

aronia

Aronia fruit are black, about the size of medium blueberries, and borne on shrubs. Aronia are native to eastern North America, where they were known as chokeberries until the beginning of the 21st century. There are two major species, the black chokeberry (*Aronia melanocarpa*) and the red chokeberry (*Aronia arbutifolia*). Both species were primarily grown as ornamentals in the 20th century, but only *Aronia melanocarpa* was fully hardy in Minnesota. Since 2000, there has been a growing interest in *Aronia melanocarpa* for fruit rather than as an ornamental. The name aronia has largely replaced the name “black chokeberry”. Many landscapers still call the fruit chokeberries, but fruit growers only use the name aronia. Not only is the name “chokeberry” unappealing, but consumers understandably confuse chokeberries with chokecherries. Chokecherries are stone fruit similar to cherries and plums, while aronia are pome fruit related to apple, pears, and saskatoons. The similarity to apples is why an old German word for aronia translates to “apple berries.”

The firm, black fruit forms on small clusters with 8-12 fruit per cluster (Figure 4). The leaves are simple and elliptical, with a glossy, dark green color that turns bright red in the fall (Figure 5). The flowers are small, forming pretty clusters after the leaves emerge.

Aronia plants selected for fruit production are tall shrubs that grow to a maximum height of 14 feet. Branches sprout from the base of the plant and, left unpruned, a shrub will have up to twenty large, upright branches. The plants also produce some spreading branches. Branches can live over 20 years. The mother plant does send out a few suckers and unmaintained shrubs will form dense plantings consisting of the mother plant and small suckers.

Aronia plants have been selected for both fruit quality and as ornamentals. Ornamental varieties all have edible fruit, but the fruit is smaller and yields are lower than fruiting varieties. Most commercial aronia growers plant ‘Nero’ and ‘Viking’. ‘Viking’



Figure 4. Ripe aronia fruit



Figure 5. Aronia leaves in early fall

is taller and produces higher yields than ‘Nero’; but ‘Nero’ is probably better for growers who must harvest by hand. Most growers have noticed few or no differences between the two varieties regarding

fruit quality. Many European varieties have not been introduced to the U.S., including the common German cultivar ‘Hugin’.

Cultivar	Origin	Height	Primary Uses
Nero	Eastern Europe	5-6 feet	Fruit
Viking	Northern Europe	6-8 feet	Fruit
McKenzie	Iowa – North Dakota	7-9 feet	Shelterbelt plantings
Iroquois Beauty	Northeast U.S.	3-5 feet	Ornamental
Autumn Magic	Northeast U.S.	5-6 feet	Ornamental

HISTORY

Aronias are native to eastern North America. Henry David Thoreau summed up the attitude of most European settlers with the phrase, “Fair to the eye, but scarcely palatable...sweetish berries with a dry and so choking taste.” Instead of being domesticated for fruit production, aronia was domesticated as an ornamental shrub, with white flowers in the spring, dark green leaves in the summer, deep red leaves in the fall, and dark berries that stick on the plants over the winter.

In the 19th and 20th centuries, both the red and

black aronias were widely planted as ornamental shrubs across the U.S. In the 19th century, the species was introduced to Europe, and Eastern Europeans discovered that the shrubs could grow in extremely cold climates and that the fruit was healthful. By the early 20th century, Europeans were breeding the plant for fruit production resulting in taller shrubs with larger fruit. There is some evidence that the cultivar ‘Viking’ is an interspecific hybrid with mountain ash (*Sorbus aucuparia*), which may explain the large fruit and high sorbitol content. [See *Health Benefits* section below for more on sorbitol.]

Aronia became especially popular in Poland, Russia and the Ukraine. Europeans developed large-fruited varieties for fruit production including 'Nero'

(Czechoslovakia) and Viking (disputed; Finland or Sweden) which are currently being planted in the United States.⁵

USES AND HEALTH BENEFITS

Aronia is easy to grow and remarkably free of diseases. Americans started to develop an interest in growing aronia for fruit after its health benefits became known at the beginning of the 2000s. By 2008, farmers in Iowa, Missouri and other states were planting aronia for the juice market. By 2014 the market collapsed, leaving many growers confused and frustrated.

