Improving Aronia Berry Sustainability and Fruit Quality

Funded by USDA / Specialty Crop Multi-State Program (2018-2021)

Research Update (2018-2019)

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Collaborative Farms (2018-2019)
Title: Improving Aronia Berry Sustainability and Fruit Quality.

Rationales

1. Commercial aronia cultivars have limited genetic diversity. Determining the factors (genetics, pre-harvest conditions) is critical to establishing sustainable cultivars and optimizing locations for cultivation.

2. Large variation found in aronia berry quality because of pre-harvest factors, but they haven’t been rigorously evaluated.

3. Nutritional labeling of aronia berry is critical for marketing whole fresh and frozen berries. But nutrient values have not been established for aronia berry.

4. Aronia berry is an excellent source of polyphenols, but off-taste severely affect consumer acceptance. Therefore, it’s vital to improve the flavor.

Impacts

1. Identified genotypes will allow farms precisely manage and marketing their aronia berries. New cultivars will increase the diversity of aronia industry.

2. Defining best harvest times will allow farmers in different states knowing when aronia berries are at their peak to be harvested with the best quality.

3. Identified regions or pre-harvest factors that affect berry quality will allow farmers or researchers for more precise trial design and cultivar testing.

4. Established nutrient and flavor profiles will be an important benchmark for horticultural performance, cultivar selection, consistent marketing of quality parameters for berry processing.

5. Identified compounds contributing to the consumer acceptance of aronia berries and new processing strategies will improve the flavor and marketability of aronia products.

6. The findings and technologies developed in aronia berry model could be adapted to many other similar specialty crops, and so help their development.
Microbial Analysis of Aronia Berries

Plate counts (log CFU g⁻¹)

- Aerobic bacteria
- Yeasts and Molds
- Lactic acid bacteria
- Coliform bacteria
- Salmonella spp.
- Listeria spp.
- E.coli O157:H7

Week 5
Week 6
Week 7
Farm A
Farm B
Farm C
Farm D
Farm E
Sensory Evaluation of Aronia Berries
Sourcing (by breed/by season) & Market Analysis

Examples

- Green tea products in Japan: 2 years ago
- Current hot-selling green teas in Japan

A, B, C, D: Different breed
1, 2, 3: Different harvest season

Tomato

Richness
Sourness

A2, B2, C2, D2

A1, B1, C1, D1

A3, B3, C3, D3

astringency
**Brix Analysis of Aronia Berry Juice**

<table>
<thead>
<tr>
<th>Farm</th>
<th>Week 5</th>
<th>Week 6</th>
<th>Week 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farm A</td>
<td>16.6</td>
<td>16.6</td>
<td>16.6</td>
</tr>
<tr>
<td>Farm B</td>
<td>13.0</td>
<td>13.0</td>
<td>13.0</td>
</tr>
<tr>
<td>Farm C</td>
<td>16.9</td>
<td>16.9</td>
<td>16.9</td>
</tr>
<tr>
<td>Farm D</td>
<td>15.2</td>
<td>15.2</td>
<td>15.2</td>
</tr>
<tr>
<td>Farm E</td>
<td>13.1</td>
<td>13.1</td>
<td>13.1</td>
</tr>
</tbody>
</table>
Total Phenols Analysis of Aronia Berry Juice

<table>
<thead>
<tr>
<th>Farm</th>
<th>Week 5</th>
<th>Week 6</th>
<th>Week 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farm A</td>
<td>6.3</td>
<td></td>
<td>6.3</td>
</tr>
<tr>
<td>Farm B</td>
<td>3.9</td>
<td>3.9</td>
<td></td>
</tr>
<tr>
<td>Farm C</td>
<td>7.4</td>
<td></td>
<td>7.4</td>
</tr>
<tr>
<td>Farm D</td>
<td>7.6</td>
<td>7.6</td>
<td></td>
</tr>
<tr>
<td>Farm E</td>
<td>4.9</td>
<td>4.9</td>
<td></td>
</tr>
</tbody>
</table>
Continuing Work

1. Physiochemical properties of juice: titratable acidity, anthocyanins, etc.
2. Sensory evaluation: Panel & Electronic tongue
3. Aroma analysis: GC-MS
4. Correlations analysis
Continuing Work

