



Jujube and Aronia

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Introduction

Black aronia (*Aronia melanocarpa*) and jujube (*Ziziphus jujube*) are minor fruits that could have commercial potential in some areas of Kentucky. Growers looking for unique crops to add to their product mix may want to consider these novel fruits on a small scale.

Jujube is a 15- to 30-foot deciduous tree native to China. Also known as Chinese date, jujube produces round to elongate fruit ranging from cherry-sized to small-plum-sized. Adaptable to a wide range of temperatures, jujube has a low winter chill requirement to set fruit. Trees are generally considered hardy to minus 10°F. Rich in vitamin C, the versatile jujube fruit can be eaten fresh, dried and used in a number of value-added products.

Aronia, also known as chokeberry (not to be confused with chokecherry, *Prunus virginiana*), is a hardy, vigorous plant native to Eastern North America. The purplish-black fruit is approximately ¼- to ½-inch in size and borne on a medium to large shrub that can be 5 to 10 feet tall. The astringent fruit, which is very high in several healthful compounds, is being used in the food industry to add color and/or antioxidants to other juices, such as apple and grape. Aronia fruit is also used in making wine, jam, syrup, yogurt and tea. Aronia is a desirable landscape shrub with seasonal interest: white flowers in the spring, clusters of dark berries in the summer, and reddish fall foliage.

Markets

Potential markets for jujube and aronia include farmers markets, roadside stands, Community Supported Agricul-



ARONIA (RIGHT) AND JUJUBE (INSET)

ture (CSA), and as a specialty ingredient for food-service sales. Jujube could also be marketed to Asian markets and restaurants. Dried jujube can replace raisins or dates in snacks and baked goods. Due to astringency (bitter, drying characteristic) and mealy texture, aronia is not suitable for direct fresh sales. Growers need to market this fruit for cooking or in value-added products. Cooking, along with the addition of a sour component to recipes, greatly improves texture and flavor. Aronia berries may also have potential as an item for the local smoothie industry and as a dried product for making tea.

Marketing Outlook

Marketing minor fruits like jujube and aronia is a challenge as they are unfamiliar to the majority of consumers. Introducing the crops through farmers markets, local food networks, or CSA subscriptions may prove effective marketing strategies. Product sampling and point-of-purchase materials about



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handling and use would need to be included upon sale of fruit or fruit products. While some Kentuckians may recognize the name chokeberry, promoting this crop as aronia likely is more effective than using a name with “choke” in it. For jujube, product introduction in communities with substantial Asian ethnic populations may help grow awareness and demand of local fresh product.

Aronia and jujube have positive health aspects, and these characteristics may help grow markets for both crops among more health-conscious American consumers. Both are high in vitamin C. Aronia is promoted as a healthful fruit due to its high nutrient and antioxidant content, but producers must exercise care to adhere to food marketing guidelines when making any health claims about such crops. Commercially, aronia production is more likely to develop in areas where multiple producers can cooperatively machine harvest crops for processing. Jujube may be well suited for development as a niche market crop for fresh markets, similar to gooseberries or currants.

Production Considerations

Cultivars

Hundreds of cultivars of jujube are available in China and other Asian countries; however, the selection for U.S. growers is much more limited. Jujube generally has two spines at the bases of leaves, which may slow hand harvest. However, some virtually thornless jujube cultivars have been developed. Cultivars also vary in fruit shape (round to elongate), taste (level of sweetness), size (cherry to plum size), earliness, and tree form (upright, weeping and zigzag branching pattern). Self-compatibility is often uncertain so it is advisable to plant two or more different cultivars in the orchard to provide for cross-pollination and to increase yields.

Little information on jujube cultivar performance is available for commercial producers. At least one Kentucky-owned and operated orchard/nursery sells several jujube cultivars and may provide cultivar selection guidance based on local experience.

Select aronia cultivars based on their fruit productivity. While many cultivars exist, some are intended primarily for ornamental use; others exist that are prized for their uniform fruit size and high yields. Some commercial crosses developed in Eastern Europe, such as Viking

and Nero, are now available in the U.S.

