Effect of 1-MCP on UK Cultivar Plums

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Introduction

The UK currently produces around 15,000 tonnes of plums of which half are the dessert/dual purpose variety Victoria. This variety is central to the UK production with complementary varieties such as Opal, and Marjorie’s Seedling extending the UK season. The supply of a continuous stream of English fruit from mid July to the end of October is a desirable attribute for sales to the UK supermarkets. This work was undertaken to ascertain whether the UK plum varieties Victoria and Marjories Seedling were suitable for maintaining the parameters of continuous supply and season extension.

Materials & Methods

Plums harvested at commercial maturity (cv Victoria) on 19th Aug 2003 using normal practices were taken from two orchards in differing agro-climatic areas, and transported immediately to Writtle College Postharvest Unit (Essex, UK). One sample from each area was treated with 1-MCP at 650 ppb using a small 1-MCP research vapouriser. The atmosphere was sealed within a sealed 1m³ thick bag for 24 hours. All samples were stored in darkness inside a Postharvest Research Cold Store, maintaining 1°C, 70-85% RH.

560 grams fruit samples of were taken from each treatment group and placed in 3 litre plastic containers for 4.5 hours and tested for CO₂ and ethylene (C₂H₄). At weekly intervals a sample of 20 fruits from each orchard treatment group were removed for destructive testing. These were assessed on each side of the fruit for colour, external quality, and pressure (using a penetrometer with 8mm probe, mounted in a stand).

Internal quality of the fruit was noted and fresh cut samples of the fruit flesh were then taken, juiced and tested for sugar (Brix). The number of external and internal defects were counted. A second sample of fruit was taken from each treatment batch and placed at 20°C in darkness to simulate consumer conditions, the fruit subject to similar quality analysis as outlined above.

Similar samples of Marjorie were sourced on the 9th September 2003, and subjected to same method.

Results & Discussion

Victoria: The advantages of 1-MCP treatment increased as the length of cold storage was extended. The greatest pressure difference was seen at 56 days cold storage, with 1-MCP fruit having an advantage of 1.38kg/cm². Shelf life pressure showed greater improvements with firmness gain at 28+7 days shelf life of 0.66kg/cm² and 1.27 kg/cm² after 35+7.

The Brix for all cultivars remained above the commercial acceptable level of 12% for both treated and untreated fruit. A decrease in respiration was observed with an average reduction of respiration rate during cold storage of 0.25 mg CO₂Kg⁻¹hr⁻¹.

Marjorie: For the first 28 days of cold store the pressure for both treated and untreated fruit remained constant (average 3.39 kg/cm²). The 1-MCP treatment gave a firmer fruit from day 28 of cold storage. The difference in firmness between day 28 and 42 averaged 0.88 kg/cm². 1-MCP fruit was firmer after all shelf life tests with this variety, with an average increase in firmness of 1.01 kg/cm², peaking at 1.44 kg/cm² on day 21+7 days shelf life.

The Brix showed only minimal variation, adjusted by 2.1% during the storage period, with no effect from the 1-MCP treatment. There was no statistical difference observed between respiration rates and Brix of 1-MCP treated and untreated Marjorie fruit. The average reduction of ethylene production between days 28 to 42 due to the 1-MCP treatment was 0.23 uL kg⁻¹ hr⁻¹. The number of disorders observed after the shelf life period was lower in 1-MCP treated fruit for all shelf life tests. 1-MCP showed a 25% reduction in the number of infected fruit for 28+7 and 35+7 samples.

Table 1: Fruit firmness (kg/cm²) of Victoria and Marjorie after shelf life period (7 days, 20 degrees Celsius)

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Storage Period (Cold + Shelf Life)</th>
<th>1-MCP Fruit Pressure</th>
<th>Untreated Fruit Pressure</th>
<th>Firmness advantage from 1-MCP treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Victoria</td>
<td>28+7</td>
<td>1.30</td>
<td>0.64</td>
<td>0.66</td>
</tr>
<tr>
<td></td>
<td>35+7</td>
<td>1.55</td>
<td>1.28</td>
<td>1.27</td>
</tr>
<tr>
<td>Marjorie</td>
<td>7+7</td>
<td>3.10</td>
<td>2.21</td>
<td>0.90</td>
</tr>
<tr>
<td></td>
<td>14+7</td>
<td>2.61</td>
<td>1.66</td>
<td>0.95</td>
</tr>
<tr>
<td></td>
<td>21+7</td>
<td>2.64</td>
<td>1.20</td>
<td>1.44</td>
</tr>
<tr>
<td></td>
<td>28+7</td>
<td>2.66</td>
<td>1.80</td>
<td>0.77</td>
</tr>
</tbody>
</table>

No internal defects were observed in 1-MCP treated fruit at 35+7, compared to the untreated sample (34 infected fruit).

Conclusion

The benefit of 1-MCP treatment was cultivar dependant, but firmness was maintained during cold storage and more noticeably after 7 days shelf life period (similar observations by Valero et al 2003, Salvador et al 2003). 1-MCP treatment reduced the number of fruit showing disorders, most noticeably after shelf life periods.

The results observed from this experiment indicate that there is potential for growers to use 1-MCP on UK cultivars, in order to extend both cold storage life, but also to aid quality maintenance throughout the supply chain, giving benefits to consumers. Further trials to confirm the benefits on both the cultivars in this report and other UK cultivars are planned in the forthcoming storage season.