In the U.S. aronia is primarily used by large food processors as an additive to energy drinks and fruit juices. The extract serves both as a coloring agent and to increase antioxidant content. In Europe, aronia has been used as a food coloring and is added to fruit syrups, teas, jellies, and jams. A number of wineries

throughout the U.S. are trying to develop dessert wines from aronia fruit. Wine makers often mix aronia with other fruit to add color to the wine.

When aronia is combined with other fruit, it can add a good flavor, color, and health benefits. Aronia can be mixed with many types of fruit, such as apples, pears, and plums. Jam made from aronia and plum is intense, dark, and fares well in taste tests. The future of aronia production largely depends on what uses people will find for this easy-to-grow fruit.

Eastern Europeans have long been interested in using aronia to reduce blood pressure. Scientists in the former Soviet Union started investigating the health benefits of aronia long before Americans became interested in phytonutrients.⁶ After learning about its impressive health benefits, Americans started planting aronia for fruit production. Some examples of health benefits found in the scientific literature:

1. Polish men with high blood pressure who drank 250 milliliters of aronia juice per day over six weeks saw a significant decrease in HDL cholesterol and triglycerides along with a decrease in systolic and diastolic blood pressure readings of 13 and 7 respectively.⁷ Similar results have been achieved in animal studies.
2. Patients who had previously suffered heart attacks experienced reduced blood pressure after consuming high-anthocyanin aronia extracts.⁸

Note from Thaddeus:

I once incorporated aronia jelly into a taste test (see chokecherry), using jelly made from only aronia and sugar. Aronia is naturally high in pectin, and the jelly had no added pectin. The jelly had a rich purple color with good firmness, but ranked the lowest of any jelly used in the taste test. The astringency disappeared during cooking, so the poor showing was not due to the "choking taste". People just didn't like the flavor of plain aronia.

⁵ Brand, M. 2008. Aronia: Native shrubs with untapped potential. *Journal of the Arnold Arboretum* 67(3): 14-25.

⁶ Jansky, S.H. and Bell, R.A.. 1994. Botanical Gardens of Russia, Ukraine, Belarus, and Georgia. *HortScience* 29: 938-1107.

⁷ Skoczyńska, A., Jędrzychowska, I., Poręba, R., AffelskaJercha, A., Turczyn, B., Wojakowska, A., Andrzejak, R. 2007. Influence of chokeberry juice on arterial blood pressure and lipid parameters in men with mild hypercholesterolemia. *Pharmacological Reports* 59(1):177-182. ISSN 1734-1140.

⁸ Kulling, S. and Rawel, H. 2008. Chokeberry (*Aronia melanocarpa*) – A Review on the Characteristic Components and Potential Health Effects. *Planta Med* 2008; 74(13): 1625-1634. doi: 10.1055/s-0028-1088306

3. In laboratory studies and in at least one animal study aronia extracts appeared to prevent colon cancer or slow down the rate of cell proliferation⁹
4. Aronia likewise has been shown to prevent or reduce problems associated with Type II diabetes. Patients who drank 200 milliliters of aronia juice per day over three months saw a decrease in fasting glucose levels.¹⁰

As is the case with most fruit being touted for health benefits, scientists have not been able to determine exactly which compounds in the fruit improve health. Aronia has some of the highest antioxidant levels of any fruit, but a lower variety of anthocyanins compared to other purple fruit. Some studies show only three different anthocyanins in aronia.

Aronia fruit has an extremely high concentration of sorbitol, a sugar alcohol commonly found in fruit.

