Grower Summary

TF 199

Optimising the rate of establishment of Controlled Atmosphere storage of Bramley's Seedling apples

Annual 2012

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Use of pesticides

Only officially approved pesticides may be used in the UK. Approvals are normally granted only in relation to individual products and for specified uses. It is an offence to use non-approved products or to use approved products in a manner that does not comply with the statutory conditions of use, except where the crop or situation is the subject of an off-label extension of use.

Before using all pesticides check the approval status and conditions of use.

Read the label before use: use pesticides safely.

Further information

If you would like a copy of the full report, please email the HDC office (hdc@hdc.ahdb.org.uk), quoting your HDC number, alternatively contact the HDC at the address below.

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Project Number:	TF 199
Project Title:	Optimising the rate of establishment of Controlled Atmosphere storage of Bramley's Seedling apples
Project Leader:	Dr Richard Colgan
Contractor:	NRI
Industry Representative:	Nigel Jenner
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Previous report/(s):	None
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Project Cost:	£48,300

Headline

- Progress is being made in identifying optimum establishment techniques for controlled atmosphere storage of Bramley.

Background and expected deliverables

Scrubbed low oxygen storage (5% CO_2 + 1% O_2) (5/1 CA) has resulted in major improvements in storage quality of Bramley's Seedling apples particularly in the control of bitter pit and superficial scald. The use of 'SmartFresh^{TM}' (1-MCP) or ethylene scrubbing is widespread and provides further scald control. A disadvantage of 5/1 CA with either SmartFresh^{TM} or ethylene scrubbing is the propensity for carbon dioxide injury to develop. To avoid this, it is recommended that establishment of CA conditions for SmartFresh^{TM}-treated fruit is delayed for three weeks. Concerns regarding the ability of stores to achieve rapid establishment of 5/1 CA after this initial delay has prompted many growers to adopt a procedure whereby stores are sealed immediately and carbon dioxide is scrubbed while oxygen concentrations are allowed to drop to 10% for 21 days before 5/1 conditions are established. An optimum strategy has not however been established.

This project therefore seeks to determine an optimum strategy to control CO_2-injury while maintaining background colour, firmness, bitter pit and scald control in long-term stored Bramley's. Bramley's stored long-term are also susceptible to high numbers of core rots (up to 8-10% losses). More rapid establishment of CA may lead to a reduction in the incidence of core rots.

In addition to low oxygen storage, approximately 40% of the UK's Bramley's Seedling Crop is stored in traditional gas ventilated 9% CO_2, 12% Oxygen (9/12) stores. With the loss of the antioxidant diphenylamine (DPA) to control scald, growers are restricted to treating Bramley's with SmartFresh^{TM} to reduce the development of superficial scald on long-term stored fruit. Currently, a delay of three weeks in the establishment of CA conditions is recommended to avoid the development of CO_2-injury. Such a delay in CA conditions will often result in loss of quality during the storage season. The identification of a strategy to allow stores to be sealed earlier will help to improve the quality of fruit stored in the 9/12 regime.

Summary of the project and main conclusions

5/1 Stores

CA stores of Bramley's sealed immediately after fruit has cooled to store temperature (4-4.5°C) are best established through existing industry protocols; allowing oxygen to drop to 10% O_2 during the first three weeks of storage, and thereafter allowing store oxygen to drop to 1% O_2.

In cases where sealing of stores has been delayed by five days from harvest, an increase in the incidence of internal carbon dioxide injury and core-flush was observed during long-term storage.

Preliminary results from the first year of the project have shown that rapid pull down of oxygen from 21 to 1% over three weeks helped to reduce the incidence of **internal** browning caused by CO_2-injury where store sealing was delayed by five days from harvest. **However, it is important to note that rapid pull down of oxygen from 21% to 1% O_2 on early harvested Bramley's is likely to increase the risk of external CO_2-injury.** This work requires further development before the benefits to industry can be properly evaluated.

9/12 Stores

Delaying sealing of SmartFresh^{TM}-treated Bramleys in 9/12 CA for 3 weeks resulted in an increased incidence of post-harvest rots (8.3%). Immediate sealing of stores and maintaining CO_2 at 1.5% for the first three weeks of storage reduced rotting to 2%. In the first year of this trial, immediate sealing of Bramley stores with a low build up (1.5%) of CO_2 did not result in significant external CO_2-injury.

Storage trials in the 2012-2013 storage season have extended this work to Bramley harvested over several picking dates and fruit selected from a wider range of orchards.

Conclusions

Immediate sealing of Bramley's Seedling stores once fruit has cooled to store temperature (4.0-4.5^{o}C) helps to reduce the incidence of internal CO_2-injury and core-flush in Bramley's stored in 5% CO_2, 1% O_2 (5/1). Delaying sealing of stores after fruit has reached store temperature increased the risk of internal browning.

The existing industry strategy of allowing store oxygen to drop to 10% O_2 during the initial 3 week period after store sealing (<1% CO_2) should be continued by growers at present.

While some benefits on the internal quality of Bramley's have been found with more rapid pull down of oxygen over this period, the susceptibility of fruit to external CO_2-injury needs to be assessed more fully.

SmartFresh^{TM}-treated Bramley's kept in traditional ventilated 9% CO_2, 12% oxygen (9/12) storage benefited from sealing stores immediately after cooling fruit to store temperature and maintaining CA at 1.5% CO_2 for the first 3 weeks of storage through venting with air. This regime reduced the incidence of storage rots and internal flesh browning (core-flush and senescent browning).

Financial benefits

Reduced wastage through lowering the incidence of internal browning disorders of Bramley's and lowering the incidence of rotting will have a financial benefit to growers.

Action points for growers

From the results of this project in its first year, growers may consider the following conclusions when managing controlled atmosphere Bramley stores:

- Rapid cooling of fruit and sealing of stores helps to reduce the incidence of internal CO_2-injury, core flush and senescent breakdown in Bramley

- In 5/1 Bramley stores, delaying sealing of stores 5 days from harvest results in fruit with a higher incidence of CO_2-injury and core-flush.

- In 9/12 gas ventilated stores, after cooling, immediate sealing of SmartFresh^{TM}-treated Bramley's stored and maintaining CO_2 at 1.5% for the first three weeks of storage through venting with air, significantly reduced the incidence of post-harvest rots.