



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

*Dave Jarnagin*  
*4/27/2023*

## Elderberry and Elderflower (*Sambucus* spp.): A Cultivation Guide for Florida<sup>1</sup>

David Jarnagin, Ali Sarkhosh, Juanita Popenoe, Steve Sargent, and Kevin Athearn<sup>2</sup>

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

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A “cyme” is the flowering or fruiting portion of *Sambucus*.

“15-20 years” and the last few years of research remains largely unpublished as of today.















**Early June 2022, 18 months from  
cuttings planted direct in row on  
December 7<sup>th</sup>, 2021.**









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[www.HyldemoerandCo.com](http://www.HyldemoerandCo.com)

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## Research and Publications

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### CURRENT PUBLICATIONS

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

[Elderberry and Elderflower \(Sambucus spp.\): Markets, Establishment Costs and Potential Returns](#)

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

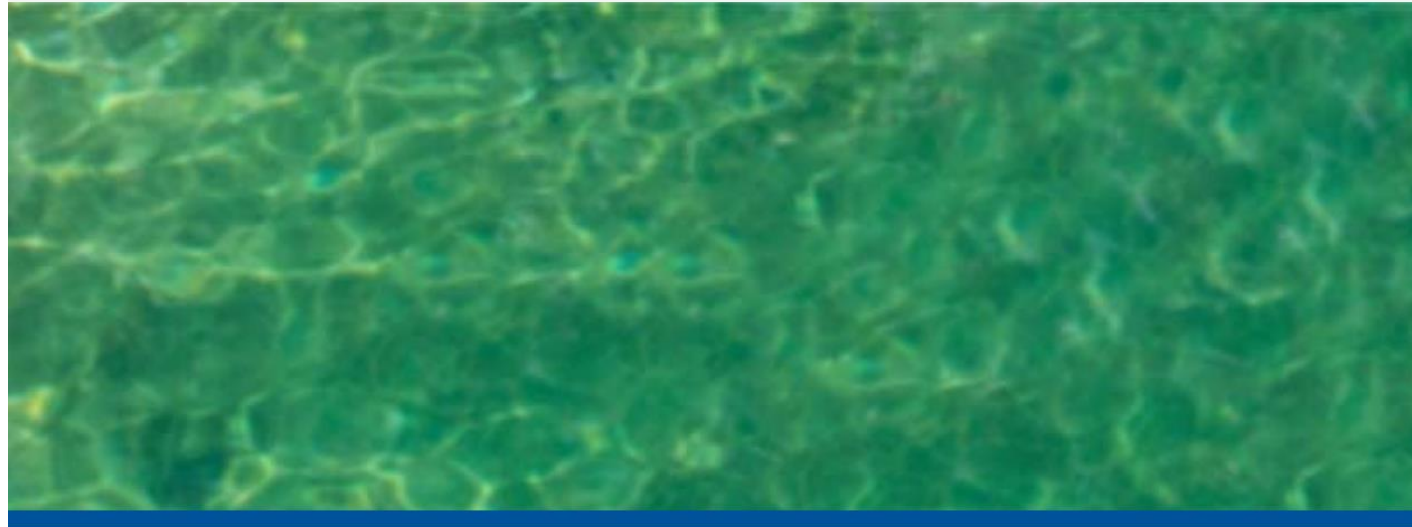
[Southern SARE: Farmers Testing Elderberry Varieties for Florida Cultivation](#)

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### ONGOING RESEARCH

National Institute of Food and Agriculture, SBIR Phase I: [Diversifying the Regional Wine Industry Through Sustainably Grown Sambucus](#)





## ELDER

### PUBLICATIONS

- [Elderberry and Elderflower \(Sambucus spp.\): A Cultivation Guide for Florida](#)
- [Elderberry and Elderflower \(Sambucus spp\): Markets, Establishment Costs, and Potential Returns](#)
- [Sambucus nigra ssp. canadensis: Elderberry](#)
- [Sambucus canadensis 'Aurea': 'Aurea' American Elder](#)
- [Sambucus mexicana: Mexican Elder](#)

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[Landscape Tree Varieties D-L](#)

### RELATED UNITS



## Elderberry Cultivation

David Jarnagin

Elderberry, *Sambucus* spp., is collected from wild plants for use in medicine. European *Sambucus* species were introduced to Americans as *Sambucus canadensis*.



Figure 1. Elderflower cyme.  
Credits: Hyldemoer + Co., Florida

The purpose of this publication is to provide information on growing American elderberry as a commercial crop for Florida. Although elderberry is not a commercial scale crop in Europe, in the United States, it has been more of a commercial crop in the postharvest processing parts of the country.

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## Elderberry and Elderflower (*Sambucus* spp): Markets, Establishment Costs, and Potential Returns<sup>1</sup>

Kevin Athearn, David Jarnagin, Ali Sarkhosh, Juanita Popenoe, and Steven Sargent<sup>2</sup>

### 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

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Search “EDIS Elderberry”

# Research priorities

Postharvest processing

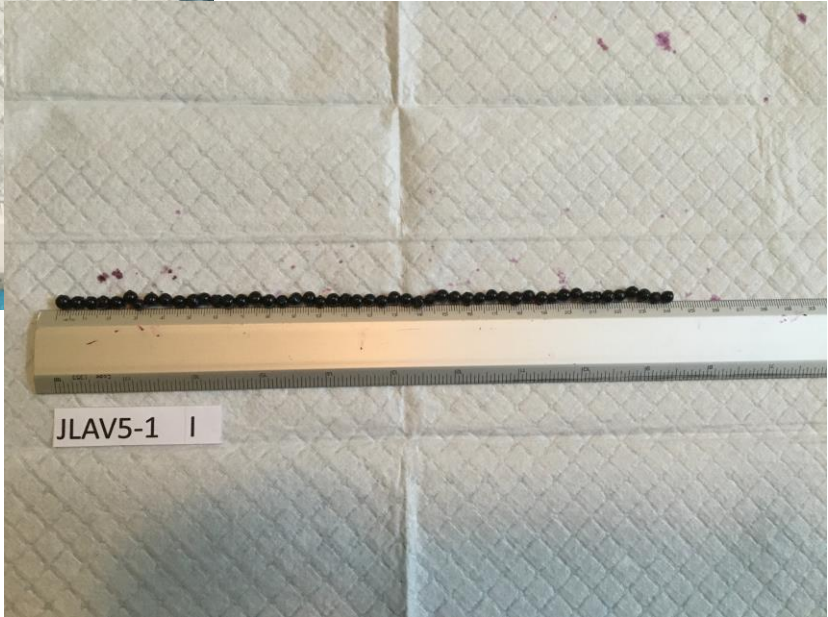
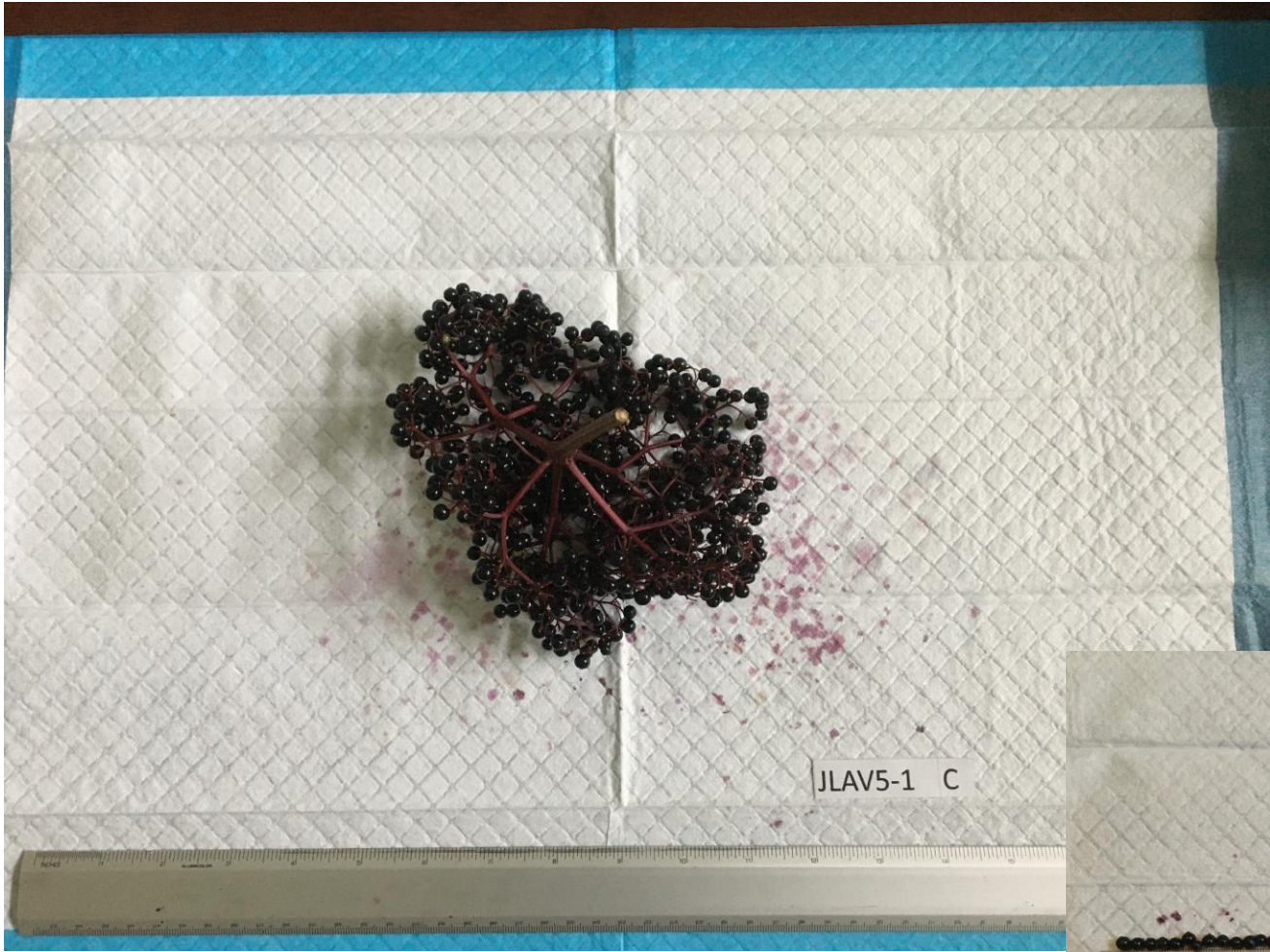
Variety development