Sugar alcohols are chemically related to the alcohols, but function similar to the sugars in food. Sorbitol levels in aronia are as high as 8% fresh weight, and usually comprise about a third of the total soluble solid content or Brix.¹¹ Sorbitol is a natural sweetener found in many rose family fruit species and is often associated with sweet cherries. Sweet cherries typically have sorbitol contents between 2 and 4% of fresh weight. Sorbitol contains similar calories as regular sugar, but the bacteria that cause tooth decay cannot grow on sorbitol, and it is therefore frequently added to many brands of sugarless gum or other products where tooth decay is a concern. Humans metabolize sorbitol slowly. A small amount of sorbitol is easily digested and absorbed, while a large amount of sorbitol either gives people an upset stomach or works as a laxative. Most yeast strains used in wine making cannot metabolize sorbitol. Because sorbitol does not ferment with regular sugar, it is occasionally added to sweeten wine.¹²

Astringency

Chokeberries and the distantly related chokecherries received their unappetizing names because both fruits are astringent. Astringency causes the mouth to experience an unpleasant drying sensation, regardless of the amount of juice in the fruit. In addition to aronia and chokecherry, astringency is found in a wide cultivar of unrelated fruit, including green persimmons, seedling pears, Cornelian cherry dogwood, and several other species. Astringency is often confused with acidity, but the two are quite different. Astringency is a tactile sensation felt in the sides and back of the mouth as well as the tongue (hence the “choking”), while acidity is a taste detected on the tongue. Acidity in fruit is caused by the presence of organic acids, but astringency is caused by polyphenolic compounds which bind to proteins in the mouth. The exact mechanism of astringency is poorly understood, but astringency appears to be harmless. Fruit can be astringent and low in acid at the same time. Neither aronia nor chokecherries are very acidic. Most of the time astringency disappears during processing; however, there are times when astringency can be carried into wine, cooked juice, and even jelly.

Astringency either drops or disappears during ripening in most fruit. In aronia, astringency nearly disappears at the end of the long harvest window. In chokecherries, astringency drops after ripening but rarely disappears.

⁹ Lala, G., Malik, M., Zhao, C., He, J., Kwon, Y., Giusti, M., Magnuson, B. 2006. Anthocyanin-Rich Extracts Inhibit Multiple Biomarkers of Colon Cancer in Rats. *Nutrition and Cancer* Vol. 54(1):84-93. https://doi.org/10.1207/s15327914nc5401_10

¹⁰ Kulling, S. and Rawel, H. *ibid.*

¹¹ Snebergrova, J., Cizkova, H., Neradova, E., Kapci, B., Rajchl, A., and Voldric, M. 2014. Variability of characteristic components of aronia. *Czech J. of Food Sci.* 32: 25-30.

¹² Kulling, S. and Rawel, H. *ibid.*

Soluble solids, Sweetness and Brix

Soluble solids refers to the percentage of dissolved solids in fruit, and is usually measured using a handheld device called refractometer, which gives a reading in degrees Brix. A Brix reading is often used to quantify sweetness, and for most fruit, Brix and sugar content are closely tied together. The most common use of Brix is in wine production. Quite often grape growers receive premiums for batches of grapes with a higher Brix reading, because higher Brix means that the wine can have a higher alcohol content. Brix readings do not estimate sweetness or the potential to produce alcohol when a high percentage of the soluble solids are dissolved acids or sorbitol. Black currant, although very sour, can have a high Brix reading because the acids overwhelm the available sugars. Brix cannot accurately estimate potential alcohol production in aronia. Since a third of the total soluble solids in aronia is sorbitol, and yeast cannot convert sorbitol to alcohol, aronia juice with a respectable Brix of 18 will produce a very weak wine.

(D. Drummond, personal communication).

PROPAGATION

Aronia usually comes true from seed, which means that plants started by seed retain the traits of the parent plant. Traditionally, the ability to come true from seed was attributed to low genetic diversity within common varieties. Recently, researchers have speculated that aronia has the ability to form seeds without pollination, which makes seedlings identical to the mother plant.¹³ Aronia is one of the few perennial fruits traditionally propagated using seeds. In order to get good seed germination, macerate the fruit in a blender and store the mash of seeds and fruit at freezing temperatures for three months. Seeds are planted in early spring, kept in a nursery the first growing season, and planted in the field the following year.

