Red Drupelet Disorder in Blackberries: Update 2016

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Project Overview

• Three years, commenced in August 2015

• *Year one*: Inducing the disorder and understanding the underlying physiology behind drupelet reversion

• *Year one/two*: Mechanisms responsible for causing or increasing susceptibility to the disorder

• *Year two/three*: Evaluating potential management techniques for reducing the disorder
Red Drupelet Disorder

• Postharvest reddening of previously black individual drupelets

• Can affect up to 50% of a fruit – up to 30% of a crop

• Reduces marketability – consumer perception is defective fruit

• Very little research into the disorder

• Loss of anthocyanin pigment is the underlying factor (cyanidin 3-glucoside)
Red drupelets showing signs of physical damage
Causes of Reversion

• Rapid temperature and/or humidity changes seem to cause increased expression of the disorder
  – Rapid swelling and shrinking of the cell wall
  – Fruit harvested >22.5C suffers the most

• More exposed areas in storage suffer
  – Cool quicker, more moisture loss
  – Top of pallets, front of cool room

• Physical damage a major cause
  – Blackberries are very fragile
  – Picking, packing, and shipping all add to risk

• Nutrition may also play a role
Season One Trials

• Nitrogen manipulation trial
  – High N identified as a possible factor
• Inducing reversion with physical damage and temperature manipulation
  – Bruising and manipulating storage temp
• Assessing effectiveness of staged cooling
• Detailed analysis of the biochemistry in affected drupelets
  – Soluble solids, pH, titratable acidity, full anthocyanin pigment analysis
Season One Trials
Nitrogen manipulation

- Some growers indicated that high nitrogen applications during harvest increased susceptibility to RDD
- High, medium, and low applications were applied via fertigation during harvest
- Randomised complete block design
- Harvested five times through the season
- Fruit assessed for RDD, firmness, yield, berry weight, pH, TA, brix, anthocyanin content
Season One Trials: Preliminary Results

**Average Reverted Drupelets Per Pick With Treatment**

- **Pick Number**
  - 1
  - 2
  - 3
  - 4
  - 5

- **Treatment (N)**
  - Low
  - Medium
  - High

**Average Firmness Per Pick With Treatment**

- **Pick**
  - 1
  - 3
  - 4
  - 5

- **Error Bars: +/- 1 SE**
- **Mean 24 Hour Firmness**
  - Low
  - Medium
  - High

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**Error Bars: +/- 1 SE**
Season One Trials: Preliminary Results

Average Yield (g/m) Per Pick With Treatment

Average Berry Mass Per Pick With Treatment

Error Bars: +/- 1 SE
Season One Trials: Preliminary Results

Average Penetration Force (N) With 2mm Probe

Penetration Force (N)

Error Bars: +/- 1 SE

Black
Half Red
Full Red

Colour Drupelet
Season One Trials: Staged Cooling

• Fruit was harvested on three dates early in the season
• Two treatments:
  1. Precooled: 8°C for two hours, 2°C for 22 hours
  2. No precooling: 2°C for 24 hours
• Assessed for drupelet reversion and quality
### Season One Trials: Staged Cooling

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Number of fruit assessed</th>
<th>% Fruit with no reversion</th>
<th>% Fruit with 1-4 reverted drupelets</th>
<th>% Fruit with 4+ reverted drupelets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-cooled</td>
<td>400</td>
<td>41.5</td>
<td>36.9</td>
<td>22.4</td>
</tr>
<tr>
<td>Non Pre-cooled</td>
<td>400</td>
<td>23.4</td>
<td>45.4</td>
<td>30.4</td>
</tr>
</tbody>
</table>

- 23.4% of 2C stored fruit showed no reversion compared to 41.5% of pre-cooled fruit
- Smaller difference in total number of reverted drupelets – severe reversion still affected pre-cooled fruit
Season One Trials: Inducing Reversion

• Temperature manipulation
  – Exposure of fruit to rapid cooling from warm temperatures

• Bruising
  – Fruit was bruised with different levels of physical impact and compression forces at different temperatures

• Fruit had to be harvested extremely carefully to avoid unwanted damage prior to the work
Season One Trials: Inducing Reversion
Season One Trials: Inducing Reversion

24 days
Preliminary Results

Drupelet Reversion with Impact Force

Reversion With Bruising and Storage Temperatures

Storage Temp
- 2
- 7
- 20

Impact Force
- Control
- Low
- High

Temp at Bruising
- 2
- 7
- 20
Season One Trials : Inducing Reversion

A: Control – no physical force applied to fruit

B: Fruit with physical force applied at 0-2°C

C: Fruit with physical force applied at 7-9°C
Moving Forward

• Staged cooling has potential, particularly in warm environments
• Bruising and temperature management during handling
• Manage picking techniques to reduce double handling
• Punnet design is worth considering
• Modified/controlled atmosphere may play a role
• Potential agronomic techniques
Thanks

- Costa Berries – David Bardon and Cameron Folder
- RABA – Raspberries and Blackberries Australia
- TIA – Penny Measham and Dugald Close