Product development

Wine







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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.

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# Presentation outline

## Topics:

- Introduction to the crop and botany
- Propagation
- Soil, fertility and soil health
- Establishment
- Weed control
- Pruning
- Pests
- Harvest / postharvest
- Toxicity

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# Introduction

## Key points:

- Long history of use both of flowers and fruit around the world, including North America
- Elder is suitable for both commercial and home growing
- Harvest and postharvest processing remains a major challenge
- Market value closely tied to antioxidant concentrations (anthocyanins)
- Good candidate for organic cultivation when certain conditions are met
- Site selection and soil quality are critical



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# Introduction

## Edits and additions:

- **Growing for compositional quality (anthocyanin content) vs. growing for home use (flavor)**
- **Factors differentiating commercial vs. home cultivation include harvest timing, postharvest processing, caring for a small number of individual plants compared to the commercial scale**

Other *Sambucus* species have been used for many purposes and may provide additional potential for cultivation in Florida, whether as a commercial crop or for genetic diversity for breeding purposes. Information about markets and budgeting can be found in another EDIS publication, *Elderberry and Elderflower (Sambucus spp.): Markets, Establishment Costs, and Potential Returns*.

### Differentiating *Sambucus* Species

The specific type of *Sambucus nigra* ssp. *canadensis* native to Florida was at one time classified as a separate species, *S. simpsonii*, but is currently grouped with the *canadensis* subspecies. There are significant differences to note for commercial production between native Florida phenotypes and American *Sambucus* found farther north. As has been found in many areas of the country, the European species, *S. nigra*, does not thrive long term in Florida and also appears to have a higher reproductive chill-hour requirement than occurs in the South.

Some differences between species are visually obvious, as shown by variation in leaflet size and configuration of three species below (Figure 2). Other important differences are discussed later in this document. This paper discusses cultivation of American *Sambucus* species and varieties, though species from other parts of the world that have not previously been evaluated may also hold potential.

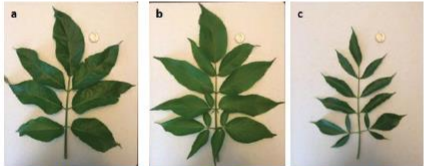


Figure 2. Mature leaves of maximum size: (a) *S. nigra* (most often having 7 leaflets with a maximum of 9), (b) *S. canadensis*, (most often having 9 or more leaflets and ranging from 7 to 11 or more), and (c) *S. simpsonii* (most often having 9 or more leaflets and ranging from 7 to 11 or more).

Credits: Hyldemoer + Co., Florida

Another form of *Sambucus*, previously known as *S. mexicana*, has also been reported in Florida. This form does not appear to have commercial fruit or flower production value (see <https://edis.ifas.ufl.edu/st580>). *Sambucus* varies widely across North America despite the recent and considerable reduction in number of named species as compared to older taxonomy; *S. simpsonii* has been largely removed as a separate species or subspecies, and *S. mexicana* is most often replaced with either the *S. nigra* ssp. *canadensis* or *S. nigra* ssp. *cerulea* species names, depending on geography,

further confusing the identity of these conspicuously different plants.

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# Botany

## Key points:

- Bolli, 1994
- Family, **Caprifoliaceae**... **Adoxaceae**... **Viburnaceae**
- Genus, *Sambucus*
- Species, *S. nigra* ssp. *canadensis* vs. *S. canadensis* vs. *S. simpsonii*: or “a southern extension of *Sambucus nigra* ssp *canadensis* found only in Florida”

# A BRIEF REVIEW OF RECENT CONTROVERSIES IN THE TAXONOMY AND NOMENCLATURE OF *SAMBUCUS NIGRA* SENSU LATO

Select Language |   

## Authors

W.L. Applequist

## Abstract

The genus *Sambucus* is widespread and morphologically difficult, and as a result, **no taxonomic treatment to date has been entirely satisfactory**. The only modern revision, by Bolli, reduced the number of recognized species worldwide from over 30 to nine. In Bolli's treatment, five taxa formerly considered to be distinct species, including *S. canadensis*, *S. cerulea*, *S. peruviana*, and the endemic island taxa *S. maderensis* and *S. palmensis*, were placed within *S. nigra* as subspecies. Available data relating to these taxa are briefly reviewed. It is suggested that, while the **recognition of the American elder as *S. nigra* subsp. *Canadensis* is reasonable**, *S. cerulea* and possibly *S. peruviana* would be better treated as distinct species; the best classification of the other two taxa remains uncertain. The **preferred family assignment for *Sambucus* is *Adoxaceae***, though the name of this family **may change in future** depending upon the ultimate disposition of published nomenclatural proposals now in process.

## Citation

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## Keywords

American elder, blue elder, European elder, *Sambucus canadensis*, *Sambucus cerulea*

## Language

English

## Full text

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### Differentiating *Sambucus* Species

The specific type of *Sambucus nigra* ssp. *canadensis* native to Florida was at one time classified as a separate species, *S. simpsonii*, but is currently grouped with the *canadensis* subspecies. There are significant differences to note for commercial production between native Florida phenotypes and American *Sambucus* found farther north. As has been found in many areas of the country, the European species, *S. nigra*, does not thrive long term in Florida and also appears to have a **higher reproductive chill-hour requirement than occurs in the South**.

Some differences between species are visually obvious, as shown by variation in leaflet size and configuration of three species below (Figure 2). Other important differences are discussed later in this document. This paper discusses cultivation of American *Sambucus* species and varieties, though species from other parts of the world that have not previously been evaluated may also hold potential.

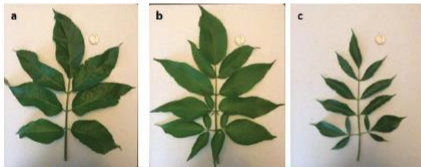


Figure 2. Mature leaves of maximum size: (a) *S. nigra* (most often having 7 leaflets with a maximum of 9), (b) *S. canadensis*, (most often having 9 or more leaflets and ranging from 7 to 11 or more), and (c) *S. simpsonii* (most often having 9 or more leaflets and ranging from 7 to 11 or more).

