Commercial benefits achieved by the removal of ethylene in a long plum supply chain with It’s Fresh!

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Background

• Discuss a technology It’s Fresh! that will assist with:
  “Enhancing supply chain and consumer benefits: ethical and technological issues”.

• Cold supply chain between continents

• Plum realities (*Prunus saliciana*), climacteric or suppressed climacteric

• Plum requirements, unbroken and accurate cold chain

• Looking for solutions

• Summary
THE COLD/LOGISTICS/VALUE CHAIN FOR PLUMS
Time line for post harvest life of stone fruit picked in the Western Cape of South Africa and shipped to Europe.

- **Picking Day 1**
- **Cooled to dew point Day 2**
- **Packed and pre-cooled Day 3**
  - Container on vessel Day 7
  - Loaded into a container & delivered in port Day 6
  - Stored under cooling Days 4 to 5
  - Cape Town to Rotterdam Days 8 to 22
  - Fruit unloaded and sent to DC Day 23
  - DC to supermarket Days 24 to 28
  - Plums spend 50% of their post harvest life in a reefer container
Shipping temperature regime for plums
Range of pulp temperatures of plums measured at the base, middle and top of a pallet loaded in the centre of a 12m container.
Methodology I

- Side by side shipping trials of 4 varieties of plums, namely: Sapphire, Flavourking (Pluot), Southern Belle and African Delight.
- Test the effect of the technology “It’s Fresh!” ®. The active being zeolite with a palladium catalyst.
- Each variety picked from the same orchard, cooled to dew point and then packed in the same pack house.
- Half the population packed with two It’sFresh small transit filters per 5.0 Kg double layered carton.
- Fruit pre-cooled to -0.5°C.
- Then loaded into either 6 or 12m refrigerated containers and shipped from Cape Town to the EU.
- Where possible the control and treated were shipped on the same vessel.
Methodology II

• Shipping temperature regime:
  • Sapphire, dual temp
  • Flavourking, dual temp
  • Southern Belle, single temperature of -0.5°C.
  • African Delight, single temperature of -0.5°C.

