

ELDERBERRY RESEARCH AND PRODUCTION IN MISSOURI



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(Editor's note: I was privileged to meet Patrick Byers while driving an airport shuttle van for the recent national berry meetings last month. He kindly agreed to share this information on the work he and other researchers have been doing with elderberry production in Missouri. Elderberries are a native species for New York and may provide a potential marketing opportunity for New York growers.)

Introduction

The Elderberry (*Sambucus nigra* L. ssp. *canadensis* (L.) R. Boll) is native to much of North America. The plant is a medium to large shrub or small tree. Foliage is pinnately compound, and the stems are noted for large, raised lenticels. Flowers are borne in flattened panicles, usually in May, and fruit ripens in July, August, and September. Flowers and fruit are produced on both current season's shoots and on older wood.

Elderberries were undoubtedly utilized by Native Americans, and were harvested from the wild by European settlers. Organized efforts to improve the native elderberry, however, began in the 20th century. The cultivars Adams 1 and Adams 2 were selected from the wild by William W. Adams in New York in 1926. Ezyoff, of unknown parentage, was introduced by Samuel H. Graham of Ithaca, New York, in 1938. More recent breeding efforts at the Kentville, Nova Scotia experiment station have resulted in Johns (1954), and Nova, Scotia, Kent, and Victoria, all released in 1960. The Nova Scotia releases are all seedlings of either Adams 1 or Adams 2. The latest release, York (1964), is a cross of Ezyoff and Adams 2 and was developed by the New York Agricultural Experiment Station.

A review of the elderberry literature reveals studies at Pennsylvania State University on elderberry culture, and at the University of Illinois on fertilization and cultivar evaluation. Recent work has focused on elderberry juice composition and the use of elderberry juice as a colorant. Reported elderberry investigations in Missouri prior to 1997 were limited to cultivar testing at the State Fruit Experiment Station of Southwest Missouri State University.

The elderberry is a native, adapted plant in Missouri, and there is a demonstrated, growing demand for elderberry fruit and flowers from winemakers, jelly processors, and producers of various nutraceutical preparations. Commercially available cultivars were developed elsewhere, in New York and Canada, and native midwestern germplasm has not been utilized to any extent in the development of adapted cultivars. Research-based information on suitable cultural practices is lacking; numerous possibilities for cultural studies are available.

The Elderberry Improvement Project

The Elderberry Improvement Project was initiated in 1997 from discussions among Patrick Byers of the SMSU State Fruit Experiment Station (SMSU-SFES), Andrew Thomas of the University of Missouri Southwest Research and Education Center (UMC-SWREC), and Alan Erb, formerly of Kansas State University (KSU). The project also received initial and ongoing support from John Brewer of Wyldwood Cellars, Mulvane, Kansas. Chad Finn, with the USDA-ARS laboratory in Corvallis, OR, joined the project in 2000.

The Elderberry Improvement Project has evolved into three components:

1. Collection of native elderberry germplasm
2. Replicated evaluation of superior native germplasm
3. Cultural studies

Collection of Native Germplasm

The collection of native germplasm was initiated in 1997 and is ongoing. The plantings are maintained at the SMSU-SFES, UMC-SWREC, and at Corvallis. Available commercial cultivars were obtained from KSU and commercial nurseries. John Brewer donated selections from his elderberry project. Superior elderberries were solicited from elderberry enthusiasts among the public. Other superior elderberries were gathered during collection trips. At present (2005) the collection consists of 6 named cultivars, 31 selections from Missouri, 2 selections from Kansas, 3 selections from Oklahoma, 5 selections from Arkansas, 1 selection from Tennessee, 3 selections from North Carolina, and 4 selections of the European Elder. The collection includes 55 selections and cultivars. Information collected includes phenology and plant growth, harvest date, yield, panicle size, berry size, fruit quality, and ratings of disease and insect problems.

