3.3 (0.2)	tr	216.4 (19.4)	2.7 (0.2)	390.9 (32.1)a–ce
Scotia	107.0 (2.9)	55.2 (0.8)	10.5 (0.7)	27.8 (1.5)	ND	ND	3.8 (0.2)	tr	21.1 (2.5)	2.2 (0.1)	tr	296.9 (9.7)	3.8 (0.2)	528.3 (12.1)b–f
York	102.9 (4.0)	27.4 (1.3)	9.6 (1.7)	8.0 (0.3)	ND	ND	3.3 (0.2)	tr	19.6 (4.2)	3.5 (0)	tr	219.6 (9.7)	2.8 (0.1)	396.6 (19.4)a–ce
Gordon B	100.6 (6.6)	50.7 (3.2)	5.3 (0.6)	2.8 (0.2)	ND	ND	13.1 (3.0)	tr	23.0 (3.0)	4.5 (0.4)	ND	359.6 (33.3)	2.5 (0.2)	562.6 (48.7)b–f
Netzer	54.7 (3.4)	6.3 (0.4)	1.7 (0.1)	0.3 (0)	ND	ND	7.9 (0.3)	tr	10.1 (2.9)	1.7 (0)	tr	195.8 (4.2)	1.4 (0.1)	280.0 (5.5)a–c
Harris 2	61.3 (1.2)	28.1 (0.7)	3.3 (0)	3.3 (0.2)	ND	ND	5.6 (0)	tr	15.0 (0.3)	2.1 (0)	ND	211.2 (0)	2.1 (0.1)	332.1 (2.0)*
Korsor	16.0 (1.0)	8.2 (0.4)	122.2 (2.7)	253.7 (4.1)	ND	tr	ND	ND	ND	ND	ND	ND	ND	400.2 (6.6)a–e
Haschberg	32.2 (2.2)	11.2 (1.0)	143.0 (12.3)	204.6 (17.3)	tr	tr	ND	tr	ND	ND	ND	ND	ND	391.0 (31.9) a–ce
2005 growing season														
Adams 1	181.2 (5.0)	56.5 (1.4)	39.4 (1.5)	56.4 (1.6)	ND	ND	8.2 (0.5)	tr	22.8 (2.0)	3.6 (0.7)	ND	552.6 (23.7)	14.1 (1.0)	934.6 (31.5)d–f
Adams 2	194.7 (12.4)	61.1 (2.4)	33.6 (7.0)	62.7 (3.5)	ND	ND	10.9 (2.7)	tr	27.1 (2.0)	4.6 (0.2)	tr	594.2 (31.1)	16.3 (1.2)	1005.2 (47.8) d–f
Johns	167.8 (10.9)	41.2 (3.0)	14.6 (1.0)	10.1 (0.8)	ND	ND	5.7 (0.5)	tr	16.3 (1.7)	4.9 (0.4)	tr	367.3 (33.2)	4.5 (0.4)	632.1 (50.1) b–d
Scotia	176.9 (6.8)	94.6 (2.6)	15.0 (0.4)	40.3 (2.2)	ND	ND	6.7 (0.2)	tr	23.9 (1.2)	3.7 (0.1)	tr	520.2 (13.4)	6.8 (0.3)	888.1 (22.2) d–f
York	146.8 (3.4)	36.8 (1.0)	12.6 (0.4)	7.8 (0.5)	ND	ND	5.6 (0.3)	tr	19.2 (1.4)	4.4 (0.2)	tr	351.5 (11.0)	4.3 (0.2)	589.0 (11.6) a–c
Gordon B	149.6 (6.6)	74.6 (6.4)	6.4 (0.5)	3.8 (0.7)	ND	ND	15.3 (0.7)	tr	27.5 (1.6)	6.5 (0.3)	ND	555.0 (28.5)	3.9 (0.5)	842.6 (40.0)d–f
Netzer	79.6 (2.6)	8.6 (0.4)	3.2 (0.6)	1.9 (0.3)	ND	ND	10.2 (1.0)	tr	18.9 (0.5)	2.4 (0.1)	tr	267.4 (16.8)	1.8 (0.3)	394.0 (22.5)ab
Harris 2	40.8 (0.3)	14.7 (0.1)	1.7 (0.2)	1.3 (0.1)	ND	ND	3.3 (0.1)	tr	13.2 (0.6)	1.1 (0.1)	ND	130.6 (8.5)	1.1 (0.2)	207.7 (9.0)*
Korsor	37.3 (2.5)	18.3 (1.0)	269.1 (16.4)	481.4 (24.0)	ND	tr	ND	ND	ND	ND	ND	ND	ND	806.1 (39.8)cd
Haschberg	59.2 (1.6)	19.5 (0.6)	268.1 (20.6)	309.7 (18.3)	tr	tr	ND	tr	ND	ND	ND	ND	ND	656.5 (40.7)b–d

* 'Harris 2' values were not included in the statistical analysis.
Totals with different lower-case letters (within a column for the different growing seasons) were significantly different (Bonferroni test, $P \leq 0.05$). Values in parentheses are standard errors. ND, not detected in sample; 'tr' represents trace levels detected and was not included in the quantification.

Ongoing Analysis 2022-2023…

J Lee, CE Finn



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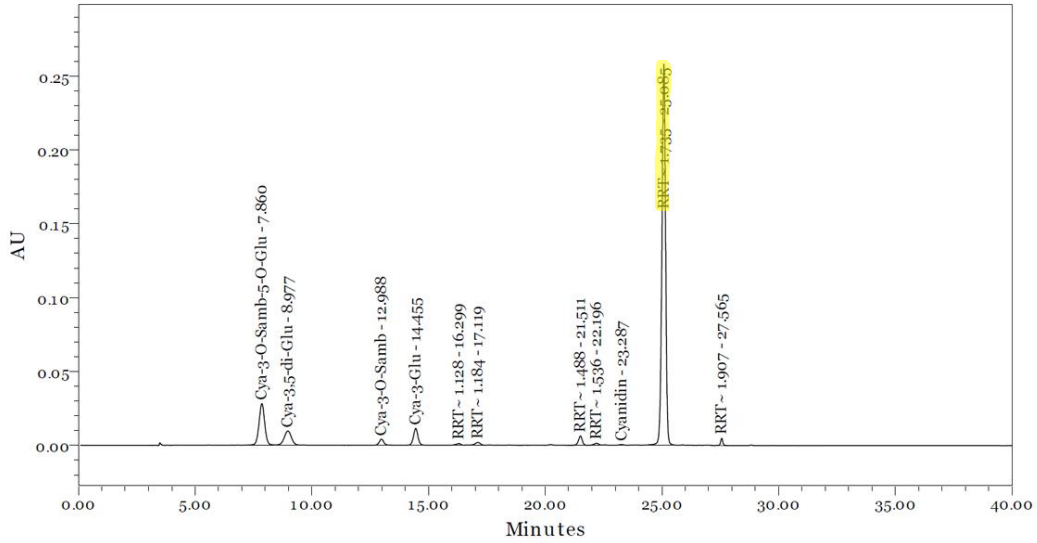

HPLC chromatogram (535 nm) of:CS04789 (Juice)

Sample Description: Fresh/Frozen Elderberries: Juice

Product Code: NA

Lot Number: NA

Sample Set Name: USPE051

Comments:
Sample extracted with: [Solvent 1 : Solvent 2 (1:4 v/v)]
Solvent 1: [Methanol : HCl (945.95 : 54.05; v/v)]
Solvent 2: [H_3PO_4 : HPLC water (100 : 900 v/v)]

