IMPACT OF TRAINING SYSTEMS FOR ‘BRIANNA’, ‘FRONTENAC’, ‘LA CRESCENT’, AND ‘MARQUETTE’ IN SE WISCONSIN

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Wisconsin Wine and Grape Industry

- Acres of vineyards
  2011: 360
  2016: ~600
- Average vineyard 1-5 acres
- Economic contribution
  2012: 77.1 million

Varieties Grown in Wisconsin

Chart 1-16: Total Planted Cold-Hardy Vines, Red Varieties: Wisconsin

- Marquette: 42%
- Frontenac: 26%
- St. Croix: 7%
- Sabrevois: 8%
- Marechal Foch: 9%
- Other Red: 4%
- Petite Pearl: 1%
- King of the North: 3%

Chart 1-17: Total Planted Cold-Hardy Vines, White Varieties: Wisconsin

- La Crescent: 15%
- Brianna: 19%
- Frontenac gris: 27%
- Prairie Star: 7%
- Edelweiss: 5%
- St. Pepin: 13%
- Other White: 3%
- La Crosse: 7%
- Louise Swenson: 4%
Before NGP
Training Systems
Training systems vary in many aspects

Crop load
Shoot direction
Cordon height
Canopy density
Canopy architecture
# of canopies
Potential for mechanization

yield
fruit quality
frost susceptibility
vine vigor
disease incidence
Labor requirements
Research question

How do training systems affect yield, fruit composition, and vine growth habit for cold climate hybrid grape cultivars?
Vineyard Plot Design

West Madison Agricultural Research Station
Verona, Wisconsin

Year of establishment: 2012
Vine spacing: 7 feet
Total area: 1/3 acre
Soil type: loam and silt loam mix
Total # of panels: 48
Treatments

Vertical Shoot Positioning

Scott Henry

High Wire Cordon

Illustration: Madeline Wimmer 2015
Scott Henry

Upper Canopy

Lower Canopy
Grape Cultivars

BRIANNA

LA CRESCEINT

MARQUETTE

FRONTENAC
Management practices

- Dormant pruning
- Pre-bloom shoot thinning
- Shoot positioning (VSP & SH)
- Combing (HC & SH)
- Leaf pulling
- Lateral shoot removal
- Hedging and skirting
- 25% cluster reduction (SH ONLY)
2015/2016 RESULTS
Growing Degree Day Accumulation

- APRIL 2015: 2686
- MAY 2016: 2822
- JUNE
- JULY
- AUGUST
- SEPTEMBER

GDD Accumulation (F)
Precipitation Patterns

- April: 0 in
- May: 5 in
- June: 10 in
- July: 15 in
- August: 20 in
- September: 25 in

2015: 27.5 in
2016: 29.2 in
Crop yield per trellis foot (lbs)

Harvest: Yield (lbs/ft trellis)

- **Brianna**
- **Frontenac**
- **La Crescent**
- **Marquette**

- 2015
- 2016

Letters above the bars indicate significant differences.
Harvest: tons per acre (average 2015-2016)

Crop yield per acre (tons)

**Brianna**

- **HC:** 4.0 ± 0.5
- **SH:** 6.5 ± 1.0
- **VSP:** 3.0 ± 0.5

**Frontenac**

- **HC:** 6.0 ± 0.5
- **SH:** 8.0 ± 1.0
- **VSP:** 6.0 ± 0.5

**La Crescent**

- **HC:** 4.0 ± 0.5
- **SH:** 6.5 ± 1.0
- **VSP:** 3.0 ± 0.5

**Marquette**

- **HC:** 4.0 ± 0.5
- **SH:** 6.5 ± 1.0
- **VSP:** 4.0 ± 0.5
Fruit Chemistry
Fruit Chemistry: Brianna

Soluble Solids

<table>
<thead>
<tr>
<th>Year</th>
<th>Total soluble solids (°Brix)</th>
<th>30-Jul</th>
<th>13-Aug</th>
<th>27-Aug</th>
<th>10-Sep</th>
<th>24-Sep</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>HC 19.4</td>
<td>SH 19.1</td>
<td>VSP 17.1</td>
<td></td>
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</tr>
<tr>
<td>2016</td>
<td>HC 16.5</td>
<td>SH 16</td>
<td>VSP 16.8</td>
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</tbody>
</table>

Titrateable Acidity (g/L)