Although aronia can be propagated from seed, plants propagated from root suckers will begin producing fruit a year or two before those started from seed. For small scale production, aronia suckers can be dug up from the mother plant during dormancy and planted in early spring or propagated from stool beds. Stool beds are made by piling wood chips or soil around the base of a multi-stemmed shrub. Roots form on the stems of the plant, and those rooted stems can be transplanted into containers during dormancy the next winter. Larger nurseries propagate aronia with softwood cuttings, tissue culture, and layering.

PLANTING AND CARE

Aronia can grow in both sandy and clay soils. It even appears to thrive in low, wet areas with acidic soils. Ideally, soil pH should be between 5.5 and 7.0. Aronia will survive in a variety of sites, but to produce large yields, it should be grown in full sun, properly fertilized, weeded, and pruned.¹⁴

Aronia can thrive in very poor soils and needs little or

no fertilizer in most cases. If the plants are putting on two to three feet of new growth every year, fertilizer is not needed. There have been cases where aronia grew and yielded poorly due to dry soils and low nitrogen in sandy soils of Minnesota. If the plants grow less than a foot each year, a high nitrogen fertilizer should be applied. Conventional producers can add one cup of granular fertilizer, like calcium nitrate, onto the ground

¹³ Brand, M. 2008. Aronia: Native shrubs with untapped potential. *Journal of the Arnold Arboretum* 67(3): 14-25.

¹⁴ Jensen, Jeff. Agroforestry on the Farm: Aronia Berry at Winding Creek, Belmond, IA. 2014. http://lib.dr.iastate.edu/cgi/viewcontent.cgi?article=1010&context=leopold_pubspapers

in the spring. Organic producers should add two to five pounds per plant of a high nitrogen fertilizer, like blood or feather meal; or top-dress with high-quality compost in early spring.

Commercial growers have planted aronia anywhere from two to six feet apart within rows. Growers who plan to mechanically harvest typically plant two feet apart, while growers who plan on picking fruit by hand should consider planting aronia six feet apart. Rows can be spaced 12 to 20 feet apart depending on the width of equipment used to mow between rows or to harvest berries.

Most aronia plants are sold as 18 inch seedlings, and need to be kept free from weeds during the first three or four years to achieve maximum growth rates and early production. Large commercial growers often

plant into landscape fabric to reduce weed pressure, but wood chips also work.

Proper pruning is essential to keep aronia healthy and productive, and to facilitate picking. Growers often develop pruning systems for their own farms that take into account the vigor of the shrubs and the availability of labor. The goal of pruning aronia is to keep new fruiting branches sprouting and remove older, less productive branches while keeping plants open and narrow so that the fruit can be easily harvested. Root suckers should be mowed in the growing season or pruned out in early spring; otherwise the plants will grow into an impenetrable thicket within five years. Small producers should remove three or four canes near the crown each winter so that no canes are older than five years old. Many large producers with mechanized equipment cut entire rows down to three feet high every four years.

HARVESTING

In Europe, aronia is primarily harvested by machine. Several large producers in Iowa purchased blueberry harvesting machines and modified the machines to harvest aronia. Berries harvested by hand sell for a higher price than those harvested by machine. Picking rates by hand average between 15 and 20 pounds per hour. If picking by hand, always train and prune the plants so that all the fruit can be picked without ladders.