Site selection and planting

Jujube is a relatively undemanding tree adaptable to various soil types, as well as a range of soil pH. Trees will even tolerate poor soils as long as they are well drained. While jujube is somewhat drought-tolerant, regular watering is recommended for the best fruit quality. A Kentucky jujube grower suggests an in-row spacing of 15 feet and a between-row spacing of 20 feet. Tree spacing can vary depending on equipment and ultimate size of mature trees. Cultivation under trees is not recommended since root injury induces undesirable sucker formation many feet from the parent tree.

Pruning is not necessary to enhance fruit yields, but winter pruning does help promote tree health, shape and size management. A low chilling requirement means that jujube will produce fruit even after a mild winter. Despite low chilling, leaf emergence and bloom is late enough that it should escape spring frost injury. USDA zone 6a is the limit of jujube hardiness; growers in this zone should understand that cold damage is possible in exceptional years when winter lows exceed the projected annual minimum temperatures.

Aronia prefers neutral to slightly acidic, well-drained soils located in full sun. Plants are not very drought tolerant and will require supplemental irrigation during periods of rainfall deficit. Barerooted plants should be transplanted in spring after all threat of frost has passed. Later transplanting, into midsummer, is possible with containerized aronia as long as plants are provided adequate moisture. Spacing depends on harvest method (hand or mechanical), production system (hedge system or individual plants), and equipment. At an in-row spacing of 3 feet, aronia will spread via suckers and create a dense hedge within three to four years. Wider spacing is used when it is desirable to maintain individual shrubs. The recommended between row spacing ranges from 10 to 14 feet, depending on equipment/harvester requirements. Established plants are pruned annually to maintain a suitable height for harvest and to increase productivity.

Pest management

Jujube is relatively disease- and insect-free in the

U.S., making it a potential candidate for organic production. Aronia fruit are subject to spotted wing drosophila infestations, making spraying a necessity. Jujube research plots in Mississippi identified minimal late-season incidence of diseases and leaf feeding by insects. Diseases identified as *Cercospora*, *Phoma* and *Colletotrichum* spp., and root knot, reniform and other nematodes were identified in the plots. Weed management within rows is most important the first few years during plant establishment. Aronia fruit are attractive to deer and birds, and wildlife exclusion strategies could present significant time and expense for commercial plantings.

Harvest and storage

Jujube may bear a very small number of fruit the first season; however, it is more common for production to begin the second or third year. Reasonable harvests can be expected after four to five years. Fruit will not ripen all at once on the tree, frequent harvests are necessary every few days over the course of a month or more. Starting from an immature green stage, ripening fruit transitions to yellow- or whitish-green, becoming mottled with mahogany-colored spots. Fully ripened fruit have a reddish-brown color and will begin to wrinkle as they soften and lose moisture on the tree.

Once harvested, sugar content does not continue to accumulate; fruits picked earlier at the yellow-green stage are noticeably less sweet than those allowed to fully ripen. Green fruit will not ripen satisfactorily off the tree; however, later stages will continue to ripen at room temperature. Fruit for fresh use is generally harvested by hand sometime after the first brown color appears, but before fruit begins to wrinkle. Fresh fruit can be stored for a week to a month, depending on the temperature and relative humidity. Fruit for drying is best harvested when fully mature; dried fruit can potentially store for extended periods.

Aronia may bear a small crop one year after rooted cuttings are planted; however, production normally begins in the second or third year. Yields increase each year until plants reach maturity in approximately five years. Berries are hand-harvested by cutting off fruit clusters. Fruit are also picked with a mechanical blueberry harvester. Aronia berries are less tender than blueberries and therefore less prone to injury during transport to market.

Labor requirements

For aronia, labor needs are estimated at 50 to 75 hours for establishing 1 acre. At a production level of 18,000 pounds, using a mechanical harvester, annual labor needs for aronia will be 15 to 25 hours for management, 65 hours for harvest, and 65 hours for packing/grading. Machine harvest is more efficient for areas of 1 or more acres. Hand harvest of aronia berries requires about one hour for every 16 pounds harvested.

Economic Considerations

Initial investments for perennial crops include land preparation, purchase of plants or trees, and installation of an irrigation system. Additional investments include harvest containers, packaging and transportation costs, and may also include wildlife, bird and pest control.