Ongoing Analysis 2022-2023…

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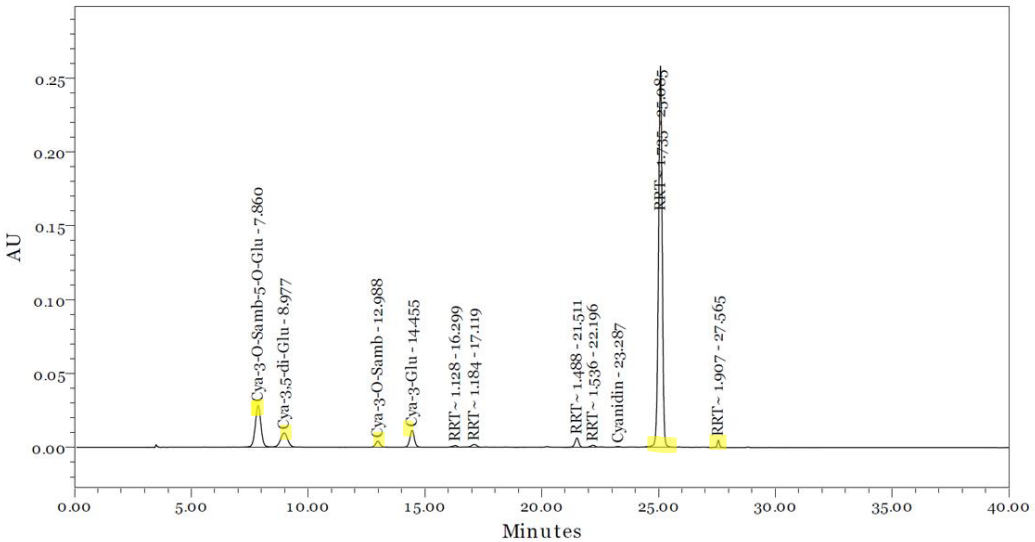
Identified compound ($[M+H]^+$ ion, fragments)	Cyanidin 3-sambubioside-5-glucoside (743, 581, 449, 287)	Cyanidin 3, 5-diglucoside (611, 449, 287)	Cyanidin 3-sambubioside (581, 287)	Cyanidin 3-glucoside (449, 287)	Cyanidin 3-rutinoside (595, 449, 287)	Pelargonidin 3-glucoside (433, 271)	Cyanidin-based anthocyanin (785, 623, 449, 287)	Delphinidin 3-rutinoside (611, 465, 303)	Cyanidin 3-(Z)-*p*-coumaroyl-sambubioside-5-glucoside (889, 727, 449, 287)	Cyanidin 3-*p*-coumaroyl-glucoside (595, 449, 287)	Petunidin 3-rutinoside (625, 479, 317)	Cyanidin 3-(E)-*p*-coumaroyl-sambubioside-5-glucoside (889, 727, 449, 287)	Cyanidin 3-*p*-coumaroyl-sambubioside (727, 287)	
Peak	1	2	3	4	5	6	7	8	9	10	11	12	13	Sum
2004 growing season														
Adams 1	134.6 (13.6)	37.3 (2.8)	27.5 (2.3)	42.9 (3.2)	ND	ND	5.2 (0.3)	tr	26.4 (2.0)	2.4 (0.5)	ND	341.4 (20.4)	9.0 (0.6)	626.6 (36.4)d–f
Adams 2	108.1 (11.5)	32.2 (3.5)	26.2 (2.4)	37.3 (4.0)	ND	ND	4.6 (0.5)	tr	17.7 (1.7)	2.7 (0.2)	tr	324.2 (29.4)	8.7 (0.8)	561.7 (52.4)c–f
Johns	102.2 (10.2)	26.2 (2.0)	10.7 (0.9)	7.7 (0.4)	ND	ND	3.2 (0.3)	tr	18.5 (2.5)	3.3 (0.2)	tr	216.4 (19.4)	2.7 (0.2)	390.9 (32.1)a–ce
Scotia	107.0 (2.9)	55.2 (0.8)	10.5 (0.7)	27.8 (1.5)	ND	ND	3.8 (0.2)	tr	21.1 (2.5)	2.2 (0.1)	tr	296.9 (9.7)	3.8 (0.2)	528.3 (12.1)b–f
York	102.9 (4.0)	27.4 (1.3)	9.6 (1.7)	8.0 (0.3)	ND	ND	3.3 (0.2)	tr	19.6 (4.2)	3.5 (0)	tr	219.6 (9.7)	2.8 (0.1)	396.6 (19.4)a–ce
Gordon B	100.6 (6.6)	50.7 (3.2)	5.3 (0.6)	2.8 (0.2)	ND	ND	13.1 (3.0)	tr	23.0 (3.0)	4.5 (0.4)	ND	359.6 (33.3)	2.5 (0.2)	562.6 (48.7)b–f
Netzer	54.7 (3.4)	6.3 (0.4)	1.7 (0.1)	0.3 (0)	ND	ND	7.9 (0.3)	tr	10.1 (2.9)	1.7 (0)	tr	195.8 (4.2)	1.4 (0.1)	280.0 (5.5)a–c
Harris 2	61.3 (1.2)	28.1 (0.7)	3.3 (0)	3.3 (0.2)	ND	ND	5.6 (0)	tr	15.0 (0.3)	2.1 (0)	ND	211.2 (0)	2.1 (0.1)	332.1 (2.0)*
Korsør	16.0 (1.0)	8.2 (0.4)	122.2 (2.7)	253.7 (4.1)	ND	tr	ND	ND	ND	ND	ND	ND	ND	400.2 (6.6)a–e
Haschberg	32.2 (2.2)	11.2 (1.0)	143.0 (12.3)	204.6 (17.3)	tr	tr	ND	tr	ND	ND	ND	ND	ND	391.0 (31.9) a–ce
2005 growing season														
Adams 1	181.2 (5.0)	56.5 (1.4)	39.4 (1.5)	56.4 (1.6)	ND	ND	8.2 (0.5)	tr	22.8 (2.0)	3.6 (0.7)	ND	552.6 (23.7)	14.1 (1.0)	934.6 (31.5)d–f
Adams 2	194.7 (12.4)	61.1 (2.4)	33.6 (7.0)	62.7 (3.5)	ND	ND	10.9 (2.7)	tr	27.1 (2.0)	4.6 (0.2)	tr	594.2 (31.1)	16.3 (1.2)	1005.2 (47.8) d–f
Johns	167.8 (10.9)	41.2 (3.0)	14.6 (1.0)	10.1 (0.8)	ND	ND	5.7 (0.5)	tr	16.3 (1.7)	4.9 (0.4)	tr	367.3 (33.2)	4.5 (0.4)	632.1 (50.1) b–d
Scotia	176.9 (6.8)	94.6 (2.6)	15.0 (0.4)	40.3 (2.2)	ND	ND	6.7 (0.2)	tr	23.9 (1.2)	3.7 (0.1)	tr	520.2 (13.4)	6.8 (0.3)	888.1 (22.2) d–f
York	146.8 (3.4)	36.8 (1.0)	12.6 (0.4)	7.8 (0.5)	ND	ND	5.6 (0.3)	tr	19.2 (1.4)	4.4 (0.2)	tr	351.5 (11.0)	4.3 (0.2)	589.0 (11.6) a–c
Gordon B	149.6 (6.6)	74.6 (6.4)	6.4 (0.5)	3.8 (0.7)	ND	ND	15.3 (0.7)	tr	27.5 (1.6)	6.5 (0.3)	ND	555.0 (28.5)	3.9 (0.5)	842.6 (40.0)d–f
Netzer	79.6 (2.6)	8.6 (0.4)	3.2 (0.6)	1.9 (0.3)	ND	ND	10.2 (1.0)	tr	18.9 (0.5)	2.4 (0.1)	tr	267.4 (16.8)	1.8 (0.3)	394.0 (22.5)ab
Harris 2	40.8 (0.3)	14.7 (0.1)	1.7 (0.2)	1.3 (0.1)	ND	ND	3.3 (0.1)	tr	13.2 (0.6)	1.1 (0.1)	ND	130.6 (8.5)	1.1 (0.2)	207.7 (9.0)*
Korsør	37.3 (2.5)	18.3 (1.0)	269.1 (16.4)	481.4 (24.0)	ND	tr	ND	ND	ND	ND	ND	ND	ND	806.1 (39.8)cd
Haschberg	59.2 (1.6)	19.5 (0.6)	268.1 (20.6)	309.7 (18.3)	tr	tr	ND	tr	ND	ND	ND	ND	ND	656.5 (40.7)b–d