Replicated Evaluation Of Superior Native Germplasm

The replicated evaluation of superior native germplasm began in 2003 and is ongoing. Replicated plantings were established at the SMSU-FES in Mountain Grove and UMC-SWREC in Mount Vernon which include 10 advanced selections and 2 commercial cultivars (Johns and Adams 2). Our hope is to identify elderberry cultivars with sufficient merit for release and commercial planting. This component of the project was expanded in 2004 with the establishment of a study to investigate the effects of environment on the expression of genetic traits in elderberry; Chad Finn with the USDA-ARS is a cooperater on this study. Data collected in these studies include phenology and plant growth, insect and disease ratings, panicle yield, panicle size, berry yield, berry size, and juice parameters. We are particularly excited about our collaboration with Dr. Penelope Perkins-Veazie at the Lane, Oklahoma, USDA experiment station. Dr. Perkins-Veazie and her lab will measure antioxidant levels in fruit samples from each of the selections and cultivars in the replicated study.

Cultural Studies

A study was initiated in 2000 to investigate 4 pruning strategies: annual removal of all shoots, removal of all shoots every 2 years, training to a tree form, and no pruning. Data collected in this study includes phenology and plant growth, insect and disease ratings, panicle yield, panicle size, berry yield, berry size, juice parameters, and antioxidant levels.

Future directions in the Elderberry Improvement Project include the following:

- Continued collection of superior native germplasm
- Naming and release of superior selections
- Entering superior selections into the germplasm repository system
- Additional cultural studies in such areas as fertility management, insect and disease management, and harvest management

The Elderberry Improvement Project would not have been possible without the support of Southwest Missouri State University, the University of Missouri, Kansas State University, the USDA National Plant Germplasm System, the Northwest Center for Small Fruit Research, and John Brewer and Margaret Tidwell. In particular we appreciate the contributions of the administrations and staff of the SMSU State Fruit Experiment Station and the UMC Southwest Research and Education Center.

Elderberry Culture

The information presented here is gathered from several sources (see references), including our experiences with the Elderberry Improvement Project.

Cultivars

Several elderberry cultivars are available commercially, including Adams 1, Adams 2, York, Nova, Scotia, Kent, and Johns. Of these, in our trials Adams 2 has consistently outperformed all others. Recommendations from other regions include all these cultivars. A large portion of the commercial fruit crop, especially in the Midwest, is harvested from wild plants. Among the native selections in our trials are several that outperform Adams 2.

Propagation

Elderberries are easy to propagate. Root cuttings (pencil diameter or slightly smaller, 4-6 inches long) may be dug in early March before growth begins. The cuttings are placed horizontally in a flat or pot, covered with .75 to 1 inch of a light soil or soiless medium, and kept warm and moist. Often a single root cutting will produce 2-3 plants. Dormant hardwood cuttings root easily. Collect 3-4 node cuttings before growth begins in the spring, and place the basal 2 nodes below the surface of a well-drained soil or medium. Be sure that the cutting wood is not cold damaged. A dip of the basal end of the cutting in an IBA rooting powder may increase rooting. Sprouted hardwood cuttings and softwood cuttings are also easily rooted, provided provision is made to maintain high humidity around the cuttings until rooted. An intermittent mist system works well. A rooting hormone dip may be beneficial. Cuttings of 2-3 nodes root well. Remove a portion of the foliage from softwood cuttings (we usually leave only the 2 basal leaflets of each leaf). Softwood cuttings typically root well until about July 1; rooting percentage drops as the summer progresses.

Establishment

Bare root 1-year plants dug from a nursery work well for planting establishment. Recently propagated container-grown plants may be used to establish plantings during the same season. Our plantings are on raised ridges (berms) that are spaced 12 feet apart. Plants are spaced 4 feet apart in the planting row.

Pruning

Elderberries produce fruit on shoots older than one year, and produce suckers from the crown or root system that will bear fruit the first year. Several references recommend a selective removal of older shoots when pruning. Initial results from the Mountain Grove pruning study suggest little difference among the four pruning treatments in either panicle yield or berry yield. We have learned that the average size of treatment 1 (the annual removal of all shoots) panicles is significantly larger, suggesting that current season suckers produce larger though fewer panicles. Most of the panicles on treatment 1 plants were harvested in two harvests, over a period of two weeks.

