

Grower Summary

TF 192

Modulating the storage
temperature for Cox apples for
improved quality and control of
rotting

Annual 2010

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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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HDC is a division of the Agriculture and Horticulture Development Board.

Project Number: TF 192

Project Title: Modulating the storage temperature for Cox apples for improved quality and control of rotting

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Contractor: East Malling Research

Industry Representative: Nigel Jenner

Report: Annual

Publication Date: 5 August 2011

Previous report/(s): None

Start Date: 1 July 2009

End Date: 30 June 2012

Project Cost : £ 54,040

Headline

- Storing Cox at 1.5-2°C for 6 months results in significant low temperature breakdown and this is not relieved by intermittent warming for 2 months to 3.5-4 °C.

Background and expected deliverables

Cox remains the most important dessert apple variety in the UK despite its susceptibility to a range of physiological disorders and fungal rots. The firmness of the stored fruit at the point of sale is often marginal in relation to specifications laid down by the multiple retailers, despite harvesting at the correct stage of maturity and providing optimum storage conditions. Although the use of 1-MCP (SmartFresh™) has helped significantly in delaying softening during storage and shelf-life, care must be taken when it is used on fruit destined for post-January storage due to a heightened risk of core flush.

This project addresses the need to supply consumers with Cox of consistent quality from September until March and to minimise the wastage incurred by growers due to the development of fungal rots. Current levels of wastage are often unacceptable and there is limited scope for chemical intervention to ameliorate the problem, although use of rot risk assessment can assist in management of rots to minimise losses. There are currently no fungicides permitted for post-harvest application to apples in the UK. Fungicides applied pre-harvest for rot control usually result in detectable residues in the fruit at harvest.

Reducing the temperature for CA-stored Cox provides an opportunity to improve fruit quality, particularly firmness, and to reduce rot development. However, it is imperative that these benefits are achieved without inducing low temperature breakdown (LTB) symptoms in the fruit. Although climate change means that there is a greater likelihood of warmer growing seasons in the future and consequently a reduced susceptibility to LTB it is unlikely that Cox will tolerate a lower storage temperature for the entire storage period. However, modulating the store temperature to provide shorter periods at lower temperatures may provide the benefits required without inducing LTB in the fruit. This approach has proved successful for other chilling-sensitive varieties in work done abroad (such as cv. McIntosh in Canada). There is an opportunity to develop a strategy for modified temperature management of commercial Cox stores in the UK that would include the use of 1-MCP (SmartFresh™).

Summary of the project and main conclusions

Cox apples were harvested on 2 September 2009 from an 11-year-old Cox orchard planted on M9 rootstock grown at East Malling Research. Maturity measurements (Firmness, Colour, Starch, % Brix and internal ethylene concentration) were made on the day of harvest. Apples were cooled to 3.5°C overnight.

The day following harvest, half the fruits were treated with SmartFresh™ (625 ppb) at 3.5°C for 24 hours whilst the untreated fruit were kept in a separate store at 3.5°C.

Subsequently, half of the SmartFresh™ and untreated fruit were inoculated with *Nectria* by dipping two replicate netted samples (50 fruit per net) of Cox in a freshly prepared spore suspension of *Nectria galligena*. This provided a total of four post-harvest treatment combinations: untreated/uninoculated, SmartFresh™/uninoculated, untreated/*Nectria* and SmartFresh™/*Nectria*.

Four boxes each containing one of the treatment combinations were loaded into each of eight storage cabinets and flushed with nitrogen to 1.25% O₂. Four cabinets were maintained at 3.5°C and four at 1.5°C. Every two months, the fruit were moved between cabinets at the two temperatures so that eight temperature regimes were tested, as shown in Table 1.

Table 1: Temperature regimes assessed during the Cox storage trials

Treatment	0 – 60 days	60 – 120 days	120 – 180 days
1	3.5-4°C	3.5-4°C	3.5-4°C
2	1.5-2°C	3.5-4°C	3.5-4°C
3	1.5-2°C	1.5-2°C	3.5-4°C
4	1.5-2°C	1.5-2°C	1.5-2°C
5	3.5-4°C	1.5-2°C	3.5-4°C
6	3.5-4°C	1.5-2°C	1.5-2°C
7	1.5-2°C	3.5-4°C	1.5-2°C
8	3.5-4°C	3.5-4°C	1.5-2°C

Fruits were inspected ex-store and after 1 week's shelf-life at 20°C in November, January and March.

Continuous low temperature storage reduced the rate of softening but caused significant amounts (30%) of LTB in long-term stored Cox. The incidence of LTB increased to 60% when continuous low temperature storage was used on SmartFresh™ treated fruit. Shorter periods of low-temperature used at the beginning of the storage period had a small effect on reducing the degree of softening and did not induce LTB in non-SmartFresh™ treated fruit. LTB was observed on SmartFresh™ treated Cox but was less severe than for the regimes where low temperatures were used continuously.

The incidence of *Nectria* rots was reduced with SmartFresh™ when combined with lower storage temperatures. SmartFresh™ treated Cox that received at least 4 months at 1.5°C had less rots. Interestingly, SmartFresh™ did not affect the incidence of rotting when Cox was stored at 3.5°C for the whole period. Rotting in untreated Cox was more variable and no clear trend in temperature regime was evident; however, fruit stored for the whole storage period at 1.5°C had the lowest incidence of rots.

Financial benefits

- No financial benefits have been identified at this stage of the project.

Action points for growers

- No action points are identified at this stage of the project.