* 'Harris 2' values were not included in the statistical analysis.
Totals with different lower-case letters (within a column for the different growing seasons) were significantly different (Bonferroni test, $P \leq 0.05$). Values in parentheses are standard errors. ND, not detected in sample; 'tr' represents trace levels detected and was not included in the quantification.



HPLC chromatogram (535 nm) of:CS04789 (Juice)

Sample Description: Fresh/Frozen Elderberries: Juice

Product Code: NA

Lot Number: NA

Sample Set Name: USPE051

Comments:
Sample extracted with: [Solvent 1 : Solvent 2 (1:4 v/v)]
Solvent 1: [Methanol : HCl (945.95 : 54.05; v/v)]
Solvent 2: [H_3PO_4 : HPLC water (100 : 900 v/v)]

Ongoing Analysis 2022-2023…

Table 3. Distribution of individual anthocyanins present in *Sambucus* samples obtained by HPLC. 'Korsør' and 'Haschberg' had unique anthocyanin profiles (cyanidin 3-glucoside and cyanidin 3-sambubioside were the major anthocyanin present) compared to the other elderberry samples (cyanidin 3-(E)-*p*-coumaryl-sambubioside-5-glucoside was the major pigment). Anthocyanins are listed in the order of elution. Units for all values are mg cyanidin 3-glucoside $100\,g^{-1}$ berries. Masses of the molecular ions and their fragments of the identified anthocyanins are listed

Identified compound ($[M+H]^+$ ion, fragments)	Cyanidin 3-sambubioside-5-glucoside (743, 581, 449, 287)	Cyanidin 3, 5-diglucoside (611, 449, 287)	Cyanidin 3-sambubioside (581, 287)	Cyanidin 3-glucoside (449, 287)	Cyanidin 3-rutinoside (595, 449, 287)	Pelargonidin 3-glucoside (433, 271)	Cyanidin-based anthocyanin (785, 623, 449, 287)	Delphinidin 3-rutinoside (611, 465, 303)	Cyanidin 3-(Z)-*p*-coumaroyl-sambubioside-5-glucoside (889, 727, 449, 287)	Cyanidin 3-*p*-coumaroyl-glucoside (595, 449, 287)	Petunidin 3-rutinoside (625, 479, 317)	Cyanidin 3-(E)-*p*-coumaroyl-sambubioside-5-glucoside (889, 727, 449, 287)	Cyanidin 3-*p*-coumaroyl-sambubioside (727, 287)	
Peak	1	2	3	4	5	6	7	8	9	10	11	12	13	Sum
2004 growing season														
Adams 1	134.6 (13.6)	37.3 (2.8)	27.5 (2.3)	42.9 (3.2)	ND	ND	5.2 (0.3)	tr	26.4 (2.0)	2.4 (0.5)	ND	341.4 (20.4)	9.0 (0.6)	626.6 (36.4)d–f
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Scotia	107.0 (2.9)	55.2 (0.8)	10.5 (0.7)	27.8 (1.5)	ND	ND	3.8 (0.2)	tr	21.1 (2.5)	2.2 (0.1)	tr	296.9 (9.7)	3.8 (0.2)	528.3 (12.1)b–f
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Netzer	54.7 (3.4)	6.3 (0.4)	1.7 (0.1)	0.3 (0)	ND	ND	7.9 (0.3)	tr	10.1 (2.9)	1.7 (0)	tr	195.8 (4.2)	1.4 (0.1)	280.0 (5.5)a–c
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Gordon B	149.6 (6.6)	74.6 (6.4)	6.4 (0.5)	3.8 (0.7)	ND	ND	15.3 (0.7)	tr	27.5 (1.6)	6.5 (0.3)	ND	555.0 (28.5)	3.9 (0.5)	842.6 (40.0)d–f
Netzer	79.6 (2.6)	8.6 (0.4)	3.2 (0.6)	1.9 (0.3)	ND	ND	10.2 (1.0)	tr	18.9 (0.5)	2.4 (0.1)	tr	267.4 (16.8)	1.8 (0.3)	394.0 (22.5)ab
Harris 2	40.8 (0.3)	14.7 (0.1)	1.7 (0.2)	1.3 (0.1)	ND	ND	3.3 (0.1)	tr	13.2 (0.6)	1.1 (0.1)	ND	130.6 (8.5)	1.1 (0.2)	207.7 (9.0)*
Korsør	37.3 (2.5)	18.3 (1.0)	269.1 (16.4)	481.4 (24.0)	ND	tr	ND	ND	ND	ND	ND	ND	ND	806.1 (39.8)cd
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CPS Code : CS04789 (Juice)