Credits: Hyldemoer + Co., Florida

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# Botany

## Key points:

- **Chill hour requirement!**

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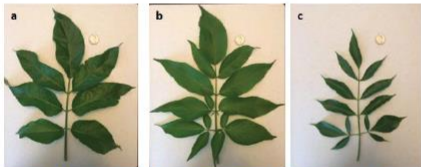


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# Botany

## Edits and additions:

- **Blackberry is the closest plant to compare in terms of cultivation method (taxonomically unrelated)**
- **Updates on trials and ongoing research**

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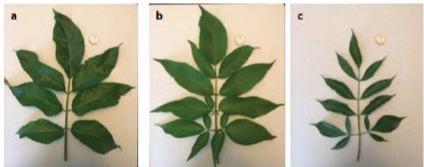


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# Propagation

## Key points:

- **Hardwood cuttings**
- **Rooting hormone is unnecessary**

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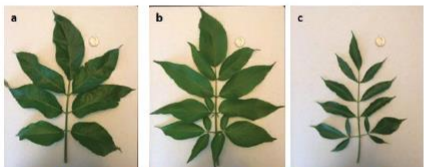


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# Propagation

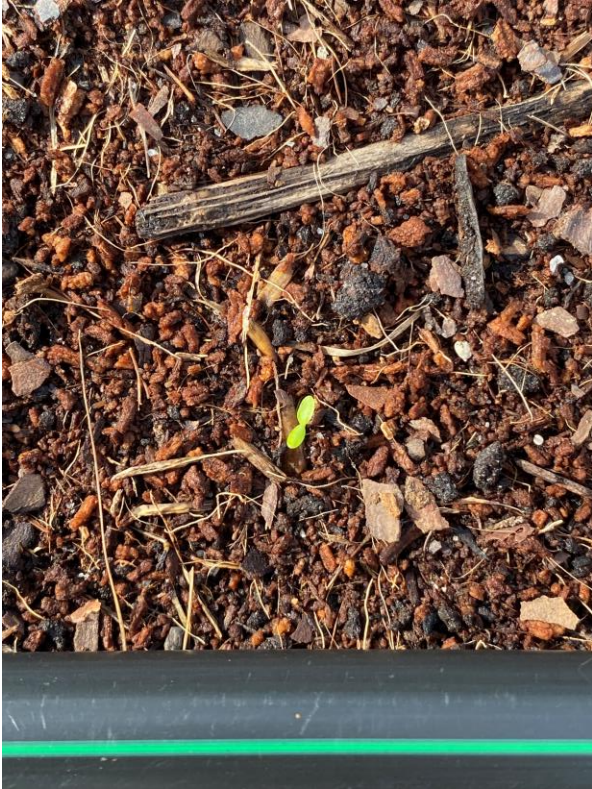
## Key points:

- **Hardwood cuttings**
- **Rooting hormone is unnecessary**

## Edits and additions:

- **10 or more cuttings per plant (goal)**
- **Container growing not recommended**
- **Seedlings**

# Seedlings





# Seedlings



# Seedlings



Planting directly in ground is preferable to potting, but if potted, keep the cuttings warm and moist. The cuttings should not be allowed to dry out or be kept too wet. Potted cuttings should be well-rooted within six to eight weeks and can be transplanted into the field after the last frost. If needed, the rooted cuttings can be transplanted into 6-inch pots. Elderberry is a very fast-growing plant in favorable conditions, and root-binding is a major concern if grown in pots for more than a few months. The potted transplants grown successfully for one season establish well in the next season, or they may be cut into pieces of main root, stolon, and crown sections along with hardwood cuttings. This method results in one potted plant yielding several (sometimes 20 or more) new plants for propagation in ground next season.

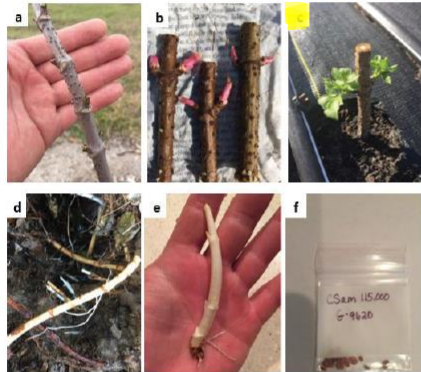


Figure 3. Propagation by hardwood cuttings (a, b, c), stolon (d, e), and seed (f).  
Credits: Hyldeboer + Co., Florida

Softwood cuttings are taken during the growing season and should be taken before flowering. Softwood cuttings must be potted in a sterile rooting medium to prevent decay. The rooting medium can be prepared by mixing peat moss and sand in equal amounts. Except for one pair of top leaves, all other leaves must be removed. The remaining steps are similar to that of propagation by hardwood cuttings but require more attention than hardwood cuttings to properly start. The rooted plants should be transplanted into 6-inch or larger pots and can be transplanted into the field the following season. Softwood cutting propagation of elderberry is seldom employed due to timing and the relative ease of propagation by hardwood cuttings.

Propagation by stolon section is an additional way to propagate elderberry. The main advantage of propagation by stolon section is that propagation material of this type can be taken over a long season annually and can be planted in a similarly long season either directly in ground or in pots. Stolon sections are planted horizontally at approximately one and a half to two inches deep, depending on soil type. The downside of propagation by stolon cuttings is the relative difficulty of digging or pulling sufficient material from the ground to gather significant volumes of planting material. The grower interested in a small planting may find propagation from stolon cuttings to be ideal because of the quality of the new canes produced initially as compared to top growth from hardwood cuttings. New canes emanating from the ground are typically more vigorous and faster to establish as compared to top growth from hardwood cuttings. Nursery production of elderberry starts propagated in this way is possible.

#### Soil and Fertility Management

Elderberry is well adapted to a wide range of soil types and fertility. However, the best yields for commercial cultivation can be obtained from well-drained, mildly acidic soils (pH 6.0–6.5). Florida soils are sandy and range from poorly drained to excessively drained. Therefore, if there are waterlogging issues after heavy rain, planting on raised beds is recommended. In the case of very quickly drained soils, the addition of organic matter in the form of properly aged compost becomes a requirement and is further discussed below. Soil amendment selection is critical for adjusting pH and must be able to be incorporated evenly to a depth of at least eight inches. Elderberry is relatively shallow rooted, and the 6”–10” root zone is a critical depth for uptake of water and nutrients.

The potential for sustainable and/or organic cultivation of this hardy crop is one of its most important features. Organic fertilizers are considered less prone to loss due to off-gassing and leaching, both of which are commonly encountered in the use of conventional fertilizers. The ideal fertilizer program for elderberry is not well documented. Currently, there are no UF/IFAS fertilizer recommendation rates available for elderberry. Fertilization programs should be adjusted based on the results of leaf nutrient analysis. As a guide, nitrogen can be applied 4–8 weeks after planting at a rate of 10 lb per 3,630 linear feet of row. This distance is most commonly used to describe an “orchard-acre” of growing area for *Sambucus* planted 2–3 feet apart in a row in rows spaced 12 feet on center. After the first season, test the soil and apply phosphorous and potassium at the recommended rate per 1,000 linear feet of cane fruit before

# Propagation cont.

## Key points:

- Set hardwood cuttings directly in row
- Potted plants best utilized by dissection prior to planting in row
- Softwood cuttings are far more difficult to establish than stolon material

## Edits and additions:

- Lateral planting of hardwood cuttings is preferable
- Microprop

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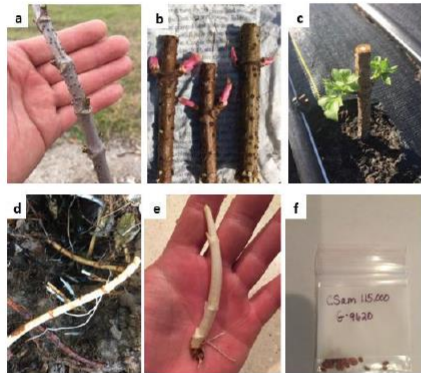


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#### Soil and Fertility Management

Elderberry is well adapted to a wide range of soil types and fertility. However, the best yields for commercial cultivation can be obtained from well-drained, mildly acidic soils (pH 6.0–6.5). Florida soils are sandy and range from poorly drained to excessively drained. Therefore, if there are waterlogging issues after heavy rain, planting on raised beds is recommended. In the case of very quickly drained soils, the addition of organic matter in the form of properly aged compost becomes a requirement and is further discussed below. Soil amendment selection is critical for adjusting pH and must be able to be incorporated evenly to a depth of at least eight inches. Elderberry is relatively shallow rooted, and the 6–10" root zone is a critical depth for uptake of water and nutrients.

The potential for sustainable and/or organic cultivation of this hardy crop is one of its most important features. Organic fertilizers are considered less prone to loss due to off-gassing and leaching, both of which are commonly encountered in the use of conventional fertilizers. The ideal fertilizer program for elderberry is not well documented. Currently, there are no UF/IFAS fertilizer recommendation rates available for elderberry. Fertilization programs should be adjusted based on the results of leaf nutrient analysis. As a guide, nitrogen can be applied 4–8 weeks after planting at a rate of 10 lb per 3,630 linear feet of row. This distance is most commonly used to describe an "orchard-acre" of growing area for *Sambucus* planted 2–3 feet apart in a row in rows spaced 12 feet on center. After the first season, test the soil and apply phosphorous and potassium at the recommended rate per 1,000 linear feet of cane fruit before

# Soil, Fertility and Health

## Key points:

- pH (hard water!)
- Row prep is vital and may be a barrier (cost compared to blueberry)
- Know your soil and the exact chemical profile of amendments (compost is tricky)
- Fertilization is not a mysterious topic. Heavy feeder?