Fertilization and Irrigation

We apply nitrogen annually to the elderberry plantings. Mature plantings receive 60-80 pounds of nitrogen, applied at bud break in late March – early April. We apply other nutrients every second year, using a complete fertilizer as the nitrogen source. Elderberries are not drought tolerant, and we irrigate the plantings during dry periods. We use trickle irrigation. The plantings are also mulched, to help conserve soil moisture.

Elderberry Pests

While elderberries are relatively pest resistant, we have noted several potential problems in our plantings. An unidentified stem borer causes wilting and dieback of new shoots in April and May in the Mountain Grove plantings. Larvae of a sawfly have defoliated plants at the Mount Vernon site. The adult elder borer, also known as the elderberry longhorned beetle, has been collected at both the Mount Vernon and Mountain Grove sites. The larva of this spectacular beetle bores into the woody parts of the plant. Stink bugs are routinely noted on ripe panicles, but the amount of damage is unknown. A potentially damaging pest is the eriophyid mite, present at both the Mountain Grove and the Mount Vernon sites. This mite causes cupping and crinkling of the foliage, and can cause abortion of florets and young fruit. The economic impact of this pest is unknown. Fall webworms were also noted in the Mount Vernon planting. An unidentified leaf

spot disease, which usually is noted in midsummer, can cause premature leaf drop and occasionally defoliation. Birds of several species will feed on elderberry fruit; those selections with pendulous panicles appear to be less attractive to birds.

Elderberry Harvest, Yields, and Juice Parameters

Elderberry harvest takes place in late July, August, and early September. Entire panicles are clipped and harvested when all berries are fully colored. The panicles on current season's shoots ripen later than panicles on older wood. A bush with shoots of mixed age will ripen fruit over a 3-week period. We harvest plants at weekly intervals. Berries may be removed from the panicle by freezing the entire panicle and shaking off the fruit. The berries may be refrozen and processed as needed.

In the early 1970's, Dr. Skirvin of the University of Illinois reported on yields from an elderberry trial that included Adams 1 and Adams 2. Average yields over the two cultivars were 1214 lb/acre in the first year, 8677 lb/acre in the second year, and 8582 lb/acre in year 3. Maximum yields (for Adams 2) were 3735 lb/acre in the first year, 13495 lb/acre in year 2, and 13846 lb/acre in year 3. The average yields for Adams 2 and the selection Gordon B from the pruning trial at Mountain Grove were 1226 lb/acre in the first year, 3338 lb/acre in year 2, and 5621 lb/acre in year 3. Gordon B had the highest yields in this trial - 1842 lb/acre in the first year, 4868 lb/acre in year 2, and 7572 lb/acre in year 3. In the first harvest year (2004) of the replicated selection/cultivar trial at Mountain Grove, the highest yield, 11352 lb/acre, was reported for the selection Wyldwood 1. The following table includes juice parameters from the 2002 harvest:

Table 1: Means of juice characteristics from 2002 elderberry harvest at two locations:

| Site | # Samples | °Brix | pH | TA (ml) |
|------------|-----------|-------|------|---------|
| Mt. Vernon | 34 | 11.44 | 4.72 | 0.85 |
| Mtn. Grove | 26 | 12.59 | 4.56 | 0.92 |
| Combined | 60 | 11.94 | 4.65 | 0.88 |

Uses for Elderberry Fruit and Flowers

At present, most of the elderberries grown in the Midwest are harvested for processing markets. Several wineries produce elderberry wines from the fruit, and the flower panicles are used to flavor wines. Jelly and jam are produced from elderberry juice or blends of elderberry and other fruits. Elderberries contain high levels of antioxidants, and elderberry juice and concentrate are marketed as nutraceuticals. The pigments in elderberry juice are suitable for colorant use.

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