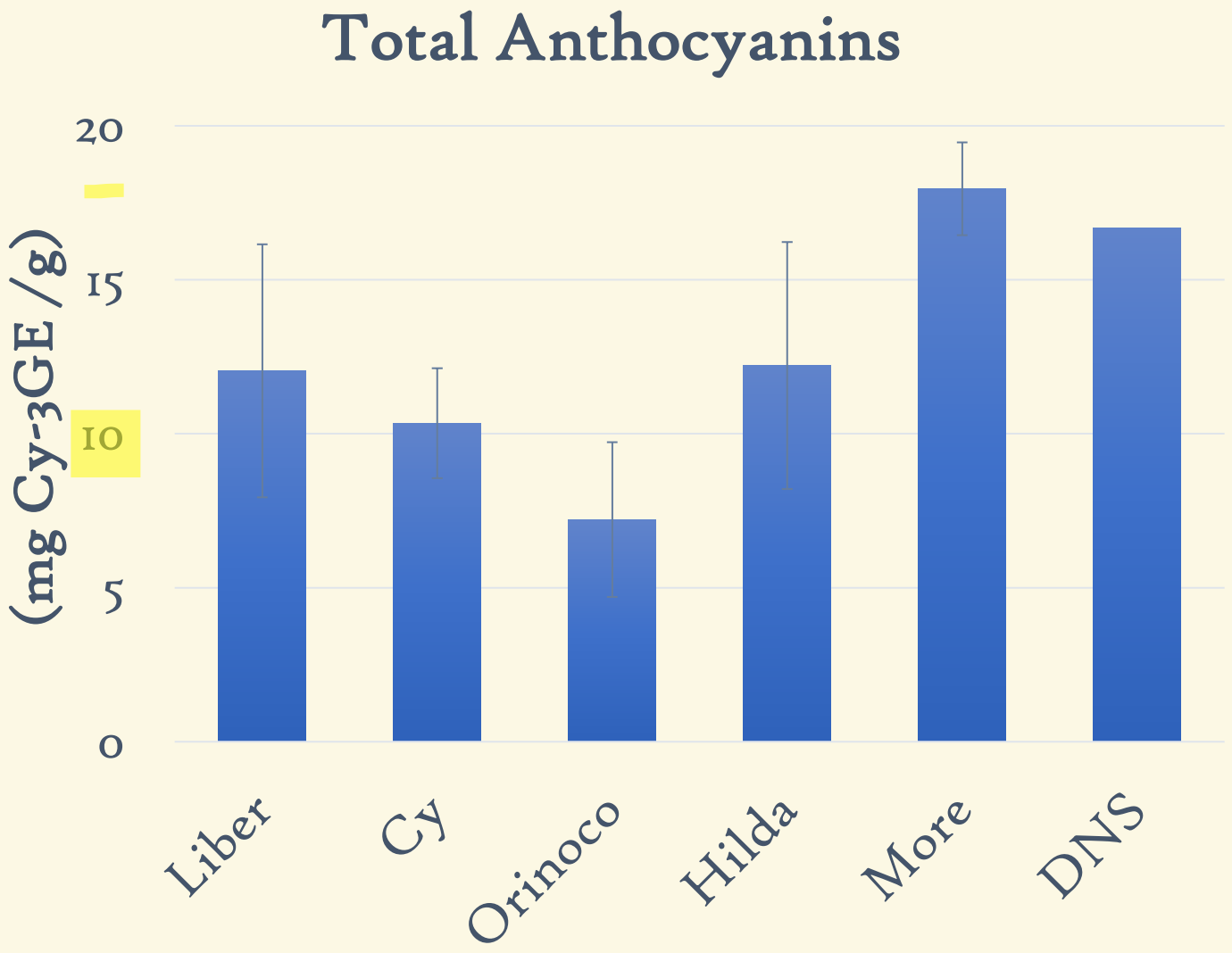
	CPS Code	Sample	Specific Gravity	Cya-3-Glu Equivalents (mg/g)*
1	CS04789 (Juice)	Fresh/Frozen Elderberries: Juice	1.037	11.729

CPS Code : CS04790 (Solid)

	CPS Code	Sample	Dry Matter (%)	Cya-3-Glu Equivalents (mg/g)**
1	CS04790 (Solid)	Fresh/Frozen Elderberries: Solid	42.25	11.322

Total Anthocyanin amount in Raw Material (mg)	Total Anthocyanin concentration in Raw Material (mg/g)	Total Anthocyanin concentration in Raw Material (%)
345	11.5	1.15%

*Corrected for the Sample's Specific Gravity
**Corrected for Dry Matter Percentage


Total Anthocyanins
(mg Cy-3GE /g)
20
15
10
5
0
Liber
Cy
Orinoco
Hilda
More
DNS

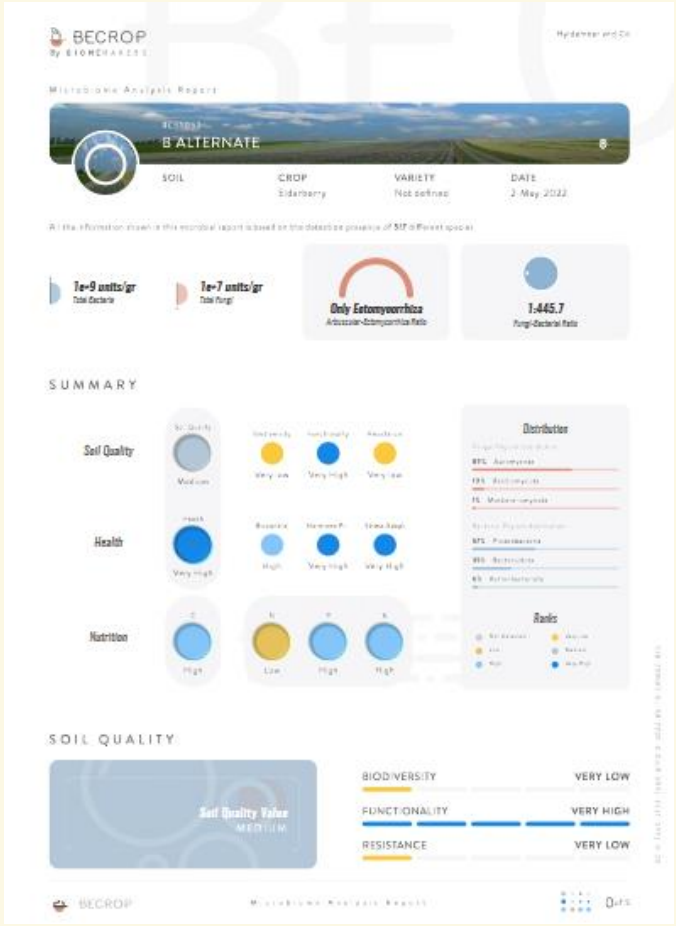
National Institute of Food and Agriculture, Small Business Innovation Research Grant, 2022 – 2024…

National Institute of Food and Agriculture, Small Business Innovation Research Grant, 2022 – 2024…

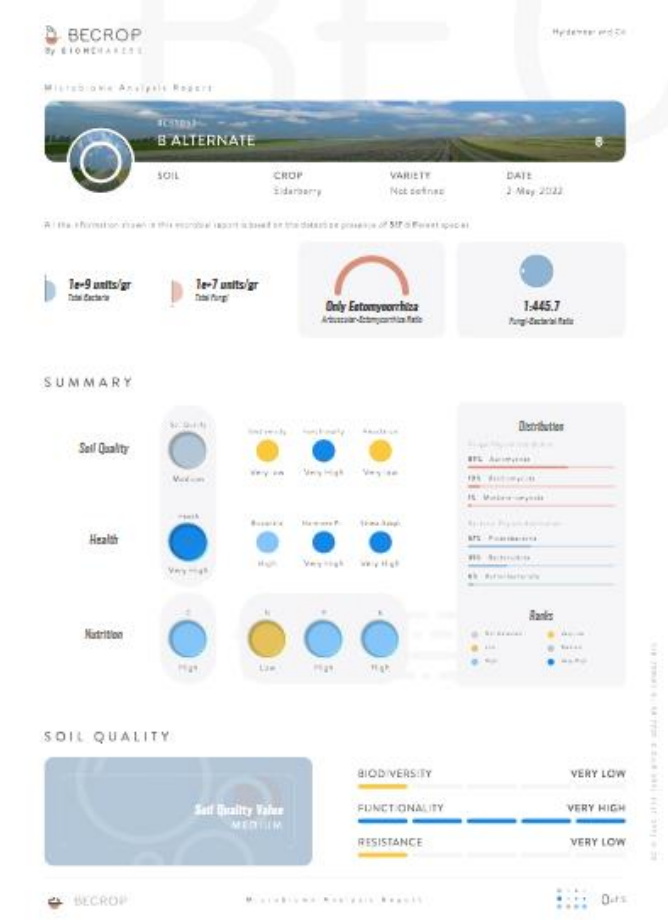
- Cultivation and Establishment (2 acres)