## Edits and additions:

- Plant and row spacing are subject to many considerations

the new season starts. Apply nitrogen at 60–80 lb/acre for mature, bearing elderberry until further trial results become available. Florida's sandy soil has severe nutrient-leaching issues. Because of this, fertilizer should be applied in stages via fertigation when possible or via the proper use of slow-release fertilizers when fertigation is not practical.

To amend poor, sandy soils in Florida, compost is highly recommended. Mixing properly aged and high-quality compost into sandy soil will increase nutrient- and water-holding capacity and provide some slowly released nutrients. Compost also enhances the environment for many species of soil microbes. For example, mycorrhizae are fungi that form symbiotic relationships with plants by assisting in water and nutrient absorption while the plant provides carbohydrates in exchange. Elderberry greatly benefits from soil microbes because the relatively shallow root system can be augmented with networks of mycorrhizae or other soil microbes. The plant's very dense and fine feeder-root system creates an ideal environment for beneficial soil microbe communities. Without healthy soil conditions, elderberry cannot absorb all the micronutrients needed from the soil. Therefore, use of compost with microbial inoculants is helpful for the cultivation of elderberry in Florida's sandy soils.

### Planting and Irrigation

Elderberry can be planted either in the spring or fall. Spring planting should be made after the last chance of frost to avoid damage to newly forming roots after planting. Fall plantings yield the fastest-establishing plants because the cool season encourages root development over vegetative growth. Issues with damage from grasshoppers as well as moles, gophers, and other soil-dwelling rodents may be encountered over the winter due to the relative dryness of the winter months in Florida and the need to provide irrigation throughout these dry periods. This moisture attracts overwintering pests due to the simple fact that a relative abundance of water is present from even brief irrigation.

If plants were held in pots before planting, any damaged or dead canes and 8 to 10 inches off the top of healthy canes should be pruned before planting. Use of a sealant for pruned canes is generally advisable at this stage, because the pithy core of elder canes is very attractive to a variety of wood-boring and nesting insects. Removing (pinching) flowering heads from the first-year plants also encourages the development of a good root system.

After planting, provide enough water to wet the entire root zone. Apply 1 to 2 inches of water to the root zone per week during dry periods, depending on soil type. Keeping roots from drying with frequent watering is important to establishment and production. The major uptake of water and nutrients in established plants occurs between the root zone depth of 6–10 inches in elderberry. The utilization of soil-moisture-sensing technology is highly recommended for determining proper irrigation scheduling. Above all else, elderberry is not tolerant to drought stress. Therefore, methods to keep soil moisture consistent are important for commercial cultivation. Drip irrigation using a 0.5–0.75 inch plastic line with emitters spaced at 18–24 inches is commonly used. More tightly spaced arrangements of emitters can be somewhat hard to find but may provide for a more consistent wetting pattern throughout the entire area of the row, especially if arranged in dual runs of drip line. Microsprinkler irrigation may be utilized depending on the grower's confidence in their ability to combat fungal disease pressure, but wetting of the ground-level leaves is counterproductive in most instances and should be avoided. If the plants are grown in bare-ground conditions, frequent watering is very important because Florida's sandy soil dries very quickly, and it is very hard to rewet if it dries completely. Covering rows with pine bark mulch or landscape fabric will help maintain soil moisture and discourage weed competition. Proper alleyway management is important for an elderberry orchard long-term.

The mature size of American elderberry is generally 10 to 12 ft tall and wide (Figure 4). However, the utilization of primocane fruiting varieties along with coppicing techniques (see <https://vergepermaculture.ca/2014/03/31/coppicing/>) could be used by elderberry growers in Florida to control plant size. Upon the end of the second to third growing season, the elderberry planting should be evaluated to ensure that colonization of new canes has been achieved in a radius out from the central plant crowns. This will display as "suckering" and demonstrates that the plants are mature enough to withstand heavy pruning close to ground level toward the end of winter while dormant. Recommended spacing of elderberry for commercial cultivation ranges considerably by location and climate. Common recommendations range from 6 ft between plants and 12 ft between rows in more northerly climates, where coppicing of primocane bearing varieties is of little benefit due to the short growing season; to a very tight spacing of 2 or 3 ft by 12 to 15 ft, with tighter row spacings possible for varieties with a more erect growth habit. Spacing can be adjusted to suit the farm's equipment or other orchard management considerations. Generally, a wider linear plant

# Soil, Fertility and Health

## Key points:

- The difference between a “real-state acre” and a cultivated acre is vital to understand
- We'll talk about compost in a minute
- Soil health, organic matter and moisture are vital, and are a vast topic

the new season starts. Apply nitrogen at 60–80 lb/acre for mature, bearing elderberry until further trial results become available. Florida's sandy soil has severe nutrient-leaching issues. Because of this, fertilizer should be applied in stages via fertigation when possible or via the proper use of slow-release fertilizers when fertigation is not practical.

To amend poor, sandy soils in Florida, **compost** is highly recommended. Mixing properly aged and high-quality **compost** into sandy soil will increase nutrient- and water-holding capacity and provide some slowly released nutrients. **Compost** also enhances the environment for many species of soil microbes. For example, mycorrhizae are fungi that form symbiotic relationships with plants by assisting in water and nutrient absorption while the plant provides carbohydrates in exchange. Elderberry greatly benefits from soil microbes because the relatively shallow root system can be augmented with networks of mycorrhizae or other soil microbes. The plant's very dense and fine feeder-root system creates an ideal environment for beneficial soil microbe communities. Without healthy soil conditions, elderberry cannot absorb all the micronutrients needed from the soil. Therefore, use of **compost** with microbial inoculants is helpful for the cultivation of elderberry in Florida's sandy soils.

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# Soil, Fertility and Health

## Edits and additions:

- **Compost isn't the right material for all situations**

# Soil, Fertility and Health



Account No.	801	Name	HYLDEMOER + CO LLC	Grower	SBIR P1
Invoice No.		Company	HYLDEMOER + CO LLC	Field ID	JS-D120
Date Recd	4/12/2023	Address	15576 NW 141ST CT	Sample ID 1	-
Date Rept	4/14/2023	City, State, ZIP	WILLISTON, FL 32696	Sample ID 2	-
				Sample Depth	0-6

## SOIL ANALYSIS

Lab #	Fertility													
	Nitrate ppm NO3-N	Nitrate lb/A N	Phosphorus ppm P	Sulfur ppm S	Potassium ppm K	Calcium ppm Ca	Magnesium ppm Mg	Sodium ppm Na	Zinc ppm Zn	Iron ppm Fe	Manganese ppm Mn	Copper ppm Cu	Boron ppm B	Chloride ppm Cl
7453	8.4	15	159	-	11.11	109	342	140	32	6.08	103	3.2	1.14	0.42
Rank														

Lab #	Other Soil Measures														
	Soil pH 1:1 H2O	Buffer pH Mod. WDFP	Soluble Salt mmho/cm	Excess Lime	Soil OM % LOI	Org. C % C	Total C % C	Total N % N	Ammonium ppm NH4-N	CEC meq/100g	Base Sat %	Base Saturation			
7453	6.5	6.6	0.10	NONE	15.8	-	-	-	10.9	58	42	43	11	9	1
Rank															

Lab #	Crop	Yield	N Credits	Fertility Recommendations, lbs of Required Nutrients per Acre												
				P205	K2O	S	Zn	Mg	Fe	Mn	Cu	B	Cl	Lime T/A		

Reviewed By: Emily Shatto Date: 4/14/2023	Analysis Performed by Regen Ag Lab, LLC
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Regen Ag Lab, LLC 31740 Hwy 10, Plessanton NE 68866 308-627-0065 regenaglab.com

Gain Ground



Account No.	801	Name	HYLDEMOER + CO LLC	Grower	HYLDEMOER + CO LLC
Invoice No.		Company	HYLDEMOER + CO LLC	Field ID	SBIR P1
Date Received	4/12/2023	Address	15576 NW 141ST CT	Sample ID 1	JS-2MD
Date Reported	4/14/2023	City, State, ZIP	WILLISTON, FL 32696	Sample ID 2	-

## PLANT ANALYSIS REPORT

Lab # 512 Type SAMBUCUS Stage INFLORESCENCE

### Results on a Dry Basis

Nutrient	Value	Units
Nitrogen	3.19	% N
Phosphorus	0.32	% P
Potassium	2.38	% K
Calcium	2.33	% Ca
Magnesium	0.70	% Mg
Sulfur	0.18	% S
Sodium	0.03	% Na
Zinc	28.96	ppm Zn
Iron	79.77	ppm Fe
Manganese	72.17	ppm Mn
Copper	5.58	ppm Cu
Boron	26.65	ppm B
Molybdenum	4.74	ppm Mo
Aluminum	81.23	ppm Al

### Sufficiency Range

Nutrient	Rank
Nitrogen	
Phosphorus	
Potassium	
Calcium	
Magnesium	
Sulfur	
Sodium	
Zinc	
Iron	
Manganese	
Copper	
Boron	
Molybdenum	
Aluminum	

### Reviewer Comments

Sufficiency ranges for this crop are unknown to the lab.

