



NZ Pink Lady Growers Association

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SUMMARY OF KEY FINDINGS FROM INTERNATIONAL STUDY ON FLESH BROWNING IN 'PINK LADY™' APPLES

Summarised by Dr Nagin Lallu of HortResearch, March 2008

- Three types of flesh browning occur in 'Pink Lady™' apples: 'diffuse browning', 'radial browning', and CO₂ injury.
- 'Radial browning' is associated with the vascular system whereas 'diffuse browning' is associated with the cortical tissues surrounding the vascular system.
- The browning from CO₂ injury is characterised by the presence of pits and cavities in the affected flesh tissue, and is a reflection of the sensitivity of 'Pink Lady™' to CO₂ levels in the storage atmosphere.
- The type of growing season can not only predict the type of flesh browning that will occur but also its incidence.
- Fruit from warm districts e.g. Batlow in New South Wales are prone to 'radial browning', whereas fruit from cold districts, e.g. Tasmania and Nelson, are prone to 'diffuse browning'. All fruit are prone to CO₂ injury irrespective of the growing season or region.
- The climate and more specifically the number of growing degree days (GDD) above 10°C (i.e. the total number of hours above 10°C during the season) over the entire growing season (full bloom to harvest) is linked to the type and severity of flesh browning.
- A climate model has not been developed but it is predicted that where the GDD over the entire season is <950-1100 hours, fruit are at risk of 'diffuse browning', and if the GDD is >1100 hours the fruit are at risk of 'radial browning'. The risk of 'diffuse browning' increases and that of 'radial browning' decreases with decreasing GDD.
- Where there is a risk of 'diffuse browning', the risk can be reduced by storing fruit at 3°C rather than 0°C.
- The risk of 'radial browning' can be reduced by harvesting fruit and storing fruit at 1°C rather than 0°C, or using stepwise cooling (initial 2 weeks of storage at 3°C followed by 2 weeks at 2°C then the remainder of the storage period at 1°C).
- Maintaining the CO₂ level at or below 1% also decrease the risk of 'radial browning' but has no effect on 'diffuse browning'.
- 'Radial browning' is sensitive to harvest maturity with late or advanced maturity fruit being at higher risk than early or optimum mature fruit. Harvest maturity does not appear to affect the risk of 'diffuse browning'.

How applicable the findings are to New Zealand 'Pink Lady™' is unknown. However, GDD are in the mid range (1000-1300 hours) and both 'radial browning' and 'diffuse browning' can occur in New Zealand fruit. Fruit are known to be sensitive to CO₂ injury but there has been no evidence of temperature sensitivity in New Zealand 'Pink Lady' apples. Nevertheless based current information, the following are some best practice guidelines.

- Harvest fruit as soon as the minimum acceptable blush colour is achieved and the starch pattern index (SPI) is in the range 2.0 to 3.0. Consider any fruit from the 2nd and 3rd picks to be at risk if the SPI is greater than 3.5, and/or the SPI has remained between 2.5 and 3.5 for more than 7-10 days.
- Hold fruit at 1°C and use stepwise cooling (7 days at 3°C, 7 days at 2°C and then 1°C), except when there is a high risk of 'diffuse browning' hold fruit at 3°C.
- For storage beyond 8 weeks use CA storage, but maintain the CO₂ level at or below 1%. Establish the O₂ level at 2% over 10 days.

Note: - The complete presentation titled "Understanding Flesh Browning" can be downloaded from the internet at www.pinkladyapples.com. Instructions: On the right hand side, click on "The Apple", then on the right hand side, click on "Technical", then scroll down and click on "Flesh Browning Disorders" and click "Understanding Flesh Browning – J Jobling" to download the complete presentation that incorporates all of the data from the international study.

Other technical information and current Pink Lady™ news is also available on this site.

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