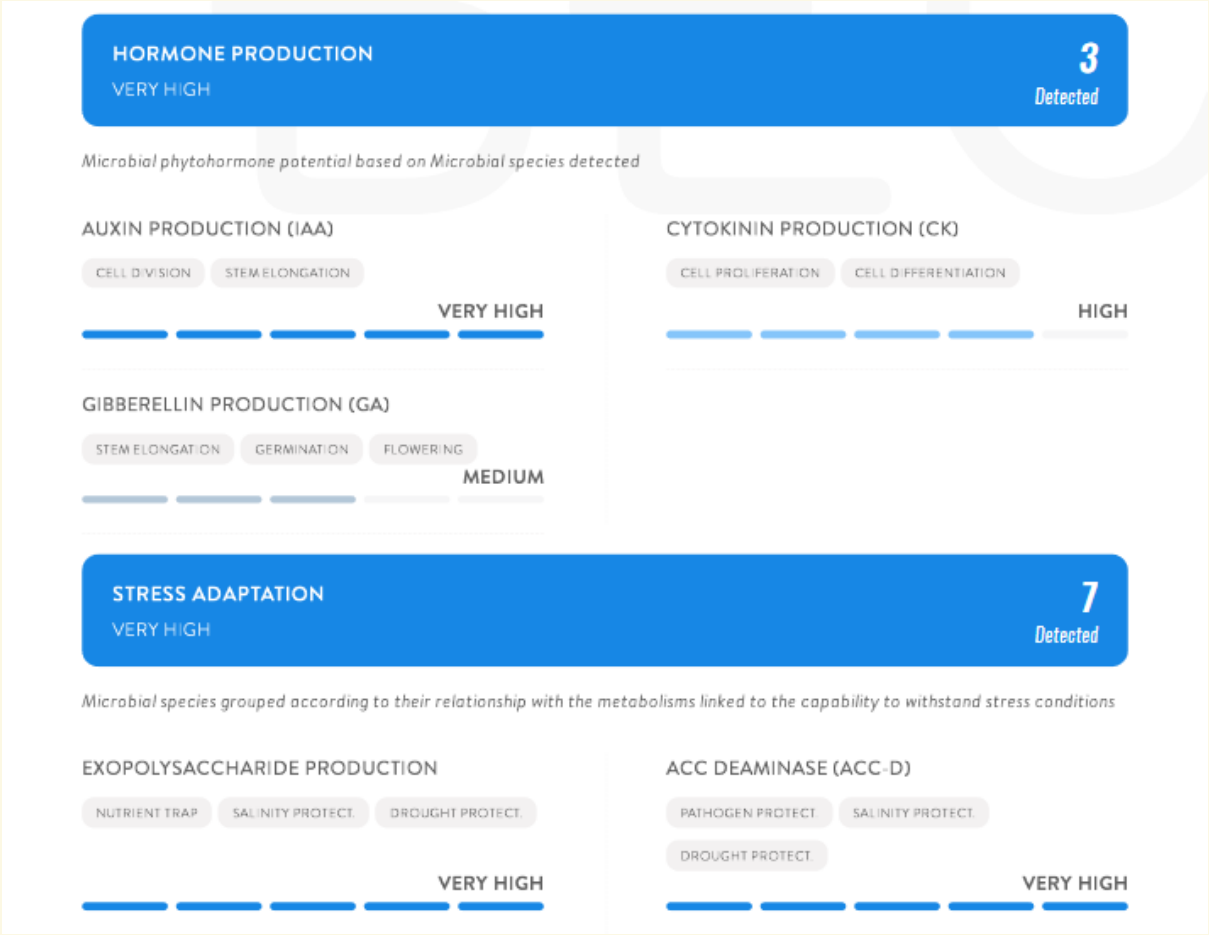
- Documentation of organic pest management and fertilization including advanced DNA sequencing of soil microbiology

National Institute of Food and Agriculture, Small Business Innovation Research Grant, 2022 – 2024…



National Institute of Food and Agriculture, Small Business Innovation Research Grant, 2022 – 2024…





National Institute of Food and Agriculture, Small Business Innovation Research Grant, 2022 – 2024…

- Compositional quality and vinification studies
- Sensory analysis as single wines and blends

- 20 month term
- Phase I ends Feb. 29th, 2024
- Phase II begins 24 to 36 months…

National Institute of Food and Agriculture, Small Business Innovation Research Grant, 2022 – 2024…

Elderberry Wine

(the basic things to know)

Elderberry Wine

- Wine style
- Color
- Acids
- Sugar and yeasts
- “The dreaded green goo”
- Fruit sanitization
- Aging

Elderberry Wine

- A deep red wine can be produced from juice extract as in a “white wine” production style

Elderberry Wine

- A deep red wine can be produced from juice extract as in a “white wine” production style

- The pomace retained from juice extraction retains significant anthocyanin content and value

Elderberry Wine

- pH: ~4.8 on average, rarely below 4.3

- “Traditional” elderberry wine recipes frequently call for the use of citric acid...

- Elderflower cordials are traditionally prepared with lemon.

Elderberry Wine

- °Brix: ~9 on average, rarely exceeding 12 (15 our high).

- Very little information available on yeast selection.

Elderberry Wine

- “The dreaded green goo” is a specific issue in elderberry wine production.

- Underripe berries, presence of stem material, and certain varieties (frequently native Fla. types) all appear to contribute.

- An initial clean-up with USP food grade mineral oil, followed by standard vessel and utensil cleaning procedures is best.

- Certain plastics tend to accumulate the goo quite badly.

Elderberry Wine

- The use of chlorine containing “sanitizers” in post harvest processing of fruit is common throughout the US.

- “Cork taint” is a fault in wines related to the use of certain cleaning agents in the winery.

- SaniDate 5.0

Elderberry Wine

- The highest-quality elderberry wines are aged several years and are rarely available for purchase.

- Other finishing and fining procedures are not well documented.

- Blending has merit as demonstrated throughout the history of elder and wine.