Reviewed By: Emily Shatto Date: 4/14/2023 Analysis Performed by Regen Ag Lab, LLC

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Gain Ground



Account No.	801	Name	DAVID JARNAGIN	Grower	SBIR P1
Invoice No.		Company	HYLDEMOER + CO LLC	Field ID	JS-D120
Date Recd	4/12/2023	Address	15576 NW 141ST CT	Sample ID 1	-
Date Rept	4/14/2023	City, State, ZIP	WILLISTON, FL 32696	Sample ID 2	-
				Sample Depth	0-6

## HANEY SOIL HEALTH ANALYSIS

Lab #	Nitrogen				Phosphorus										
	H2O Extract	H2O Extract	H2O Extract	H2O Extract	H2O Extract	H2O Extract	H2O Extract	H2O Extract							
7453	9.4	1.6	11.0	20.6	9.7	0.89	9.7	0.0	37.5	80.5	37.5	7.3	7.3	0.0	185.2
Rank															

Lab #	Other Soil Measures														
	Soil pH 1:1	Buffer pH Mod. WDFP	Soluble Salt mmho/cm	Excess Lime	Soil OM % LOI	Org. C % C	Potassium ppm K	Calcium ppm Ca	Magnesium ppm Mg	Sodium ppm Na	Zinc ppm Zn	Iron ppm Fe	Copper ppm Cu	Aluminum ppm Al	Sulfur ppm S
7453	6.5	6.6	0.10	NONE	15.8	81	543	119	41	3.38	2.0	50	0.26	71	7.32
Rank															

Lab #	Soil Health				Nitrogen Comparison				Reviewer Comments	
	H2O Extract	H2O Extract	H2O Extract	H2O Extract	Tradition	Haney	Other	Savps		
7453	319.3	115	278.9	11.84	23.22	20% Legume 80% Grass	27.8	27.5	28.3	21.10
Rank										

Lab #	Crop	Yield	N Credits	Fertility Recommendations, lbs of Required Nutrients per Acre												
				P205	K2O	S	Zn	Mg	Fe	Mn	Cu	B	Cl	Lime T/A		
7453	RASPBERRIES	1	0													

Reviewed By: Emily Shatto Date: 4/14/2023 Analysis Performed by Regen Ag Lab, LLC

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Gain Ground



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				Sample Depth	0-6

## PLFA ANALYSIS REPORT

Lab # 7453

	Value	Rank	Overall Rank
Total Biomass, PLFA ng/g soil	4487.99	EXCELLENT	ABOVE AVERAGE
Functional Group Diversity Index	1.401	GOOD	

Functional Group	Value	Units	% of Total Biomass	Ratios	
				Community	Value Rank
Total Bacteria	2118.53	PLFA ng/g	47.20	Fungi:Bacteria	0.1935 AVERAGE
Gram +	1035.10	PLFA ng/g	23.06	Protozoa:Bacteria	0.0044 POOR
Actinomycetes	281.82	PLFA ng/g	6.28	Gram+:Gram-	1.6429 IDEAL
Gram -	801.60	PLFA ng/g	17.86		
Total Fungi	409.87	PLFA ng/g	9.13	Stress Indicators	
Arbuscular Mycorrhizal	194.50	PLFA ng/g	4.33	Sat:Unsat	2.2098 LOW
Saprophytic	215.37	PLFA ng/g	4.80	Mono:Poly	19.0528 GOOD
Protozoa	9.37	PLFA ng/g	0.21	Pre 16:Cyclo 17	All Pre16:1 VERY ACTIVE
Undifferentiated	1950.23	PLFA ng/g	43.45	Pre 18:Cyclo 19	11.0511 ACTIVE

### Reviewer Comments

Reviewed By: Emily Shatto Date: 4/18/2023 Analysis Performed by Regen Ag Lab, LLC

Regen Ag Lab, LLC 31740 Hwy 10, Plessanton NE 68 308-627-0065 regenaglab.com

Gain Ground

# Soil, Fertility and Health



All the information shown in this microbial report is based on the detection presence of 488 different species



## SUMMARY



## SOIL QUALITY



All the information shown in this microbial report is based on the detection presence of 586 different species



## SUMMARY



## SOIL QUALITY



## BECROP TEST

### Microbiome Analysis Report

#### SSHCM2023

C6N180

PARCEL: SBIR P1 - | CROP: Elderberry | VARIETY: | SOIL: | DATE: 20-Feb-2023

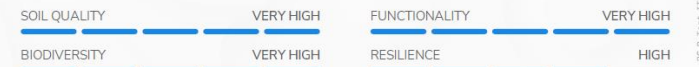
All the information shown in this microbial report is based on the detection presence of 907 different species



## Summary



## Soil Quality





the new season starts. Apply nitrogen at 60–80 lb/acre for mature, bearing elderberry until further trial results become available. Florida's sandy soil has severe nutrient-leaching issues. Because of this, fertilizer should be applied in stages via fertigation when possible or via the proper use of slow-release fertilizers when fertigation is not practical.

To amend poor, sandy soils in Florida, compost is highly recommended. Mixing properly aged and high-quality compost into sandy soil will increase nutrient- and water-holding capacity and provide some slowly released nutrients. Compost also enhances the environment for many species of soil microbes. For example, mycorrhizae are fungi that form symbiotic relationships with plants by assisting in water and nutrient absorption while the plant provides carbohydrates in exchange. Elderberry greatly benefits from soil microbes because the relatively shallow root system can be augmented with networks of mycorrhizae or other soil microbes. The plant's very dense and fine feeder-root system creates an ideal environment for beneficial soil microbe communities. Without healthy soil conditions, elderberry cannot absorb all the micronutrients needed from the soil. Therefore, use of compost with microbial inoculants is helpful for the cultivation of elderberry in Florida's sandy soils.

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The mature size of American elderberry is generally 10 to 12 ft tall and wide (Figure 4). However, the utilization of primocane fruiting varieties along with coppicing techniques (see <https://vergepermaculture.ca/2014/03/31/coppicing/>) could be used by elderberry growers in Florida to control plant size. Upon the end of the second to third growing season, the elderberry planting should be evaluated to ensure that colonization of new canes has been achieved in a radius out from the central plant crowns. This will display as "suckering" and demonstrates that the plants are mature enough to withstand heavy pruning close to ground level toward the end of winter while dormant. Recommended spacing of elderberry for commercial cultivation ranges considerably by location and climate. Common recommendations range from 6 ft between plants and 12 ft between rows in more northerly climates, where coppicing of primocane bearing varieties is of little benefit due to the short growing season; to a very tight spacing of 2 or 3 ft by 12 to 15 ft, with tighter row spacings possible for varieties with a more erect growth habit. Spacing can be adjusted to suit the farm's equipment or other orchard management considerations. Generally, a wider linear plant

# Establishment

## Key points:

- Cool soil temps best promote initial rooting over vegetative growth
- Early winter planting works best for H+Co.
- Soil moisture sensing tech
- The irrigation (and fertigation) pattern guides the colonization pattern
- Fungal disease pressure – prevention > treatment

## Edits and additions:

- Fall or early winter planting preferable (for now)
- How we handle the mole issue
- Pinching isn't necessary if properly established

# Furrow / media method



spacing encourages better growth with increased yields in the North, while in the South the higher air circulation provided by a wider, lateral row spacing may provide better disease control for a dense population in-row.



Figure 4. The same elderberry plants at 3-foot spacing in-row, Year 1 (left) vs Year 2 (right). Both photos taken in the month of June. Credits: Hyldeboer + Co., Florida

The pollination of elderberry flowers is not well studied, but many varieties are thought to be self-pollinated. Wind pollination is most commonly thought to be the norm throughout the Midwest and the northern United States. Insect-assisted pollination is also likely, especially in Florida, where the native phenotypes are frequented by pollinating insects to a higher degree than those varieties introduced from farther north. For a variety of reasons, including pollination, planting two or more cultivars together is considered desirable. The distance between the different cultivars should not be over 60 ft, and less than 20 ft is recommended. Alternating rows of different varieties could be employed, or mixing of varieties within a row could be done as lengths of a variety followed by another variety. Staggering of varieties in a pattern of A, B, A, B within a row is not recommended, because differences in ripening periods between varieties can be notable, and this would hamper efficiency in harvest. This type of staggering will also present challenges to taking cuttings for further propagation because the stolons intermingle with each other in-row and become difficult to differentiate in the late, dormant season when hardwood cuttings are taken.