Aronia have an exceptionally long harvest window. The fruit turns dark in late August and will hang on the shrubs until hard frosts arrive in late fall. The fruit should be picked between the end of August and the end of September. If harvest is delayed too long, the fruit will start to shrivel. Commercial growers are still trying to determine the best time to pick, because the berries continue to change throughout the six-week harvest window. Pectin and astringency are still high in early September, while sugar levels peak later in the month. Anthocyanin levels continue to increase after the sugar levels have dropped, and astringency is reduced later in September. Sorbitol increases for the entire harvest season.¹⁵ For jelly, aronia could

be picked early, when pectin levels are still high. Wine makers prefer to pick when sugars levels reach their peak, while juice makers may want to wait until anthocyanin levels peak and astringency is reduced.

Note from Thaddeus:

I bought a bottle of pure aronia juice, hoping to give samples to friends and coworkers, but after one sip decided to not hurt the commercial potential of aronia by allowing anyone else to taste it. Aronia has potential in mixtures with other fruits, but products made out of pure aronia are a difficult sell. Another interesting tidbit: My enologist coworker told me that a winery was looking for aronia, but it was in February, and nobody had bothered to freeze any berries.

¹⁵ Bolling, B.W., R. Taheri, R. Pei, M. Yu, S.N. Durocher and M.H. Brand. 2015. Harvest date affects aronia juice polyphenols, sugars and antioxidant activity, but not anthocyanin stability. *Food Chem.* 187: 189-96.

PRODUCTION PROBLEMS

Aronia are remarkably trouble free in most parts of Minnesota. Due to a lack of insect pests and diseases, aronia have a high potential for organic production. Reports on bird pressure have been mixed. Some growers have had to net their plants,

while others never see bird damage in their hedges until late fall. Likewise, deer don't particularly like aronia, at least in some areas. Deer damage has been seen in Minnesota, and there are reports of deer browsing in Iowa.

EDIBLE LANDSCAPING

Aronia shrubs have pleasant flowers in early spring, dark green leaves in the summer and brilliant red leaves in the fall, making them ideal landscaping plants. They also make great living snow fences. Varieties selected as ornamentals have edible fruit, but the fruit is much smaller, and the plants are shorter. Cultivars selected for fruit have the drawback

of few leaves in the first two or three feet above the ground, giving the shrubs a "leggy" appearance. Aronia can work in edible landscaping either by placing a low-growing shrub or annual near the base of a cultivar like 'Viking', to block out the "leggy" appearance, or by planting a cultivar selected for ornamental value.

COMMERCIAL PRODUCTION

Large food manufacturers who blend aronia juice into energy drinks have created a huge market for aronia, but primarily use concentrate imported from Poland, Russia, or the Ukraine. Farm gate prices were very high when the first American producers started selling their berries to food processors, but the price plummeted in 2014. Several growers have reported prices so low that the aronia was not worth harvesting.

Minnesota growers have not jumped into the aronia market as much as Iowa, and therefore Minnesota does not have enough aronia growers to grab the attention of juice makers. Instead, there are a number of small patches of aronia planted throughout the state, producing for local wineries, breweries, and farmers' markets. Aronia is easy to sell in small quantities to curious people, but the overall market appears to be quite small.

Those interested in growing direct market aronia will need to increase demand among local consumers by developing new ways to use the fruit and giving

out samples. Those who are willing to search for aronia recipes in Europe or European websites can find a treasure trove of unusual ideas. Anyone interested in developing the market for aronia should experiment with different recipes, especially those which combine aronia with other fruits. When giving out samples of aronia products, care should be taken to not turn consumers off with a product that does not taste good.

Freezing berries for sale to juice and wine makers is an option for Minnesota producers. Farmers can do processing, including freezing, of their own fruits and vegetables for sale to any buyer, and are not required to have a license for that activity unless they are adding off-farm ingredients. The farmer's processing and cold storage facilities must be inspected and approved by a Minnesota Department of Agriculture inspector.¹⁶ See the Marketing of Perennial Fruits chapter in this book for more information and resources.

¹⁶ Minnesota Institute for Sustainable Agriculture and Minnesota Farmers' Market Association. *Selling Minnesota Produce*. 2017. Local Food Advisory Committee. http://misadocuments.info/LFAC_local_produce.pdf