Elderberry Wine

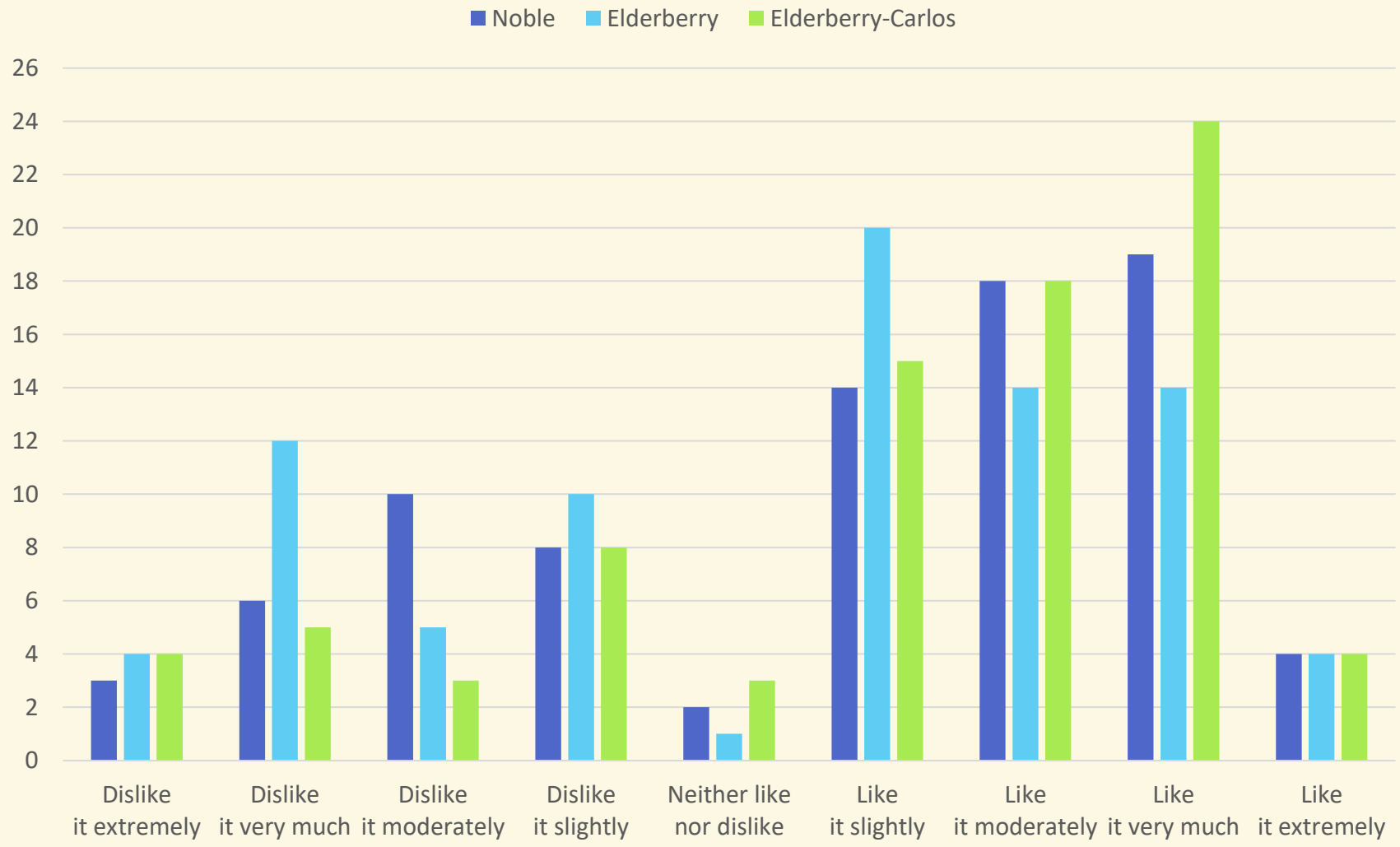
- Sensory evaluations, phase I, season I:
- Sweet vs. dry panels conducted.
- “Acrobat” Oregon, Pinot Noir, 2021 selected for comparison.

Elderberry Wine

Sensory evaluations, “sweet panel”

- Three wines
- A commercial Noble muscadine wine with lower than typical sweetness.
- Elderberry wine sweetened to match the Noble wine.
- One blend of muscadine / elder selected from bench trials: Carlos/Elder XX%/XX% .

Overall Liking – Crosstabulations – Sweet Panel



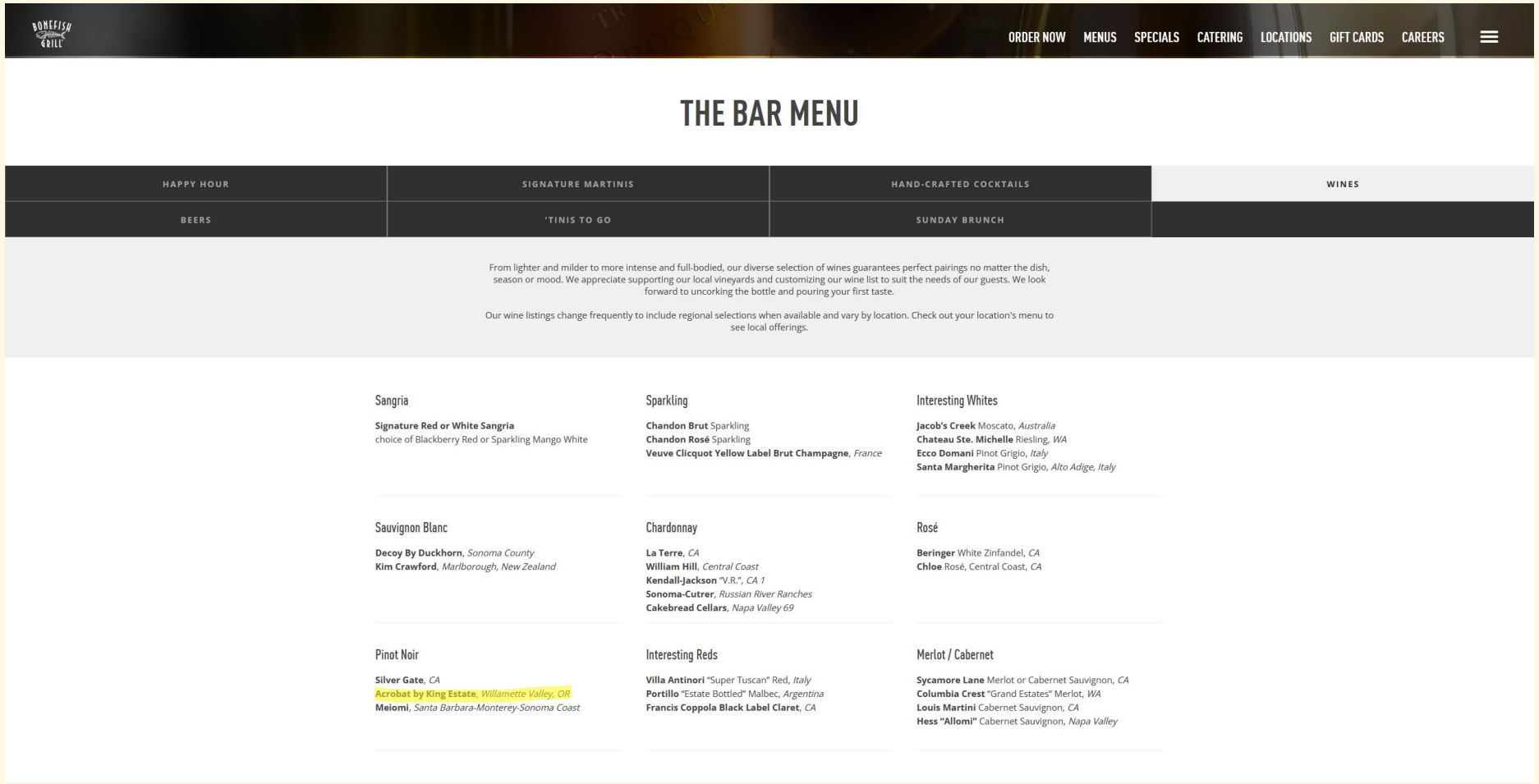
Elderberry Wine

Sensory evaluations, “dry panel”

- Two wines
- H+Co. 2023 elderberry wine (aged only 2.5 months)
- “Acrobat” Oregon, Pinot Noir, 2021

Elderberry Wine

Sensory evaluations, “dry panel”



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BEERS | 'TINIS TO GO | SUNDAY BRUNCH

From lighter and milder to more intense and full-bodied, our diverse selection of wines guarantees perfect pairings no matter the dish, season or mood. We appreciate supporting our local vineyards and customizing our wine list to suit the needs of our guests. We look forward to uncorking the bottle and pouring your first taste.

Our wine listings change frequently to include regional selections when available and vary by location. Check out your location's menu to see local offerings.

