What we’ve learned about sour rot: An update on research

Wendy McFadden-Smith
Tender Fruit & Grape IPM Specialist
Acknowledgements

• Ontario Grape and Wine Research Inc.
• Niagara Peninsula Fruit and Vegetable Growers Association
• Vincor Canada
• Schenck Greenhouses and Farms Ltd.
Acknowledgements

• Dr. Debra Inglis (Co-researcher, CCOVI, Brock University)
• Cristina Huber (Ph.D. candidate, Brock University)
• Lisa Dowling (undergrad thesis)
• Rhiannon Plant (undergrad thesis)
• Summer students
• Dr. Ai-Lin Beh (Inglis lab)
• Shiri Sauday (Inglis lab)
• Linda Tremblay (juice analysis, CCOVI)
• Paula Haag, Dan O’Gorman & Dr. Peter Sholberg, AAFC Summerland (molecular techniques)
• Dr. Keith Seifert, AAFC (ID of non-pathogenic organisms)
• Agri-Corp (sample collection)
Acknowledgements

- BASF Canada
- N.M. Bartlett
- Biosafe Systems
- Forterra Inc.
- NORAC Concepts Inc.
- Plant Products
- Bioworks Inc.
- Innovotech
Relationship between Sour Rot Severity and VA
P. noir, 2011
Relationship between Sour Rot Severity and VA
P. noir, 2011
What’s causing it???
What’s causing it?

- Samples of sour rotted berries
- Flamed to remove surface organisms
Isolations from rotted berries, 2010

AA Bacteria  Hanseniaspora  Bacillus  Aureobasidium
Isolations from rotted P. noir berries, 2011
Isolations from rotted Chardonnay berries, 2011

[Bar chart showing the distribution of different types of bacteria.]
Isolations from rotted Riesling berries, 2011
Rating scale for sour rot

0: NEGATIVE
1: GNB10
2: CGY2
3: KRY2
4: WRB1
Pathogenicity of Organisms

- **Gluconobacter**
- **Acetobacter**
- **Hanseniaspora uvarum**
- **Candida zemplinina**
- **Complex**

The graph compares the pathogenicity of these organisms. The y-axis represents the pathogenicity level, ranging from 0 to 4. The x-axis lists the different organisms. The bar heights indicate their pathogenicity levels.
## Pathogenicity of Organisms

<table>
<thead>
<tr>
<th>Organism</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>AA Bacteria</td>
<td><img src="image" alt="Graph" /></td>
</tr>
<tr>
<td>Candida zemplina</td>
<td><img src="image" alt="Graph" /></td>
</tr>
<tr>
<td>Hanseniaspora uvarum</td>
<td><img src="image" alt="Graph" /></td>
</tr>
</tbody>
</table>
Why does it happen?
Factors that promote sour rot

• Tight clusters/Thin skins
  – Varieties Affected
    • Pinot noir, Pinot gris, Gamay, Chardonnay, Riesling, Gewurztraminer, Baco noir
Factors that Promote Sour Rot

- Favoured by
  - Physical damage
  - Powdery mildew

Gadoury et al., 2007
Factors that Promote Sour Rot

- Clusters infected with bunch rot are more prone to infection by sour rot
Factors that Promote Sour Rot

But

- Frequently found sour rot without bunch rot sporulation
- Frequently found sour rot in areas of clusters (shoulders) where no berry squeeze occurred
- Very weak correlation ($r = 0.028 - 0.147$) between severity of bunch rot and sour rot 2008, 2010, 2011
Factors that Promote Sour Rot

• Grape Berry Moth
  - Bunch rot frequently associated with GBM injury
  - But a problem in vineyards with low GBM pressure
Factors that Promote Sour Rot

- Vinegar flies attracted by volatile compounds released during berry degradation
- Vector sour-rot organisms
  - passive transport by adults
  - eggs laid near base of berry where it pulls away from stem
  - transmitted throughout cluster during larval stages
  - larvae carry sour rot organisms in their gut.
Factors that Promote Sour Rot

![Graph showing temperature (C), Brix, and frost events for 2009 Riesling wines.](image-url)
Factors that Promote Sour Rot

![Graph showing Avg Temp (C) and Brix for 2010 Riesling]

- **Avg Temp (C):** The graph shows fluctuations in average temperature, marked with a purple arrow pointing upwards.
- **Brix:** The graph displays the Brix content, marked with a green line.