### Weed Control

Weed control is important for successful elderberry cultivation because elderberry does not compete well with weeds during establishment. Limitations to the use of herbicides and mechanical weeding exist for the crop. Elderberry grows new shoots from crowns and roots every year. Because of this, herbicides must be used with extreme caution. In addition, the shallow root systems of elderberry

are easily damaged by mechanical weeding. Therefore, the use of bark mulch and/or landscape fabric is invaluable to suppress weeds and to prevent the need for hand-weeding. Proper weed control also relies on appropriate row spacing and timely mowing, and these are critical components to successful establishment.

### Pruning Practices

The pruning method for elderberry is determined based on the purpose and size of the farm. If elderberry is grown in the backyard or a small-scale orchard, where labor cost is not important, standard horticultural pruning can be performed to remove dead, damaged, or diseased stems and three-year-old branches or trunk. Pruning in the first two years is typically not needed. Pruning can be done during the dormant season preceding bud break.

For medium- to large-scale commercial cultivation, operational costs must be considered. Coppicing the canes near ground level reduces operational costs in commercial cultivation. Coppicing may reduce total yield, but it will result in larger fruiting cymes and more uniform fruit ripening across the orchard. Not all American elderberry varieties perform well with an annual coppicing routine, and none of the European cultivars of species *S. nigra* will bear on primocane (first-year) growth after coppicing. Some American varieties also range considerably in their ability to bear on new canes, which may be further influenced by the low chill-hour conditions of Florida winters. Therefore, further trialing of elderberry varieties, regardless of origin, needs to be conducted before specific recommendations are published. On-farm testing is underway in Florida to determine the best varieties and cultural practices, especially to determine the relative success of utilizing coppicing methods in Florida. In summary, coppicing has several advantages over standard horticultural pruning. First, it can reduce labor costs substantially because coppicing can be accomplished using equipment such as sickle-bar cutters. By coppicing, labor costs for harvest may also be reduced because there is a more concentrated fruit set with larger cymes produced, both of which reduce the harvest window and hand-moves during manual harvest. Coppicing also reduces risks from overwintering insect eggs, pests, and disease inoculum by removing all old stems from the orchard and destroying this material.

### Insect Pests and Disease

Eriophyid mite (*Phyllocoptes* spp.), spider mite (*Tetranychus urticae*), stink bug (*Halyomorpha halys*), leaf-footed bug (*Leptoglossus zonatus*), armyworms (*Mythimna* spp.), spindle worm borer (*Achatodes zeae*), Japanese beetles

# Weed control

- Rapid establishment can be achieved





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are easily damaged by mechanical weeding. Therefore, the use of bark mulch and/or landscape fabric is invaluable to suppress weeds and to prevent the need for hand-weeding. Proper weed control also relies on appropriate row spacing and timely mowing, and these are critical components to successful establishment.

#### Pruning Practices

The pruning method for elderberry is determined based on the purpose and size of the farm. If elderberry is grown in the backyard or a small-scale orchard, where labor cost is not important, standard horticultural pruning can be performed to remove dead, damaged, or diseased stems and three-year-old branches or trunk. Pruning in the first two years is typically not needed. Pruning can be done during the dormant season preceding bud break.

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#### Insect Pests and Disease

Eriophyid mite (*Phyllocoptes* spp.), spider mite (*Tetranychus urticae*), stink bug (*Halyomorpha halys*), leaf-footed bug (*Leptoglossus zonatus*), armyworms (*Mythimna* spp.), spindle worm borer (*Achatodes zeae*), Japanese beetles

# Pollination

## Key points:

- Pollination timing requires further study
- Focus on formatting the planting for wind pollination, just like corn
- As with many crops, don't put all your eggs in one basket (variety)
- Results will vary

## Edits and additions:

- While insect pollination does not appear to be consequential, many insects do benefit from the plant's extrafloral nectaries. Fire ants do not appear to utilize these glands.

spacing encourages better growth with increased yields in the North, while in the South the higher air circulation provided by a wider, lateral row spacing may provide better disease control for a dense population in-row.



Figure 4. The same elderberry plants at 3-foot spacing in-row, Year 1 (left) vs Year 2 (right). Both photos taken in the month of June. Credits: Hyldeboer + Co., Florida

The pollination of elderberry flowers is not well studied, but many varieties are thought to be self-pollinated. Wind pollination is most commonly thought to be the norm throughout the Midwest and the northern United States. Insect-assisted pollination is also likely, especially in Florida, where the native phenotypes are frequented by pollinating insects to a higher degree than those varieties introduced from farther north. For a variety of reasons, including pollination, planting two or more cultivars together is considered desirable. The distance between the different cultivars should not be over 60 ft, and less than 20 ft is recommended. Alternating rows of different varieties could be employed, or mixing of varieties within a row could be done as lengths of a variety followed by another variety. Staggering of varieties in a pattern of A, B, A, B within a row is not recommended, because differences in ripening periods between varieties can be notable, and this would hamper efficiency in harvest. This type of staggering will also present challenges to taking cuttings for further propagation because the stolons intermingle with each other in-row and become difficult to differentiate in the late, dormant season when hardwood cuttings are taken.

### Weed Control

Weed control is important for successful elderberry cultivation because **elderberry does not compete well with weeds during establishment**. Limitations to the use of **herbicides and mechanical weeding exist for the crop**. Elderberry grows new shoots from crowns and roots every year. Because of this, **herbicides must be used with extreme caution**. In addition, the shallow **root systems of elderberry**

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# Weed control

## Key points:

- **Unrooted cuttings cannot withstand competition from weeds**
- **Lower leaves and canes are susceptible to herbicide drift**
- **Young plants are easily dislodged by weeding in close proximity to the cutting (yellow nut sedge)**
- **Row spacing and plant spacing should be well thought out**

## Edits and additions:

- **Wood mulch may promote fungal disease / bark is still tedious after a period of time. Deep mulch must be avoided**
- **Timeliness of mowing is vital to prevent weed seed dispersal, and proper mowing equipment is equally important**

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# Pruning

## Key points:

- Coppicing vs. pollarding
- European varieties cannot produce on primocane growth (until that one is found)
- The size of a cyme is relative to both the genotype and pruning. Very large cymes are not the goal (but for elderflower production, this is another story)
- Pest and disease pressure are greatly reduced through coppicing

## Edits and additions:

- Coppicing presents few, if any, negative results
- Timing is critical



spacing encourages better growth with increased yields in the North, while in the South the higher air circulation provided by a wider, lateral row spacing may provide better disease control for a dense population in-row.



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# Pests

## Key points:

- **Eriophyid mites are extremely prolific “specialists”**
- **Spider mites are very damaging, but relatively easy to cure in comparison**

(*Popilla japonica*), spotted-wing Drosophila (*Drosophila suzukii*), and other insect pests can be problematic for growing elderberry in Florida.

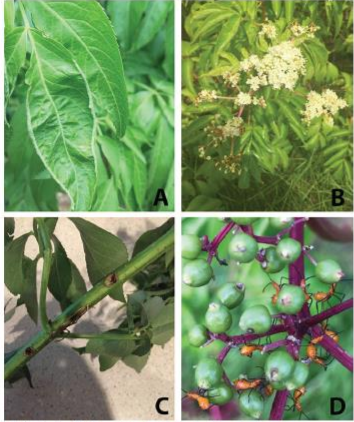


Figure 5. Early leaf infestation by Eriophyid mite (A), flower cyme with later Eriophyid mite damage (B), stem damaged by spindle worm borer (C), and leaf-footed bug nymphs on green berries (D). Credits: Hyldemoer + Co., Florida

Spotted-wing Drosophila (*Drosophila suzukii*), or “SWD,” is a major pest that causes economic loss in various fruit crops. It is an invasive fly pest found in Florida that infests unripe fruits; larvae cause feeding damage within the fruits. It also causes secondary damage by facilitating bacterial infections. Therefore, continuous monitoring and timely application of insecticides are important to prevent economic loss. **If the grower encounters SWD in their crop, they should alert their local UF/IFAS Extension office.** If the use of insecticides is restricted, physical barriers would be another option. Covering the developing, green berry cymes with a small mesh net (less than 1 mm openings) may protect fruit from damage by spotted-wing Drosophila, depending on orchard scale. The best option for control of SWD may be pheromone or scent-baited insect traps. Sulfur dust applied in early June offers good mite control. Weed control and mowing make the orchard less attractive to insects generally, and several traps are available to monitor insect pests as more is learned about the most damaging insect pests affecting *Sambucus* in Florida. The plant, new flowers, and ripe berries are attractive to deer, and the ripe berries are attractive **to a number of bird species.**

Elderberry is susceptible to fungal diseases such as **Cercospora, elderberry rust (*Puccinia sambuci*)**, cankers, leaf spots, powdery mildews, **and probably other, yet-to-be-identified bacterial and fungal diseases.** Because of Florida’s hot and humid climate and heavy rains during the growing season, the potential for high pressure from bacterial or fungal disease exists throughout the growing season. At least three sprays per year of neutral copper fungicide can reduce the disease impact. **Nutrient deficiency often contributes to serious disease and pest outbreaks.** Therefore, nutrient analysis of leaf tissue samples and correction of the deficient nutrients are needed until a stable fertilization program is developed.