Economic returns for jujube will depend on the price paid per tree and the price obtained per pound. Producers should develop their own cost and return estimates based on budget templates that are available for tree fruit and nut crops, such as apples or pawpaw. Relatively high prices per pound may be required to recoup establishment costs and generate economic profits.

For aronia, economic returns will vary considerably based on marketing channel and production methods for berries grown in small plots (less than 1 acre). Producers should adapt a budget template from another perennial or berry crop, such as gooseberry or red raspberry, to estimate profitability. Having value-added product channels is key for realizing positive returns for a new crop, like aronia, that is not ideal for fresh sales.

For plots of 1 acre or more, an interactive aronia production budget assuming mechanical harvest has been developed by Iowa State University Extension. The Iowa budget estimates were adjusted for a 2018 Kentucky scenario. For the planting and pre-production years, total planting and establishment costs (including labor) are estimated at \$10,200 per acre. A negative return of \$854 to total costs are estimated for Year 3, the first production year. Positive returns of \$6,375 above total costs are estimated in Year 4. From Year 5 forward (full production years), annual returns above total costs are estimated at \$8,906. These estimates

assume a yield of 18,000 pounds per acre and the availability of a mechanical harvester at an estimated harvest expense of \$0.21 per pound.

Minor fruits, though they initially appear promising from a production standpoint, have numerous barriers when it comes to marketability. The challenge of unfamiliarity can inhibit widespread consumer acceptance, limiting sales volume. Necessity of processing further complicates the marketing process, eliminating direct fresh sales, but possibly also increasing returns. Because of widespread inexperience with management and the current unrealized market aspect, the production of minor fruits in Kentucky is limited. Prospective growers are advised to observe caution in planting any untested crop. Smaller plantings are less likely to create oversupply; they also provide an opportunity to learn management skills before a significant investment is made. Once marketing channels, if any, are realized and greater production volume is warranted by demand in excess of supply, then planting area can increase to satisfy this unmet potential. It is the responsibility of a potential grower to discern first the market outlook, then undertake the often more enticing aspects of production.

Selected Resources

On the internet

- Aronia (Black Chokeberry): Culture of Aronia for Fruit Production (University of Maine) <http://umaine.edu/agriculture/home/aronia/culture/>
- Uncommon Fruit: Aronia (Black Chokeberry). (University of Wisconsin-Madison Center for Integrated Agricultural Systems) <http://uncommonfruit.cias.wisc.edu/aronia-black-chokeberry/>
- Aronia Berries Profile (AgMRC, 2018) http://www.agmrc.org/commodities_products/fruits/aronia_berries_profile.cfm
- Black Chokeberry: Aronia melanocarpa (USDA-NRCS, 2005) <http://www.plant-materials.nrcs.usda.gov/pubs/ndpmcpg8351.pdf>

- Chinese Jujube (University of Florida, 2014) <http://edis.ifas.ufl.edu/st680>
- “Developing jujube (*Ziziphus jujube* Mill.) or Chinese date as an alternative fruit tree crop to improve sustainability of small farmers in Mississippi.” SARE On-Farm Research Project (2016) <https://projects.sare.org/project-reports/os13-069/>
- England’s Orchard and Nursery <http://www.nutttrees.net/>
- Fruit and Vegetable Production Budgets: Aronia (Iowa State University, 2011) <http://www.extension.iastate.edu/agdm/crops/html/a1-17.html>
- Jujube, Chinese (Chinese date): Recommendations for Maintaining Postharvest Quality (University of California – Davis, 2000) http://postharvest.ucdavis.edu/Commodity_Resources/Fact_Sheets/Datastores/Fruit_English/?uid=29&ds=798
- Jujube: Chinese Date in New Mexico (New Mexico State University, 2012) 6.36 MB file http://aces.nmsu.edu/pubs/_h/H-330.pdf
- Minor Fruit Production (Cornell University) <https://blogs.cornell.edu/berries/productions/specialty-fruit-production/#aronia>
- Podcast: Jujube, with Clifford England, England’s Orchard & Nursery (UK Center for Crop Diversification, 2018) <http://www.uky.edu/ccd/sites/www.uky.edu/ccd/files/jujube.mp3>

In print

- Uncommon Fruits for Every Garden. Lee Reigh. 2004. Timber Press, Portland, OR. 308 pp.

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