**Legend:**
- Purple line: Avg Temp (C)
- Green line: Brix

**Timeline:**
- **Aug:** Days 10 to 31
- **Sept:** Days 1 to 30

**Data Points:**
- Avg Temp (C) ranges from approximately 0 to 35°C.
- Brix values range from 0 to 30.

**Months:**
- Aug: August
- Sept: September

**Year:**
- 2010 Riesling

The graph illustrates the relationship between temperature and Brix levels, potentially indicating conditions that promote sour rot in Riesling grapes.
Factors that Promote Sour Rot

2011 Riesling
Factors that Promote Sour Rot

Avg Temp (C)

Brix

TA

2011 P. noir
Pinot Noir 13.4°

Pinot Noir 15.5°

Pinot Noir 9.7°
Brix vs Sour rot Development
P. noir, 2011
What can we do about it?
Sour Rot Management

- Reduce berry injury
- Eliminate causal organisms
Reduce Berry Injury

• Loosen grape clusters
  - Reduce berry squeeze
  - Thicker cuticle
Treatments to loosen clusters

• Fruiting zone sprays @ 100 gal/A
• Gibberellic Acid
  – 5, 10, 20 ppm
  – (6.7, 13.4, 26.8 oz/100 US gal)
  – Prebloom, 50-80% bloom, bloom + 7 days
• Prohexidione-Ca
  – High, medium and low rate
  – (9.7, 4.8 and 2.4 oz/100 US gal)
• Stimplex
  – 38, 48, 68 oz/A at 80% bloom.
Cluster Compactness Scale

1 2 3 4 5 6

Zabadal and Dittmer
Reduce Injury

• Loosen grape clusters
  – Bloom basal leaf removal
    • 6 basal leaves removed at trace bloom
    • starves clusters for photosynthate and fewer flowers set fruit.
    • looser cluster with fewer berries
Before Bloom Leaf Removal
After Bloom Leaf Removal
Veraison

Untreated
No leaf removal
Leaf removal at bloom
Pea-sized berry
Leaf removal
Veraison

Leaf removal
Effect of Bloom Treatments on Cluster Looseness, 2009

Cluster Looseness

- Riesling
- Pinot noir

Treatments:
- Untreated
- Basal leaf pull
- Prohex-Ca high
- Prohex-Ca med
- Prohex-Ca low
- GA 5 ppm
- GA 5 ppm 2X
- GA 10 ppm prebl
- GA 10 ppm
- GA 10 ppm 2X
- GA 20 ppm

Graph shows the effect of various bloom treatments on cluster looseness for Riesling and Pinot noir grapes.
Effect of Bloom Treatments on Incidence of Sour Rot, Riesling, 2009

Very low sour rot severity in both Riesling & P. noir
Cluster Looseness and Disease Severity
P. noir, 2010

No Sig Dif among treatments -- Bloom timing for GA and Prohex Ca missed!!!
Sour Rot Severity, Riesling, 2010

No Sig Dif among treatments -- Bloom timing for GA and Prohex Ca missed!!!
Disease Severity and Cluster Looseness
Riesling, 2011

[Diagram showing disease severity and cluster looseness for different treatments, including Check, veraison leaf, pea-size leaf, Prebl leaf, GA 5 ppm, GA 5 ppm 2X, GA 10 ppm, GA 20 ppm, Prohex-Ca low, Prohex-Ca med, Prohex-Ca high, with color codes for Sour rot, Botrytis, and Cluster Looseness (1-6)].
No significant difference btw treatments & peasize leaf pulling
Disease severity October 2011

peasize leaf, prebloom leaf, Prohex-Ca med, Prohex-Ca high, GA 20 ppm

Sour rot, Botrytis

Legend: Sour rot, Botrytis
Return Fruitfulnessness Riesling

<table>
<thead>
<tr>
<th>Treatment</th>
<th>2009/10</th>
<th>2010/11</th>
</tr>
</thead>
<tbody>
<tr>
<td>Untreated</td>
<td>88</td>
<td>96</td>
</tr>
<tr>
<td>prebloom leaf</td>
<td>88</td>
<td>93</td>
</tr>
<tr>
<td>GA 5 ppm prebl</td>
<td>90</td>
<td>94</td>
</tr>
<tr>
<td>GA 5 ppm bl</td>
<td>92</td>
<td>97</td>
</tr>
<tr>
<td>GA 5 ppm 2X</td>
<td>86</td>
<td>96</td>
</tr>
<tr>
<td>GA 10 ppm bl</td>
<td>92</td>
<td>94</td>
</tr>
<tr>
<td>Prohex-Ca low</td>
<td>88</td>
<td>94</td>
</tr>
<tr>
<td>Prohex-Ca med</td>
<td>86</td>
<td>95</td>
</tr>
<tr>
<td>Prohex-Ca high</td>
<td>89</td>
<td>97</td>
</tr>
</tbody>
</table>
Orchardists use helicopters to protect cherry crop