Sangria

Signature Red or White Sangria
choice of Blackberry Red or Sparkling Mango White

Sparkling

Chandon Brut Sparkling
Chandon Rosé Sparkling
Veuve Clicquot Yellow Label Brut Champagne, *France*

Interesting Whites

Jacob's Creek Moscato, *Australia*
Chateau Ste. Michelle Riesling, *WA*
Ecco Domani Pinot Grigio, *Italy*
Santa Margherita Pinot Grigio, *Alto Adige, Italy*

Sauvignon Blanc

Decoy By Duckhorn, *Sonoma County*
Kim Crawford, *Marlborough, New Zealand*

Chardonnay

La Terre, *CA*
William Hill, *Central Coast*
Kendall-Jackson "V.R.", *CA 1*
Sonoma-Cutrer, *Russian River Ranches*
Cakebread Cellars, *Napa Valley 69*

Rosé

Beringer White Zinfandel, *CA*
Chloe Rosé, Central Coast, *CA*

Pinot Noir

Silver Gate, *CA*
Acrobat by King Estate, *Willamette Valley, OR*
Meiomi, *Santa Barbara-Monterey-Sonoma Coast*

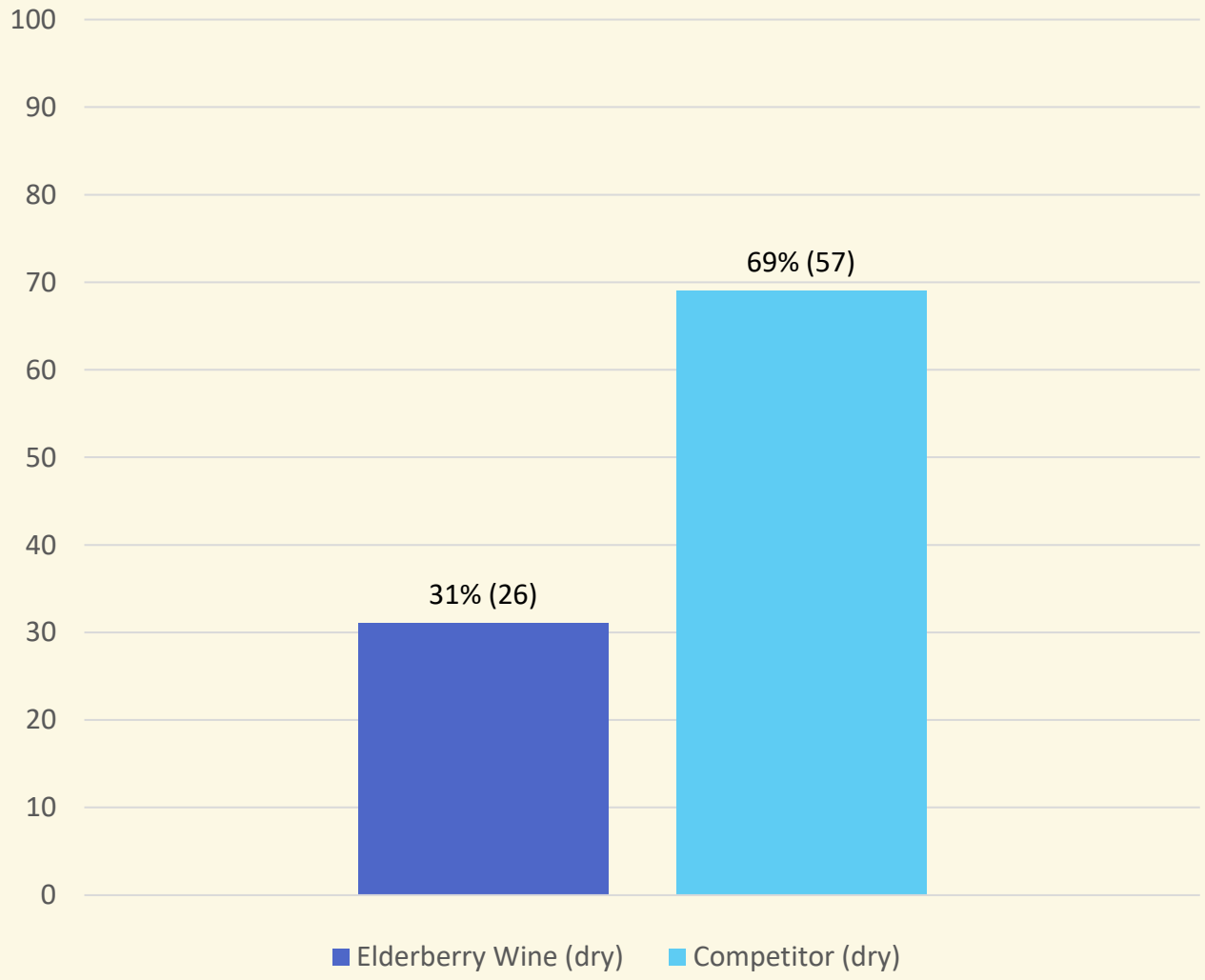
Interesting Reds

Villa Antinori "Super Tuscan" Red, *Italy*
Portillo "Estate Bottled" Malbec, *Argentina*
Francis Coppola Black Label Claret, *CA*

Merlot / Cabernet

Sycamore Lane Merlot or Cabernet Sauvignon, *CA*
Columbia Crest "Grand Estates" Merlot, *WA*
Louis Martini Cabernet Sauvignon, *CA*
Hess "Allomi" Cabernet Sauvignon, *Napa Valley*

Overall Preference – Dry Panel



The samples are significantly different at 95% confidence.

