

The Incidence of *Neofabraea* spp. in 'Pinova' Apples Can be Reduced at Elevated Storage Temperatures

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Abstract

'Pinova' apples are highly susceptible to *Neofabraea* fungal storage rots. Experiments at the Competence Centre for Fruit Growing at Lake Constance (KOB) with dynamic controlled atmosphere storage (CA) have consistently shown lower rot incidence when 'Pinova' fruit are stored under higher temperatures (3 °C) compared to storage under ultra low oxygen (ULO) at 1 °C. DCA is storage technology that can be used for organic fruit. Increased storage temperatures had no negative effects on fruit firmness (FF). 'Pinova' is a slow softening cultivar and FF at the recommended storage temperature of 1 °C did not differ from fruit stored at 3 °C. Increased storage temperatures with DCA may help reduce the incidence of *Neofabraea* spp. storage rots in 'Pinova' while still maintaining acceptable fruit quality. Increased storage temperatures can also provide energy savings.

Keywords: Dynamic controlled atmosphere (DCA), rots, fungal diseases, *Malus domestica*

Introduction

'Pinova' apples grown in Southern Germany can appear free of rot symptoms at-harvest, but latent infections can develop strongly during storage and marketing as the fruit ripen (Mayr & Späth, 2008). DCA storage based on chlorophyll fluorescence is a powerful tool to inhibit ethylene ripening processes in apple. The very low oxygen levels reached in DCA storage (< 1.0 kPa O₂) may also suppress fungal development although there is little published about DCA control of storage rots in apple. Depending on the cultivar and the storage technology used, when fruit ripening is strongly inhibited, fruit quality can still be maintained at acceptable levels even under elevated storage temperatures (Kitemann *et al.*, 2015). This study assessed the incidence of storage rots in 'Pinova' apples and the changes in FF when stored under DCA storage at elevated storage temperature and compared to storage under ULO at 1 °C.

Materials and Methods

Studies were carried out in three identical storage rooms at the KOB. Treatments compared are ULO conditions (1.0 kPa O₂ + 2.5 kPa CO₂) at 1 °C with ULO at 3 °C or DCA (~0.5 kPa O₂ + 2.5 kPa CO₂) at 3 °C. After 6.7 (2013/14) or 7.6 (2014/15) months of storage, ~1200 kg of fruit (4x ~300 kg bins) per treatment were classified as either rotten or healthy.

Results and Discussion

Results in 2013/14 show around half of the rot incidence for the two elevated temperature treatments compared to the ULO 1 °C treatment (Fig 1). In 2014/15, the overall incidence

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of rots was much lower, but the DCA 3 °C elevated temperature treatment still showed lower rot incidence when compared to the ULO 1 °C treatment.

FF was either unchanged or higher after storage and 7d shelf-life at 20 °C when compared to the FF at-harvest (results not shown). Increased storage temperatures had no negative effects on the fruit quality parameters like FF. 'Pinova' is a firm, slow softening apple cultivar and once the fruit lose some moisture during storage it is sometimes possible to measure higher FF values than were determined at-harvest.

Weight loss in the colder storage conditions was either higher or unchanged when compared to the elevated temperature treatments (results not shown). These differences can best be explained by either a higher respiration rate of the colder fruit, or/and a longer run time for the ventilation fans in the colder rooms and/or the effects of DCA on water loss.

Increased storage temperatures might be an effective way to reduce the incidence of *Neofabraea* spp. storage rots in 'Pinova' apples while still maintaining fruit quality. Additionally, increased storage temperatures provide a substantial reduction in energy consumption during storage, as experiments over multiple years have shown.

In order to further investigate the rot incidence of 'Pinova' apples stored under higher temperatures we require a wet growing season with a high incidence of rots.

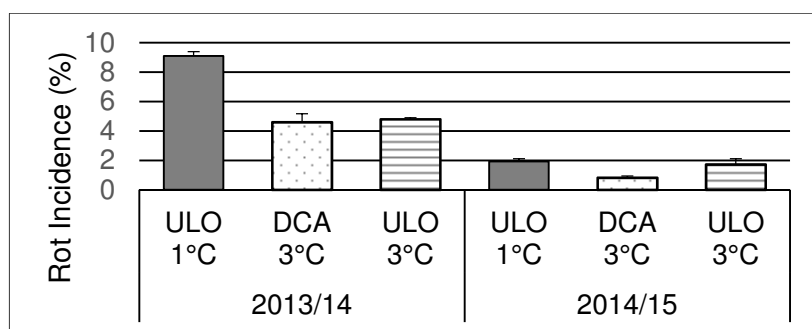


Figure 1: Rot incidence in 'Pinova' apples in two years after ULO at 1 ° or 3 °C of DCA at 3 °C. Fruit were stored for 6.7 (2013/14) or 7.6 (2014/15) months. ~8000 fruit assessed per treat., bars=SE, n=4).

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