A helicopter flies low over a cherry orchard on Elliott Avenue in Peachland Tuesday morning. Rain can collect on cherries, causing them to split, so orchard owners hire helicopters to act as giant fans, blowing water off the cherry crop. (Dave Preston photo)
Reduce Mechanical Injury

• Suggestions for Cherry Cracking
  – Osmoticum sprays
    • Mineral salts (CaCl2) applied prior to or during rain
    • Reduce absorption of water across skin
  – Calcium
    • Strengthen cell walls?
    • Timing between fruit set and veraison
  – Surfactants
    • Raingard? (non-ionic surfactant)
    • Desikote (new formulation of VaporGuard)
Reduce Mechanical Injury

• Treatments
• CaCl$_2$
  - Stopit (12% CaCl$_2$ w/v)
    • 1.64 gal/100 gal (US) biweekly (peasize berry + veraison)
    • 0.87 gal/100 gal (US) weekly starting at peasize berry

• Leaf removal
  - Peasize berry vs veraison

• Raingard
• Desikote
Treatments to Reduce Berry Injury
Riesling, 2011

[Bar chart showing comparisons between treatments and disease incidence for veraison leaf, pea-size leaf, 2X CaCl2, 4X CaCl2, Raingard, Desikote, Sour rot, and Botrytis]
Large Plot Calcium and Leaf Removal, P. noir, 2011

![Graph showing the effects of calcium levels on rot severities.

- **0Ca**: Sour rot Severity, Sour rot 10%+, Bot rot Severity, Bot rot 25%+
- **2XCa**: Sour rot 10%+, Bot rot Severity
- **4XCa**: Sour rot 10%+, Bot rot 25%+
- **Pea-size**: Sour rot 10%+, Bot rot 25%+
- **Veraison**: Sour rot 10%+, Bot rot 25%+](image)
Sour Rot Management

• Potassium Metabisulphite?
  – Used as anti-oxidant and anti-microbial (vs microbes) in vinification (40-60 g/tonne)
  – Rengasamy & Poole (NZ):
    • 5 kg per 1000 L water
    • Botrytis-infected berries dry out
  – Wicks (Australia):
    • 3-4 g/L KMS killed Botrytis spores & inhibited growth of germ tubes
    • If 4 g/L applied w/i 48 hr of infection, inhibits sporulation from infected berries
    • Little effect on sporulation after that
Sour Rot Management

• Potassium Metabisulphite (KMS)
  – Concerns:
    • Does it work?
      – Rate? Timing?
    • How does it work? (anti-oxidant/anti-microbial/both?)
    • Excess sulphites & SO$_2$ in wine?
Post-Veraison Treatments

- **Treatments**
  - KMS 2.5, 5, 10 kg/1000 L
  - Milstop (K bicarb)
  - KMS 5 kg + Milstop (K bicarb)
  - Oxidate
  - Blight Ban 506 (*Pseudomonas fluorescens*)
  - Actinovate (*Streptomyces lydicus*)
  - Agress (oxysilver nitrate)
  - Vermicompost (not shown)
- **600 L/ha in fruiting zone @**
  - 50-75% veraison
  - + 2 wk
  - + 1 wk (Ries)
  - + 1 wk (Ries)
  - + 1 wk (1 wk pre-harvest)
  - 3 d pre-harvest
  - 1 d pre-harvest
Disease Severity with Post-Veraison Treatments

P. noir, 2011

No significant difference btw treatments & peasize leaf pulling check
Disease Severity with Post-Veraison Treatments
Riesling, 2011
Disease Severity with Post-Veraison Treatments
Riesling, 2011

Check veraison leaf pea-size leaf KMS 5 kg KMS 2 wk post-ver KMS 3 wk post-ver KMS 1 wk pre-harv KMS 3 d pre-harv KMS 1 & 3 d pre-harv KMS 1 d pre-harv

Sour rot Botrytis
All Treatments
Riesling, 2011
Future Research

- Effects of temperature & wetness duration on infection
- Effect of soil moisture/soil type/vine vigour on disease development
- Changes in berry between 13 and 15 Brix that relate to susceptibility
- Screen other potential control agents
- Repeat prebloom leaf removal, GA and Prohex-Ca on same plots
- Effect of temperature on KMS activity
- Interactions between causal organisms
- Progression of berry microflora pea-size to harvest