#### Harvest and Processing

Both flowers and fruits can be harvested from *Sambucus*. Full production typically takes three to five years from planting. Harvesting can begin from the second year without impact on subsequent harvests, but first-year plants should have their flower buds pinched upon formation in order to stimulate root development. Native Florida elderberry starts to blossom in March or as early as February, and harvestable fruits are ripe as early as June. Fruit drop of the earliest berries is common and likely due to poor pollination, though more investigation is needed on this topic. Phenotypes from farther north begin to flower in May or June and fruit ripens from July through August. Coppicing will generally delay fruit formation and ripening. The harvest period of mixed shoots following standard pruning is about four to five weeks or longer, whereas harvest of fruit on new shoots after coppicing is about three to four weeks.

Some varieties being trialed in Florida show promise for a secondary, condensed winter harvest season, while the native Florida types may be harvested over a long season because they are highly indeterminate. This indeterminate characteristic could be a positive attribute for smaller-scale growers, but it would typically be a hindrance to efficiency in larger-scale operations because a grower would need to select and harvest judiciously and frequently over a very long season. An additional consideration for growing native Florida phenotypes is that they should only be grown for their fruit. Compared to other varieties from farther north, native Florida phenotypes lack culinary value of the flowers because they do not have the desirable aroma and strength of fragrance found in other varieties. If the reader believes they have a native Florida specimen displaying superior flower fragrance and strength, they are encouraged to reach out to the authors.

# Pests

## Key points:

- SWD has not been observed by H+Co. (whew!)
- Deer may or may not be a problem. This depends on the variety (reportedly) and also the deer, apparently
- Cercospora can be a very serious disease, but can be mitigated or even practically eliminated by organic means
- Other fungal, bacterial and viral disease is likely
- Birds may or may not present a serious problem
- Nutrient deficiency, or incorrect application of nutrients, leads to both pest and disease problems

(*Popilla japonica*), spotted-wing Drosophila (*Drosophila suzukii*), and other insect pests can be problematic for growing elderberry in Florida.

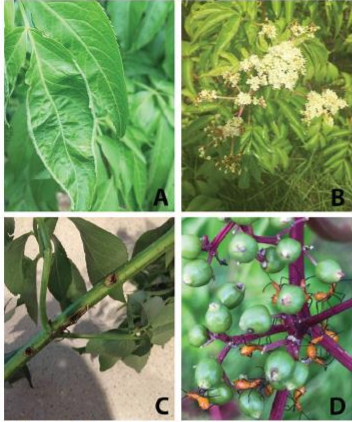


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# Pests

## Edits and additions:

- Turkey really need to be added to this list
- **IMPORTANT ADDITION:** it is advisable to scout the prospective planting area thoroughly for native elder = eriophyid mites.

(*Popilla japonica*), spotted-wing Drosophila (*Drosophila suzukii*), and other insect pests can be problematic for growing elderberry in Florida.

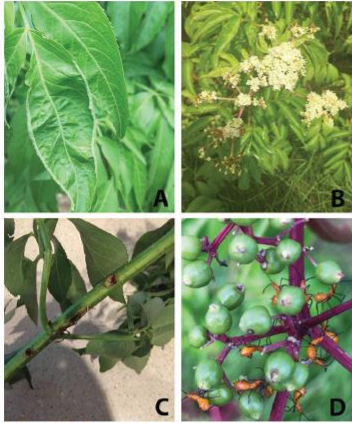


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# Harvest / Postharvest

## Key points:

- **Worthwhile harvest is possible in the first season. Second season harvest should be appreciable with good establishment.**
- **Mistakes made in years -1 / 1 have long term effects on productivity potential despite the plant’s obvious vigor (is a 20 year productivity potential possible?)**
- **Early harvest and double harvest will be key to development of the crop in Florida**
- **Native Florida plants are highly indeterminate and no Florida plant with good flower quality has been identified in Florida**
- **Small scale orchards are ideal for planting either Florida-native or other *S. canadensis***

The flower cyme of commercially grown varieties can be harvested when all the flower buds are open. Optimum fragrance is usually found in the morning hours on less humid days. Ripening of elderberry fruit is uneven between cymes. Therefore, individual cymes should be harvested by hand as the berries ripen to a uniformly reddish-black to bluish-black color, depending on variety, or at the observation of a slight wrinkling of the fruit skin (Figure 6). Care must be taken not to wait too long to harvest the cyme, or the berries will begin to drop as they become overripe. The best method to determine the proper stage of fruit maturity is to utilize a refractometer to test Brix in the field. Ripe elderberry typically tests at 9–11 degrees Brix, but the grower will need to determine the optimal Brix for given varieties on their farm and use that experience going forward.

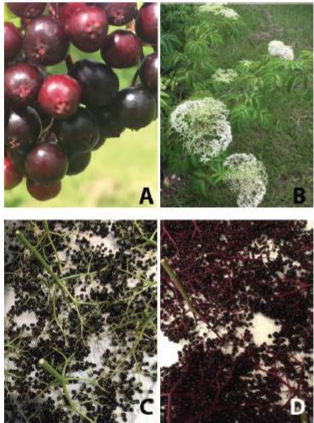


Figure 6. Ripening elderberry about 1 week prior to harvest (A) and nearly ready elderflower (B); harvested cymes of a native-Florida phenotype (C) vs. *S. canadensis* (D).  
Credits: Hyldemoer + Co., Florida

**Elderberry fruit are easily damaged by harvesting.** To prevent this, whole cymes are cut with the fruit attached, and the fruit are removed by specialized destemming equipment. The expected yield of mature American *Sambucus* ranges **from two to three tons per acre** with proper growing conditions and management.

The harvested fruit are **very perishable**, and quality can be lost within a **matter of hours** after harvest in the Florida heat. Therefore, fruit must be quickly processed following harvest or refrigerated at 32°F–40°F for temporary storage

prior to processing. Processing of fresh fruit includes freezing (-4°F), pressing for juice, or dehydration for longer-term storage. Depending on the next processing step, fruit also can be stored after **dehydration** in low-humidity facilities for a length of time.

### Toxicity

*Sambucus* has been noted for possible toxicity concerns in the United States, and confusion on the specifics has led to general statements on the degree of this concern. For example, a 1983 incident in California was reported by the CDC describing illness experienced by 11 individuals, including a single hospitalization, and attributed to the improper handling of wild *Sambucus* plants referred to as *S. mexicana*: “Bunches of berries were crushed with their leaves and branches in a stainless-steel press. Apple juice, water, and sugar were added, and the mixture was stored overnight. The drink was served the next day in a stainless-steel pot to the group of 25 persons” (CDC 1984).

While no other documented instance of toxicity is readily available, this incident illustrates that plant materials of *Sambucus* other than ripe fruit and flowers should not be ingested. The leaves, stems, canes, roots, unripe berries, and possibly the seeds of *Sambucus* contain compounds known as cyanogenic glucosides. The specific compound of greatest concern is often referred to as sambunigrin. Ingestion of plant material other than ripe fruit and flowers can cause release of cyanide into the body, correlating to the amount of these materials consumed.

Additionally, ripening of the fruit across the orchard, as well as within the singular cyme, is not uniform in the case of many varieties. Generally, the larger the individual cyme, the greater the disparity in the ripeness of the fruit across the cyme. Because of this, proper sorting of fruit is essential to remove green and underripe berries as well as the peduncles (the fine stems attached to the berry). The grower should keep in mind that the berry is formed to accomplish the dispersal of viable seed by birds, and the viability of the seed coincides with the ripeness of the berry.