5. Key flavor compounds identification

6. High pressure processing (HPP) on quality and safety of juice

7. Improving consumer preference of juice by masking technology

8. Improving consumer preference of juice by encapsulation technology
Standard Protocols for Sampling – Soil

(After harvest and before planting the subsequent crop)

2018 Collected Soil samples:
(NE, SD, IA, VT)
A. **Online Weather Information:**

http://www.weatherlink.com/map.php

($3.95/month for access)

**Advantage:** Easy to collect detailed climate information (Real time and history).

**Disadvantage:** Not from the exact location. (~5 – 30 miles away from weather station, Looks no big difference).

B. **Onsite Weather Instrument**

(about $300-600 per instrument)

**Advantage:** Exact weather information from the farm

**Disadvantage:** Not easy to manage and collect desirable climate data. Additional time cost for growers.

The number represent numbers of weather station at the location
Questionnaire of Farming Practices

Q1: How many acres of aronia do you have?______________________________________________________

Q2: When you planted ___________(MM/DD/YY) and harvested your aronia?_______________(MM/DD/YY)

Q3: How you prune your aronia plants? _________________________________________________________

Q4: What’s your fertilizing program? Which fertilizer, amount, and how frequently? _________________

Q5: What’s your irrigating program (when, times, and amount)?______________________________

Q6: Is your aronia farm an organic farm? (Yes / No).

Q7: Is your aronia affected by pests? (Yes / No). If Yes, how frequently?_____________________________

Q8: Do you use pesticides in your farm? (Yes / No). If Yes, how frequently?________________________
Questionnaire of Plant Information

Q1: What are your plant ages? _________Years _________Months __________________________________________

Q2: Where is your farm located? Flat land (Yes / No)____  Slope land (Yes / No), Orientation____________

Q3: What’s the yield of your plant? ___________lbs/plant _____________lbs/acre

Q4: Did your aronia plant has any disease?________________________________________________________

Examples
Data Analysis

1. Determine pre-harvest factors associated with improved aronia berry quality.

2. Provide advice on optimal behavior

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### Nutrients Data
- **Identify Peak Quality**
  - Appearance: Color & size
  - Basic: Brix, pH, acidity, sugar, etc.
  - Polyphenols: Total & Individual
  - Correlation: Nutrients vs. Factors

- **Establish Nutrient Profile**
  - Energy: kcal/100 g
  - Proximate: fiber, protein, etc.
  - Vitamins: A, B, C, E, etc.
  - Minerals: Mg, Ca, Fe, Na

- **Identify Key Flavor Compounds**
  - Aroma: GC-MS/O analysis

### Flavor Data
- **Identify Key Flavor Compounds**
  - Sensory Evaluation: Tasting
  - Microbiological Analysis

### Genotype Data
- **Location**: CT (UCONN)
- **Genotypes**: 'Viking', etc.
- **7 Weeks**: Sampling period
- **3 Years**: 2018, 2019, 2020

### Integrative Data Analysis
- **Climate/Soil Data**
  - Temperature, humidity, rainfall, UV & solar radiation, etc.
  - Soil type/nutrition

- **Horticultural Survey Data**
  - Pruning methods, fertility, irrigation information, etc.

- **Plant Data**
  - Plant information including plant age, history, location, yield, disease, etc.

- **Principal components analysis: genotypes index**

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**Output**:
- Identify key factors from 1) to 5) associated with 6), 7), and 8).
- Provide advice on optimal behavior to improve 6), 7), and 8).
Solid Collaboration is the Basis of This Project

Universities
- Protocols & Supplies for Sample
- Protocols & Supplies for Soil
- Questionnaire of Practices
- Questionnaire of Plants
- Research Findings and Solutions

Aronia Growers
- Samples: Berry, Tissue
- Soil
- Answers of Farming Practices
- Answers of Plant information
- Questions and Suggestions

Research & Extension

Industrial Support

Improving Aronia Berry Sustainability and Fruit Quality

https://unlcms.unl.edu/ianr/casnr/food-science/aronia-berry/
THANKS TO OUR SUPPORTORS!

MAA & Collaborative Farms

USDA Agricultural Marketing Service