<table>
<thead>
<tr>
<th>Year</th>
<th>Titrateable acidity (g/L)</th>
<th>30-Jul</th>
<th>13-Aug</th>
<th>27-Aug</th>
<th>10-Sep</th>
<th>24-Sep</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>HC 6.1</td>
<td>SH 5.7</td>
<td>VSP 5.3</td>
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<td></td>
</tr>
<tr>
<td>2016</td>
<td>HC 7.2</td>
<td>SH 6.9</td>
<td>VSP 7.1</td>
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</tbody>
</table>
Fruit Chemistry: Frontenac

Soluble Solids

2015

Total soluble solids (°Brix)

HC 23.0
SH 23.8
VSP 21.9

2016

Total soluble solids (°Brix)

HC 21.2
SH 22.1
VSP 21.8

Titrateable Acidity (g/L)

2015

HC 13.0
SH 12.7
VSP 12.0

2016

HC 13.0
SH 11.9
VSP 12.2
**Fruit Chemistry: La Crescent**

### Soluble Solids

**2015**
- Total soluble solids (°Brix)
  - HC 21.0
  - SH 19.6
  - VSP 18.7

**2016**
- Total soluble solids (°Brix)
  - HC 19.3
  - SH 18.8
  - VSP 19.1

### Titrateable Acidity (g/L)

**2015**
- Titrateable acidity
  - HC 12.2
  - SH 11.6
  - VSP 12.1

**2016**
- Titrateable acidity
  - HC 14.2
  - SH 13.1
  - VSP 12.3
Fruit Chemistry: Marquette

Soluble Solids

Total soluble solids (°Brix)

2015

HC 24.6
SH 24.5
VSP 24.3

2016

HC 23.2
SH 22.7
VSP 24.1

Titrateable Acidity (g/L)

HC 8.9
SH 8.3
VSP 8.9

HC 10.9
SH 9.9
VSP 10.7
Vine size, balance, and canopy architecture
Vine Size:
Cane pruning weights

<table>
<thead>
<tr>
<th>Year</th>
<th>Variety</th>
<th>HC</th>
<th>SH</th>
<th>VSP</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>Brianna</td>
<td>a</td>
<td>b</td>
<td>a</td>
</tr>
<tr>
<td>2017</td>
<td>Brianna</td>
<td>b</td>
<td>a</td>
<td>a</td>
</tr>
<tr>
<td>2016</td>
<td>Frontenac</td>
<td>b</td>
<td>a</td>
<td>a</td>
</tr>
<tr>
<td>2017</td>
<td>Frontenac</td>
<td>a</td>
<td>b</td>
<td>a</td>
</tr>
<tr>
<td>2016</td>
<td>La Crescent</td>
<td>a</td>
<td>b</td>
<td>b</td>
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<tr>
<td>2017</td>
<td>La Crescent</td>
<td>b</td>
<td>a</td>
<td>a</td>
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<tr>
<td>2016</td>
<td>Marquette</td>
<td>a</td>
<td>b</td>
<td>a</td>
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<td>2017</td>
<td>Marquette</td>
<td>b</td>
<td>a</td>
<td>a</td>
</tr>
</tbody>
</table>
Vine Balance: Ravaz Index

\[ R_I = \frac{\text{fruit yield}}{\text{dormant pruning weight}} \]

### Brianna

- **HC**: a
- **SH**: a
- **VSP**: b

### Frontenac

- **HC**: a
- **SH**: ab
- **VSP**: b

### La Crescent

- **HC**: ab
- **SH**: a
- **VSP**: b

### Marquette

- **HC**: ab
- **SH**: a
- **VSP**: b

Legend:
- 2015
- 2016
Canopy Architecture
Extended Point Quadrat Analysis

High Cordon

Vertical Shoot Positioning

Scott Henry
General Canopy Density Trend

Extended Point Quadrat Analysis

Canopy Density

High Cordon
Lower Scott Henry
Vertical Shoot Positioning
Upper Scott Henry
Labor Requirements

- **Labor minutes per vine**
- **pruning**, **canopy management**, and **harvest**

Bar charts showing labor requirements for different years (2015 and 2016) for **SH**, **VSP**, and **HC**.
Summary

Scott Henry
- Highest yields (8 ton/a in Frontenac)
- Fruit quality traits not different from other systems despite high yields
- Highest labor requirement, mostly due to canopy management

High Wire Cordon
- Yields generally higher than in VSP
- Requires more labor than VSP (ergonomics)
- Denser canopy architecture -> more potential shading

Vertical Shoot Positioning
- Lowest yields (~ 50% less for Brianna and La Crescent)
- Requires the least labor, with proper trellis (catch wires)

Overall no significant differences in fruit quality traits among training systems
Acknowledgements

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