Optimising degreening conditions to reduce lemon chilling injury

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When things don’t go to plan

Monitoring fruit quality during export

• Lemon shipments occasionally arrive in Asian markets with an unacceptably high incidence of skin defects

• Variation in fruit source, harvest time, degreening and pre-cooling practices and shipment temperatures could contribute to these defects
When things don’t go to plan

Monitoring from farm to retail

- Variation in degreening room temperature and ethylene concentrations were observed in central Qld facilities.
When things don’t go to plan
Monitoring from farm to retail

• Shipment temperatures varied between 2-3°C
Identifying contributing factors…

Trial 1. Temperature x ethylene

**Aim:** Identify effect of temperature and ethylene concentration on skin colour and defects

**Materials and method:**

- Late season 2017 ‘Eureka’ seedless lemons were harvested from three blocks at a Qld farm
- Fruit were degreened at 3 temperatures (24, 29, 34°C) and 3 ethylene concentrations (0, 5 and 29 ppm) for 3 days
- After degreening, fruit were stored at 1°C for 21 days then held at 20°C for 6 days to assess skin defects
Fruit assessment:

• Minolta colour meter was used to measure skin colour (hue angle):

  113°  106°  99°  96°

• Chilling injury (CI) was assessed using a 0-3 rating scale:

  0; nil  1; <1cm²  2; 1-3 cm²  3; >3 cm²

Diffuse CI
Trial 1 Results

Effect of temperature and ethylene on colour development

After 3 days of degreening

Skin colour (H°)

Ethylene concentration (ppm)

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Degreening temperature (°C)

LSD

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Trial 1 Results

Effect of temperature and ethylene on CI incidence

Degreening at 24°C plus 5 ppm ethylene gave the best outcome in terms of colour and minimising skin defects.
Identifying contributing factors…

Trial 2. Temperature x time

**Aim:** Identify the optimal time and temperature to degreen lemons without increasing skin defects

**Materials and method:**
- Early season 2018 ‘Eureka’ seeded lemons were harvested from three blocks at a Qld farm
- Fruit were degreened with 5 ppm ethylene at 20, 23, 26, and 29°C for 0, 1, 2, 3 and 5 days
- They were consolidated at 7°C for 2 days
- Fruit were stored at 1°C for 21 days then held at 20°C
Trial 2 Results

Effect of duration and temperature on skin colour change

After degreening

Cold removal/Sea freight
Trial 2 Results

Effect of duration and temperature on skin defects

<table>
<thead>
<tr>
<th>Removal time (day)</th>
<th>Temperature (°C)</th>
<th>% of fruit with any diffuse chilling injury at retail assessment</th>
<th>Temperature (°C)</th>
<th>% of fruit with any rot at retail assessment</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>20</td>
<td>23</td>
<td>26</td>
<td>29</td>
</tr>
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<td>0.0</td>
<td>0.0</td>
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<td>1</td>
<td>3.3</td>
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<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>3</td>
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<td>3.3</td>
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<tr>
<td>5</td>
<td>0.0</td>
<td>6.7</td>
<td>6.7</td>
<td>0.0</td>
</tr>
</tbody>
</table>

- Chilling and rots tended to occur on fruit that were degreened at higher temperatures (26 and 29°C) and for the longest time (5 days).
Ensuring good fruit quality in-market

- Be aware that fruit robustness varies ✓
- Don’t degreen above 26°C with ethylene ✗
- Don’t treat with more than 5 ppm ethylene ✗
- Do degreen lemons at 20-24°C for 3 days ✓
- Do condition fruit for 1-3 days prior to cooling ✓
- Ensure shipment temperatures are maintained just below the maximum protocol limit ✓

Solution: Regularly monitor degreening and shipping conditions
Wouldn’t it be great if we could predict the robustness of lemons for export?

Thank you!

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