Instructions on proper processing of the fruit prior to ingestion often recommend heating the pulp or juice, which completely breaks down the cyanogenic glucosides. Overheating is unnecessary and results in breakdown of nutritious compounds contained in the fruit. Alcoholic fermentation is also often cited as a method of breaking down the undesirable compounds. The newest research on the topic of cyanide-producing compounds in American *Sambucus* further points to an overgeneralization of toxicity

# Harvest / Postharvest

## MAJOR TAKEAWAY:

- **Ideal equipment for berry / stem, and flower / stem separation has not been developed (potentially not even in Europe).**



## Harvest / Postharvest

### MAJOR TAKEAWAY:

- Ideal equipment for berry / stem, and flower / stem separation has not been developed (potentially not even in Europe).

The flower cyme of commercially grown varieties can be harvested when all the flower buds are open. Optimum fragrance is usually found in the morning hours on less humid days. Ripening of elderberry fruit is uneven between cymes. Therefore, individual cymes should be harvested by hand as the berries ripen to a uniformly reddish-black to bluish-black color, depending on variety, or at the observation of a slight wrinkling of the fruit skin (Figure 6). Care must be taken not to wait too long to harvest the cyme, or the berries will begin to drop as they become overripe. The best method to determine the proper stage of fruit maturity is to utilize a refractometer to test Brix in the field. Ripe elderberry typically tests at 9–11 degrees Brix, but the grower will need to determine the optimal Brix for given varieties on their farm and use that experience going forward.

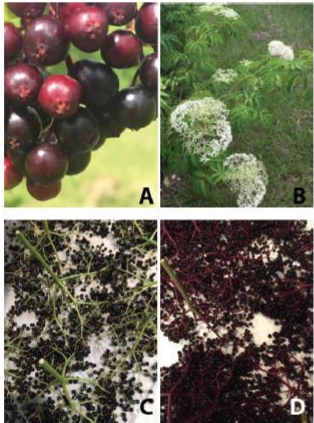


Figure 6. Ripening elderberry about 1 week prior to harvest (A) and nearly ready elderflower (B); harvested cymes of a native-Florida phenotype (C) vs. *S. canadensis* (D). Credits: Hyldemoer + Co., Florida

Elderberry fruit are easily damaged by harvesting. To prevent this, whole cymes are cut with the fruit attached, and the fruit are removed by specialized destemming equipment. The expected yield of mature American *Sambucus* ranges from two to three tons per acre with proper growing conditions and management.

The harvested fruit are very perishable, and quality can be lost within a matter of hours after harvest in the Florida heat. Therefore, fruit must be quickly processed following harvest or refrigerated at 32°F–40°F for temporary storage

prior to processing. Processing of fresh fruit includes freezing (-4°F), pressing for juice, or dehydration for longer-term storage. Depending on the next processing step, fruit also can be stored after dehydration in low-humidity facilities for a length of time.

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# Toxicity

## Key points:

- 1984, 11 of 25 persons reported sickened, with 1 hospitalization
- Whole cymes of berries with their leaves and branches crushed together, apple juice added, left to sit overnight
- What is ripe?
- Birds would also be sickened

The flower cyme of commercially grown varieties can be harvested when all the flower buds are open. Optimum fragrance is usually found in the morning hours on less humid days. Ripening of elderberry fruit is uneven between cymes. Therefore, individual cymes should be harvested by hand as the berries ripen to a uniformly reddish-black to bluish-black color, depending on variety, or at the observation of a slight wrinkling of the fruit skin (Figure 6). Care must be taken not to wait too long to harvest the cyme, or the berries will begin to drop as they become overripe. The best method to determine the proper stage of fruit maturity is to utilize a refractometer to test Brix in the field. Ripe elderberry typically tests at 9–11 degrees Brix, but the grower will need to determine the optimal Brix for given varieties on their farm and use that experience going forward.

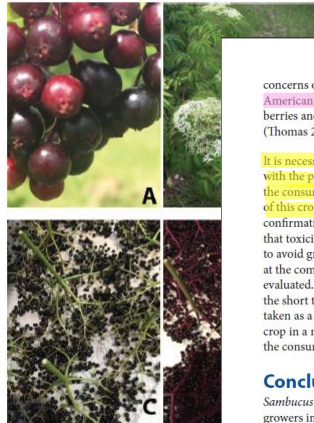


Figure 6. Ripening elderberry about 1 week prior to harvest. (A) Nearly ready elderflower (B); harvested cymes of *S. canadensis* (C) vs. *S. canadensis* (D). Credits: Hyldeboer + Co., Florida

Elderberry fruit are easily damaged by bruising. To prevent this, whole cymes are cut with a sharp knife and the fruit are removed by specialized equipment. The expected yield of mature cymes ranges from two to three tons per acre under growing conditions and management.

The harvested fruit are very perishable and can be lost within a matter of hours after harvest. Therefore, fruit must be quickly harvested or refrigerated at 32°F–40°F for

prior to processing. Processing of fresh fruit includes freezing (-4°F), pressing for juice, or dehydration for longer-term storage. Depending on the next processing step, fruit also can be stored after dehydration in low-humidity facilities for a length of time.

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concerns of ripe fruit: “Detected levels pose no threat to American Elderberry consumers. Excluding stems, green berries and leaves in juice preparation is recommended” (Thomas 2019).

It is necessary for *Sambucus* growers to become familiar with the proper handling of the fruit in order to safeguard the consumer, most importantly, and to protect the future of this crop in Florida. Some buyers of elderberry require confirmation of the identity of varieties grown to ensure that toxicity concerns are mitigated, which is further reason to avoid growing selections taken from the wild in Florida at the commercial scale until a given phenotype is properly evaluated. *Sambucus* may not be viable as a U-pick crop in the short term. Proper handling requirements of *Sambucus*, taken as a whole, necessitate an approach to marketing the crop in a manner that eliminates any toxicity concern for the consumer.

### Conclusions

*Sambucus* is growing in demand and presents interested growers in Florida with a unique opportunity. The crop is well situated for development in Florida’s climate and is suitable for cultivation on marginal lands, including small holdings and land with terrain that is unsuitable for crops grown at scales necessitating mechanization of harvest and planting. Proper irrigation management and a mindful approach to weed, pest, and disease control are required, but *Sambucus* is a comparatively vigorous and hardy crop as compared to many fruits commonly grown in Florida. The successful establishment of the crop will benefit from further trialing of variety selections and research on the best cultivation practices. Opportunities for future research on postharvest handling techniques, proper fertilizer protocols, disease management, and market channels are all available.

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# Toxicity

## Key points:

- The tomato example (you wouldn’t blame the tomato plant)
- U-pick

## Edits and additions:

- Additional details on CNGs and relationship with anthocyanin concentrations are forthcoming via new research



concerns of ripe fruit: “Detected levels pose no threat to American Elderberry consumers. Excluding stems, green berries and leaves in juice preparation is recommended” (Thomas 2019).

It is necessary for *Sambucus* growers to become familiar with the proper handling of the fruit in order to safeguard the consumer, most importantly, and to protect the future of this crop in Florida. Some buyers of elderberry require confirmation of the identity of varieties grown to ensure that toxicity concerns are mitigated, which is further reason to avoid growing selections taken from the wild in Florida at the commercial scale until a given phenotype is properly evaluated. *Sambucus* may not be viable as a u-pick crop in the short term. Proper handling requirements of *Sambucus*, taken as a whole, necessitate an approach to marketing the crop in a manner that eliminates any toxicity concern for the consumer.

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# Summary

## Key points:

- Demand is high for elderberry and growing for elderflower
- Adulteration of imported product is consistent and serious problem
- Creation of a template for cultivation in Fla. is under way

## Edits and additions:

- Some characteristics of the plant are well suited to Florida, but the ideal varieties are not yet developed

concerns of ripe fruit: "Detected levels pose no threat to American Elderberry consumers. Excluding stems, green berries and leaves in juice preparation is recommended" (Thomas 2019).

It is necessary for *Sambucus* growers to become familiar with the proper handling of the fruit in order to safeguard the consumer, most importantly, and to protect the future of this crop in Florida. Some buyers of elderberry require confirmation of the identity of varieties grown to ensure that toxicity concerns are mitigated, which is further reason to avoid growing selections taken from the wild in Florida at the commercial scale until a given phenotype is properly evaluated. *Sambucus* may not be viable as a u-pick crop in the short term. Proper handling requirements of *Sambucus*, taken as a whole, necessitate an approach to marketing the crop in a manner that eliminates any toxicity concern for the consumer.

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# References

## Key references:

- EDIS
- Univ of Missouri
- Be discerning as a large amount of inaccurate information has been circulated by individuals with relatively little experience in either the crop, or Agriculture in general.



*Thank  
you!*