Varieties

Ongoing Variety Trials

Ongoing Variety Trials: *Hibiscus sabdariffa*

Ongoing Variety Trials: *Hibiscus sabdariffa*

Ongoing Variety Trials: *Hibiscus sabdariffa*

45+ genotypes trialed over last 5 years

6 in cultivation this year

GRIN

Univ. US Virgin Islands

Ongoing Variety Trials: *Passiflora spp.*

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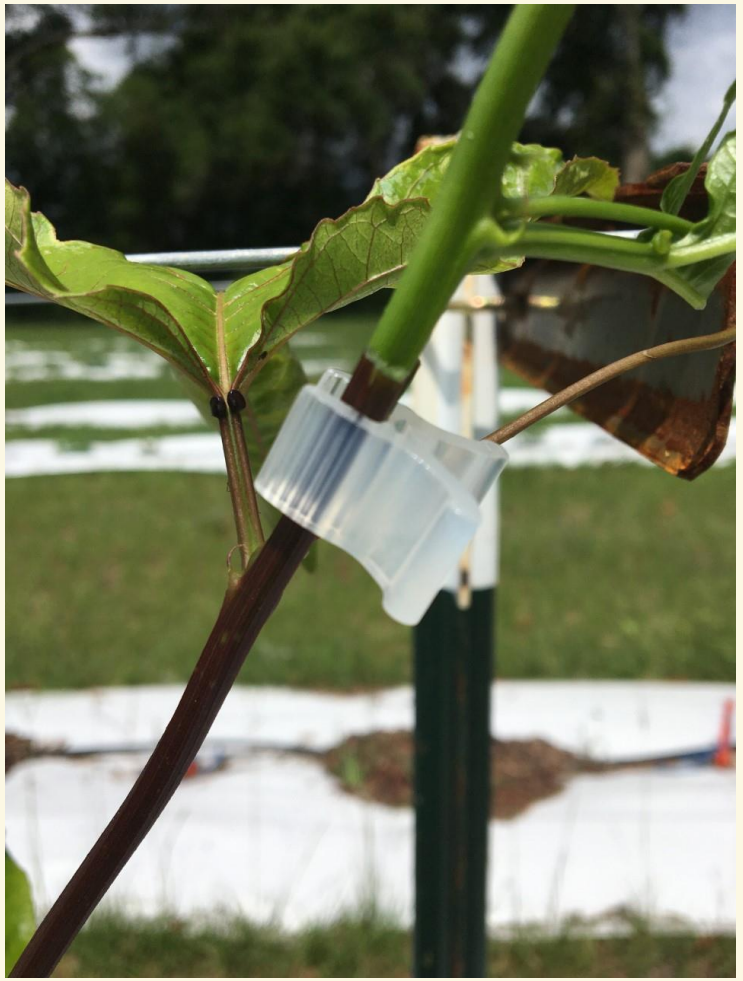
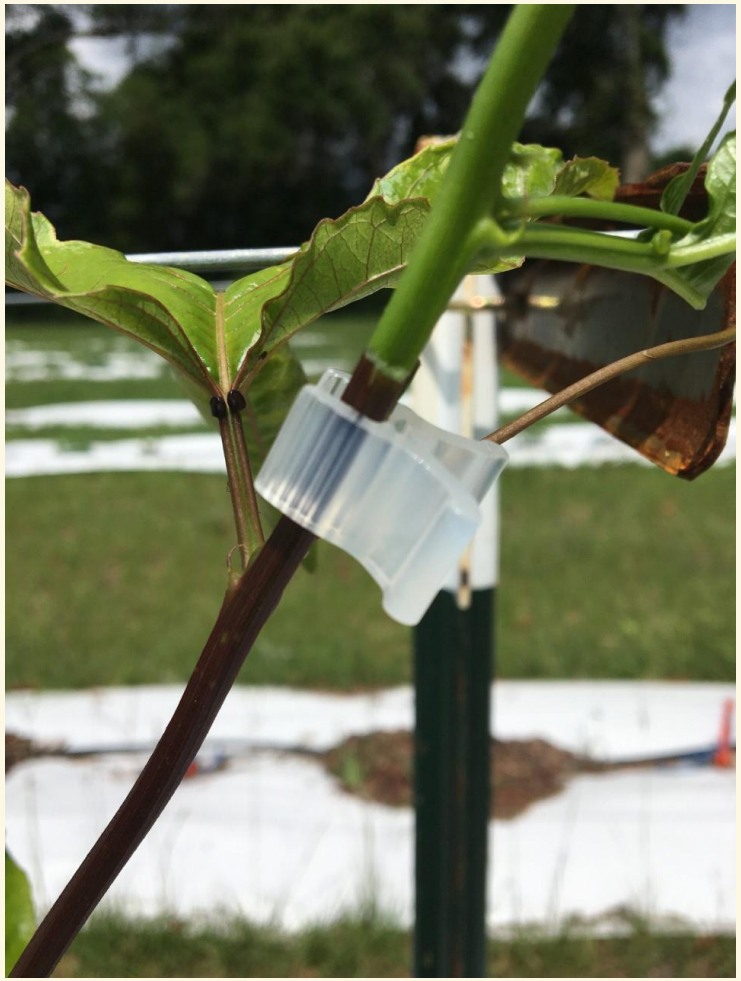


Ongoing Variety Trials: *Passiflora spp.*

16 accessions 2022
+40 in 2023

Rootstock
Cold tolerance
Flavor



Ongoing Variety Trials: *Pyrus communis*

9 varieties

Dixie Delight
McKelvey
Warren
Spalding*
Thanksgiving
Dr. Deer
Arthur Ledbetter
Moonglow
Senator Clark

Ongoing Variety Trials: *Sambucus spp.*

Previously / currently trialed named varieties

Sambucus canadensis

Ranch
Bob Gordon
Wyldewood (II)
Ozark
Pocahontas
York
Johns
Kent
Nova
Adams x 4*

Previously / currently trialed named varieties

Sambucus canadensis

Ranch
Bob Gordon
Wyldewood (II)
Ozark
Pocahontas
York
Johns
Kent
Nova
Adams x 4*

Sambucus nigra

Marge*
Haidegg 17
Korsor
Samdal
Samyl

Varieties trialed

Sambucus canadensis

Ranch
Bob Gordon
Wyldewood (II)
Ozark
Pocahontas
York
Johns
Kent
Nova
Adams x 4*

Sambucus nigra

Marge*
Haidegg 17
Korsor
Samdal
Samyl

Others

Unnamed: 7
Florida types: 5
Seedlings: 54

Varieties trialed

Sambucus canadensis

Ranch
Bob Gordon
Wyldewood (II)
Ozark
Pocahontas
York
Johns
Kent
Nova
Adams x 4*

Sambucus nigra

Marge*
Haidegg 17
Korsor
Samdal
Samyl

Others

Unnamed: 7
~~Florida types: 5~~
Florida types: 7
~~Seedlings: 54~~
Seedlings: 300+

Ranch, Bob Gordon, Adams*, Wyldewood (II*)

Likely the most widely grown varieties in the US (outside of the Southeast), in that order.

JLAV-1-3 *"Hilda"*

S. canadensis of Southeastern origin. Highest potential of all varieties previously trialed. Semi-erect growth habit, ideal size cymes, primocane bearing. Numerous cymes, fast establishing. Mainly green petiole. Excellent disease and mite resistance thus far. The highest culinary value of flowers trialed thus far with a very unique fragrance and medium sweetness. Compositional quality of fruit has tested high 2021 - 2023. Large, glossy berry. Leaves are also very glossy. High potential for cultivation in Florida.

Requires cross pollination to avoid early berry drop.

JLAV-5-1 *"More"*

S. canadensis of Southeastern origin. Very high potential compared to previously trialed varieties. Mainly erect growth habit. Large cymes, but appears to have better than average evenness of ripening despite size, primocane bearing.

Red petiole. Good disease and some mite resistanc. Medium culinary value of flowers with powdery sweet fragrance – slightly "peppery." Anthocyanins tested high to very high in 2021-2022. Relatively small berry, but heavy producer. High potential for cultivation in Florida.

JLAV series

JLAV series

31-03-200 "*Liber*"

S. canadensis of unknown origin, primocane bearing, good productivity, comparatively difficult to establish, but does not require more chill hours than typical of our latitude. Extremely high culinary value of flowers with high sweetness and powdery fragrance. Good quality of berries. Berries are individually smaller than typical. Decent disease resistance, dark red petiole, less susceptible to mites than average canadensis. Good potential for commercial cultivation in Florida.

31-03-200 “*Liber*”

33-00-400 "*Cy*"

S. canadensis likely from Nova Scotia. Very unique variety. Does not fruit on primocane growth, but blooms and fruits on floricane branches very early in the season and does not require more chill hours than typical of our latitude, despite its likely origin. Very small but numerous cymes. Very determinate in ripening and the only variety we have encountered with enough determinance to be eligible for mechanical harvest***. Slightly larger berry than typical canadensis. Less disease and pest prone than most *canadensis* trialed. Interesting stock for breeding potential. Unknown potential for Florida as its own cultivar.

33-00-400 “*Cy*”

DNS Series 1 - 43

Seedlings from aggregate seed collection throughout the Southeast not including Florida.

DNS Series 1 - 43

S. canadensis seedlings from aggregate seed collection across the Southeast *except Florida.

DNS-10, 11, 15, 18, 23, 29 and 36 selected for NIFA grant trials 2022-2024...

FGW / FRW *"Florida Waldgeisters"*

A stand-out Florida type with two distinct variations. Found growing together, one is green throughout all plant parts and the other a deep red in petioles and leaf margins. Both are in propagation for the eventual possibility of use as rootstock.

FGW / FRW *"Florida Waldgeisters"*

Summary

Cultivation of elder in the U.S., and specifically in the Southeast, is at an early stage.

The market exists and is growing for imported product, and the domestic market is taking shape.

Use in wine has a long history, and wine is an ideal vehicle for expanding regional market share.

Thanks!