Session Six
Postharvest quality, outturn

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Is Ripening and Post Harvest Quality Affected by Fruit Water Status?

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Avocado Industry Council Ltd
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Introduction

• The incidence and severity of disorders increases when pick to pack times exceed 48 hours

• Observed in library trays

• Stem end rot and body rot (brown patches) are the main disorders affected
Quality and Delays Before Storage

[Graph showing incidence and severity of quality disorders over hours after picking before packing.]
Introduction

The amount of water loss after harvest may be inducing earlier ripening because:


Ripening time and rots

![Graph showing the incidence of unsound fruit (%) against ripening time (days)](image)
Introduction

Conducted a series of experiments looking at quality in relation to ripening and water loss

We manipulated ripening by:

• Increasing water loss after harvest
• Decreasing water loss after harvest
• Adding water to the fruit (imbibing) at different physiological stages
Water loss after harvest

Weight loss before storage (%)

Time after picking before storage

Incidence of sound fruit (%), 5% threshold
Instead of removing water what happens if we add water to the fruit?

Do we get the opposite results to water loss?
Experimental

To see if we could slow down ripening water was imbibed into freshly harvested fruit
Ripeness stages

Non-stored fruit

Weight change (%)

Ripening stage

- Inhibition
- Pre-climacteric
- Climacteric

Imbibed
Non imbibed
## Ripeness stages

<table>
<thead>
<tr>
<th>Stage</th>
<th>Inhibition</th>
<th>Pre-climacteric</th>
<th>Climacteric</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imbibed</td>
<td>10.6a</td>
<td>9.7a</td>
<td>11.7a</td>
</tr>
<tr>
<td>Non-imbibed</td>
<td>9.4b</td>
<td>10.3b</td>
<td>10.2b</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stage</th>
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<th>Climacteric</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imbibed</td>
<td>79.3</td>
<td>93.3</td>
<td>90.0</td>
</tr>
<tr>
<td>Non-imbibed</td>
<td>91.7</td>
<td>87.3</td>
<td>96.2</td>
</tr>
</tbody>
</table>
Imbibing

What else does the amount of water imbibed tell us?

Amount of water imbibed may measure fruit water potential

- how readily water moves into the fruit
- indicate fruit water status
- may explain some of the variation in quality disorders
Experimental

Factors that affect fruit water status may be:

• Irrigation
• Rainfall
Irrigated vs Non-Irrigated Fruit

<table>
<thead>
<tr>
<th></th>
<th>Irrigated</th>
<th>Non-Irrigated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dawn</td>
<td>1.1</td>
<td>1.2</td>
</tr>
<tr>
<td>Mid PM</td>
<td>1.5</td>
<td>1.3</td>
</tr>
</tbody>
</table>

Increase in weight (%)
## Irrigated vs Non-Irrigated Fruit

<table>
<thead>
<tr>
<th>Time of Day</th>
<th>Imbibed</th>
<th></th>
<th>Non-imbibed</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Ripening time (days)</td>
<td>Irrigated</td>
<td>Non-irrigated</td>
<td>Irrigated</td>
<td>Non-irrigated</td>
</tr>
<tr>
<td>Mid PM</td>
<td>4.4</td>
<td>4.1</td>
<td>4.7</td>
<td>3.6</td>
</tr>
<tr>
<td>Incidence of sound fruit (%), 5% threshold</td>
<td>Mid PM</td>
<td>55.9</td>
<td>71.7</td>
<td>75</td>
</tr>
</tbody>
</table>
Effect of rain

- Weight change (%)
  - Imbibed
  - Non-imbibed

- Ripening time (days)

- Incidence sound fruit (%), 5% threshold
Conclusions

- The loss in quality with delays before packing is more because the fruit increase in ripeness rather than due to weight loss.
- The fruit water status at harvest affects ripening which influences the amount of ripe rots.
- This means what happens to the fruit before harvest and how the fruit are handled after harvest and by the packer affects final fruit quality.
Acknowledgements

Thanks to the following avocado growers for fruit for the various trials:

Hugh Moore
Graham Body
Dan & Rose Cook
Kevin Holley
Drew Skowrup
Kim Crocker
Debbie Fleming
Library Trays
– a powerful tool in fruit quality management

Dr Henry Pak
Dr Jonathan Dixon
Dr Jonathan Cutting

Avocado Industry Council
Introduction

- Cornerstone of quality improvement programme – export focus
- Feedback on fruit quality
  → Improve quality on-orchard
- Runs in parallel with out-turn monitoring
- Initially best practice, now compulsory
- Over several seasons has successfully identified quality issues and contributing factors
Methods

- ~ 20 fruit sample after grading
- Each PPIN, every 2nd picking round
- Coolstored 28 days 5 °C
- 1st assessment = external quality – on removal from coolstorage
- Ripened at 20 °C
- 2nd assessment = internal quality – at eating ripe
- Entered into central database
### Number of fruit sampled

<table>
<thead>
<tr>
<th>Year</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001/2</td>
<td>30,023</td>
</tr>
<tr>
<td>2002/3</td>
<td>22,192</td>
</tr>
<tr>
<td>2003/4</td>
<td>23,882</td>
</tr>
<tr>
<td>2004/5</td>
<td>25,873</td>
</tr>
</tbody>
</table>

Total: 101,970
Main quality disorders
Brown patches
Fuzzy patches
Seasonal trends
Fuzzy patches

Harvest month

2004/5
2003/4
2002/3
2001/2

incidence (%)
Flesh temperature audits

Temperature (°C)

frequency (%)

Before 1st Dec

After 1st Dec
out-turn monitoring

Disorder

2001
2002
2003
2004

incidence (%)
Fruit Age
Fruit Age

incidence (%) of unsound fruit (5% threshold)

Fruit age when ripe (days)
Pick to Pack Time
Pick to Pack Time

stem-end rot incidence (%)

days

0 1 2 3
Wet Fruit
influence of rain on stem-end rots

incidence (%)

rainfall (mm)

0  1-5  5-10  11-15  16-20  >20

0  10  20  30  40  50  60
Regional comparisons
Regional differences

stem-end rot incidence (%)

Far North  |  Whangarei  |  Bay of Plenty

0  |  15  |  25
Packer Reports
Shed averages – incidence brown patches
Grower comparisons
For assistance with interpretation of this report please refer to the Avocado Industry Council website (www.nzavocado.co.nz)
Conclusions

- Provides framework for quality improvement - feedback
- Successfully identified quality issues and causal factors over several seasons
- Allows remedial action within season