Optimal Aronia Berry Harvest

Aronia Berry Production in Iowa

Aronia berries, also known as *Photinia melanocarpa* or black chokeberries, have a market with a high predicted growth rate until 2027. Because of their high antioxidant activity, Aronia berries are often labeled as a super-fruit and are intriguing to consumers, farmers, and researchers. Their high levels of naturally occurring antioxidants may be beneficial in preventing diseases, such as cancer and cardiovascular disease, and are linked to maintaining a long-term healthy lifestyle. Aronia berries also have the potential to be a strong and natural coloring agent due to their heat-stable deep purple-red color pigment.

Aronia berries are well suited to the Midwest's soil and climate and require a relatively low level of time and labor to commercially grow, making them ideal for farmers looking to supplement their cash crop production. The berries are well suited to be grown specifically in Iowa due to their hardiness and suitability for smaller, underutilized plots of land to support larger-scale crop production. An added bonus to producers is their increased pest resistance compared to other crops. However, Aronia plantings still have common animal pests, such as deer and birds, and some similar microbial pests as other fruit crops. For more information on Aronia berry pests visit https://www.agmrc.org/commodities-products/fruits/Aronia-berries, which offers pest details and solutions.

The market within Iowa is growing, but is still dwarfed when compared to other common crop markets. Aronia berry use in bakery and jelly-type products is increasing. However, due to some bitter and astringent attributes of the fruit, a consistent market can be difficult to locate for the berry itself. An example of Aronia plantings can be seen in Figure 1, taken at a farm in Iowa during growth season.

Figure 1. Aronia plantings at Winding Creek Gardens

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Objectives and Procedures

The Iowa State University Department of Food Science and Human Nutrition studied the antioxidant and sensory properties of Aronia berries from 2012-14. For the duration of the research, Aronia berries from Winding Creek Gardens in Belmond, Iowa were analyzed. To see a visual of the type and overall appearance of the Aronia berries tested, see Figure 2.

Frozen samples were received weekly. Before testing, samples were thawed and juiced, then tests were performed on the resulting juice. The foremost objective of this study was to determine optimal harvest time by examining the antioxidant levels and parameters known to effect consumer sensory perception, such as sugar to acid ratio. Research focused on analyzing various components of the Aronia berries in order to determine best growth characteristics. Parameters tested and analyzed were: acidity, sugar concentration, malic acid content, sugar to acid ratio for sensory acceptability, antioxidant concentrations, and aromatic compounds. Weather parameters of volumetric soil moisture (VSM) and growing degree days (GDD) were also measured at the area of harvest, since environmental conditions can affect compounds produced within the Aronia berries. Weather parameters were then compared to berry attributes to identify if a correlation existed between weather and Aronia berry qualities.

Results and Application to Aronia Producers

Table 1. Pearson correlation coefficients between weather parameters of growing degree days (GDD) and volumetric soil moisture (VSM) compared to characteristic Aronia juice parameters.

	Antioxidant Activity	° Brix	pH	Titratable Acidity
VSM	-0.8619*	-0.8075*	-0.9759*	0.7623*
GDD	0.1905	-0.27	-0.0561	0.0218

* indicates $p<0.05$ and a significant correlation exists between the two parameters

Based on the results, it was concluded that the optimum time of harvest is the last week in August and first week in September for Aronia berries grown in Iowa. This harvest period allows for the antioxidant levels to stabilize and the color of the berries to mature, as well as a larger proportion of sugar to acid ratio to accumulate in the berries, which is preferred for consumption. Displayed in Table 1, VSM is significantly correlated with berry attributes and could play a role in altering harvest periods during years of abnormally high or low rainfall. The following equation provides an estimate of antioxidant activity relating to VSM:

***Antioxidant activity = exp (b-a*VSM²) where a =* 8.942 *and b =* 0.002221.**

One caveat to keep in mind is VSM is more related to a point in time, while overall trends of berry qualities were found as well. An additional set of data to report are the aromas found when separating individual compounds, with many fruity, slightly herbaceous, grassy, and woody aromas being detected. Specific aromas and their associated molecules are displayed in Table 2. Desired aroma compounds and antioxidant amounts of the berries were both found to increase and plateau toward this recommended harvest period, along with sugar concentrations growing relative to acid amounts staying reasonably stable. These recommended dates provide the berries with the best balance of sweetness, acidity, antioxidant abilities, flavor, and appearance; all of which can increase Aronia crop value in the market.

Figure 2. Aronia berries during growth

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Appendix

Table 2. Main Aronia berry juice compounds and retention times with associated aromas.

Retention Time (s)	Compound	Aroma
1.45	ethanol	Sweet
5.11	3-penten-2-one	Fruity and fishy
7.45	hexanal	Grass
13.9	benzaldehyde	Almond, burnt sugar
15.06	6-methyl-5-hepten-2-one	Green, fatty, citrus
19.19	nonanal	Fat, citrus, green
22.96	β-cyclocitral	Mint
25.35	Theaspirane	Honey, green, woody
25.84	Theaspirane (different isomer)	Honey, green, woody
30.5	β-ionone	Seaweed, violet, flower

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Larry Turner of Winding Creek Gardens (Belmond, Iowa) provided all Aronia berries used for testing of this project.

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