• Upon arrival in Europe samples collected and quality examined immediately and again after a 7 day shelf life.
Sapphire
Temperature recorded in a shipment of Sapphire plums.
Temperature recorded in a shipment of Sapphire plums with ethylene filters.
Maturity parameters of ‘Sapphire’ plums at picking, upon arrival in Europe and after a shelf life of 7 days. Figures in parentheses are the standard deviation.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Pressure of fruit at picking (kg)</th>
<th>TSS of fruit at picking (%)</th>
<th>Pressure of fruit at end of storage. 28 days (kg)</th>
<th>Change from pick</th>
<th>Pressure of fruit at end of shelf life. 35 days (kg)</th>
<th>Change from End of Store</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>6.9 (1.2)</td>
<td>12.2 (1.1)</td>
<td>2.5 (0.5)</td>
<td>4.4</td>
<td>1.9 (0.46)</td>
<td>0.6</td>
</tr>
<tr>
<td>It’s Fresh!®</td>
<td>7.1 (1.3)</td>
<td>12.3 (0.9)</td>
<td>3.6 (0.4)</td>
<td>3.5</td>
<td>3.2 (0.63)</td>
<td>0.4</td>
</tr>
<tr>
<td>Difference</td>
<td>-</td>
<td>-</td>
<td>1.1</td>
<td>-</td>
<td>1.3</td>
<td>-</td>
</tr>
</tbody>
</table>
Flavourking
Maturity parameters of ‘Flavourking’ pluots/plumcots at picking, upon arrival in Europe and after a shelf life of 7 days. Figures in parentheses are the standard deviation.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Pressure of fruit at picking (kg)</th>
<th>TSS of fruit at picking (%)</th>
<th>Pressure of fruit at end of storage. 28 days (kg)</th>
<th>Change from pick</th>
<th>Pressure of fruit at end of shelf life. 35 days (kg)</th>
<th>Change from End of Store</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control 15/01/2015</td>
<td>8.0 (0.8)</td>
<td>15.7 (0.9)</td>
<td>3.68 (1.3)</td>
<td>4.32</td>
<td>3.12 (0.75)</td>
<td>0.56</td>
</tr>
<tr>
<td>It’s Fresh!® 22/01/2015</td>
<td>8.2 (0.75)</td>
<td>15.3 (1.01)</td>
<td>2.9 (1.15)</td>
<td>5.3</td>
<td>2.6 (0.4)</td>
<td>0.3</td>
</tr>
<tr>
<td>Difference</td>
<td>-</td>
<td>-</td>
<td>0.78</td>
<td>-</td>
<td>0.52</td>
<td>-</td>
</tr>
</tbody>
</table>
Maturity parameters of ‘Southern Belle’ plums at picking, upon arrival in Europe and after a shelf life of 7 days. Figures in parentheses are the standard deviation.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Pressure of fruit at picking (kg)</th>
<th>TSS of fruit at picking (%)</th>
<th>Pressure of fruit at end of storage. 28 days (kg)</th>
<th>Change from pick</th>
<th>Pressure of fruit at end of shelf life. 35 days (kg)</th>
<th>Change from End of Store</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>7.6 (0.4)</td>
<td>16.5 (0.9)</td>
<td>4.81 (1.3)</td>
<td>2.79</td>
<td>1.79 (0.6)</td>
<td>3.02</td>
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<tr>
<td>It’s Fresh!®</td>
<td>4.88 (0.9)</td>
<td></td>
<td></td>
<td>2.72</td>
<td>2.94 (0.4)</td>
<td>1.94</td>
</tr>
<tr>
<td>Difference</td>
<td>-</td>
<td>-</td>
<td>0.07</td>
<td>-</td>
<td>1.15</td>
<td>-</td>
</tr>
</tbody>
</table>
African Delight
Maturity parameters of ‘African Delight’ plums at picking, upon arrival in Europe and after a shelf life of 7 days. Figures in parentheses are the standard deviation.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Pressure of fruit at picking (kg)</th>
<th>TSS of fruit at picking (%)</th>
<th>Pressure of fruit at end of storage. 28 days (kg)</th>
<th>Change from pick</th>
<th>Pressure of fruit at end of shelf life. 35 days (kg)</th>
<th>Change from End of Store</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control 6/02/2015</td>
<td>9.1 (2.2)</td>
<td>14.7 (0.9)</td>
<td>4.87 (1.1)</td>
<td>4.23</td>
<td>4.2 (0.6)</td>
<td>0.67</td>
</tr>
<tr>
<td>It’s Fresh!® 9/02/2015</td>
<td>8.5 (2.9)</td>
<td>15.0 (0.8)</td>
<td>4.23 (1.4)</td>
<td>4.27</td>
<td>3.8 (0.8)</td>
<td>0.43</td>
</tr>
<tr>
<td>Difference</td>
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<td>-</td>
<td>0.64</td>
<td>-</td>
<td>0.4</td>
<td>-</td>
</tr>
</tbody>
</table>
Summary

• The 4 commercial shipments showed that by removing ethylene from the storage environment of plums the following benefits occurred:
  • Reduced rate of softening of the plums which would allow as much as a 4 day extension to shelf life.
  • Less shrivel in the higher respiring varieties.
  • Reduction in the amount of rots in 3 of the 4 shipments.

• The cost of the technology was more than offset by the improved fruit quality, good ROI.
Conclusion

• This technical innovation of chemisorption of ethylene from storage environments with It’sFresh allows for maintenance of plum quality in long cold supply chains.
• This technology leads to the possibility of picking riper fruit with resultant better flavour.
• Currently commercial use on berries, stone fruit, pome fruit and sub-tropicals.
• First successful sea shipments of avocados.
Acknowledgements

• Cape Five Exports for assisting with the trial and absorbing the additional per unit cost of 6m containers vs 12m.
• Walda Roux for logistical support.
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• Staff at Hortkinetix.
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THANKS FOR YOUR
ATTENTION
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