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APRC Project Report

Project SP96	**Storage of Gala Apples**
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Date:	**Final Report, December 1997**

Background

Because of the renewed interest in Gala apples the APRC funded a project over three years to determine the optimum date of picking and conditions of storage for the variety. A sequential approach was taken, with the optimum date of picking being determined in the first year and the optimum conditions of storage and maximum length of storage being determined subsequently. In the second year, samples of apples from four orchards were stored in 15 controlled atmosphere CA conditions, ranging from <1%CO_2 +1%O_2 (0/1) to 8%CO_2 + 13%O_2 (8/13, ventilated gas storage). The trial in the third year was designed to confirm the findings of the second trial by storing fruit from six orchards in the best two CA conditions out of the fifteen tested.

Date of Picking

The starch-iodine test was found to be a good indicator of maturity of Gala apples and the optimum date of picking in 1994/5 was associated with a coverage of starch of 70-80%. The results of this trial were published in APRC News in July 1995. Satisfactory storage was achieved in 1995/6 using this maturity criterion, although in the final trial satisfactory storage was achieved at a coverage of starch between 50 and 88%. More mature apples did not have a higher incidence of storage disorders than less mature fruit.

Flavour

In the first and second years of the project, the production of volatile flavour compounds was determined to test the effects of length of storage on flavour. It was found that the production of volatile compounds associated with flavour perception declined by 90% between early December and early January, irrespective of storage conditions. Therefore, if Gala apples with a high flavour are required by consumers, storage should terminate at Christmas.

Firmness

Firmness also declined during storage, but the rate of decline was dependent on the composition of the atmosphere in the store. Increasing the content of carbon dioxide and reducing the concentration of oxygen each reduced the rate of softening in store. Reducing the concentration of oxygen alone minimised the rate of softening after storage, during a simulated marketing period (SMP) of 7 days at 20°C in air. Samples stored in 8/13 were as firm as samples stored in the best storage condition, 5/1, but the samples from 8/13 were very much softer after the SMP.

Firmness was maintained most effectively in 5/1 at 1.5°C. For growers without external carbon dioxide scrubbers, 0/1 at 1.5°C would be the best alternative condition of storage. These results were published in APRC News in July 1996, and the trial carried out in the third year confirmed that the two recommended storage conditions were adequate to maintain firmness above 60N until April.

Sensory Trials

In storage trials carried out in the second and third year, fruit from selected treatments were subjected to sensory analysis. In general, the scores given by the taste panel for firmness ranked in the same order as values for firmness determined using a penetrometer. Scores for 'Overall Acceptability' generally correlated well with scores for firmness and were never lower for UK Gala than for samples of imported fruit purchased at a local supermarket.

Losses from rotting and physiological disorders

Fruit in these experiments was not given a postharvest fungicide treatment with the result that, in the 1995/6 trial, rotting affected up to 12% of some samples of apples by April. Losses from rotting were less than 2% in the trial carried out in 1996/7 when the best storage conditions from the earlier trial were used.

Losses from physiological disorders were negligible until April. In 1995/6, 20% of apples from 8/13 at 1.5°C were lost through low temperature breakdown and 25% of apples from 0/1at 3.5°C were affected by skin browning. In this trial, disorders were absent in fruit from 0/1 and 5/3 at 1.5°C and only observed in April under these conditions in the 1996/7 trial. After the SMP, up to 10% of apples removed from storage at the beginning of April, and up to 30% of apples removed at the end of April, were affected by breakdown of the flesh. Browning of the skin affected samples from 0/1 stored until the beginning of April and samples from 0/1 and 5/1 after the SMP at the end of April.

It was concluded from the trials carried out in the second and third years that, to achieve a flesh firmness of at least 60N after the SMP and freedom from disorders and rotting, two CA conditions at 1.5°C should be recommended for general use: 0/1 until mid February for growers without an external carbon dioxide scrubber and 5/1 until the beginning of April for those with such equipment.

Summary

- The flavour of Gala apples stored in CA decreases after Christmas.
- Gala can be stored at 1.5°C with minimal losses from rotting and physiological disorders, and with a firmness in excess of 60N after 7 days at 20°C, until mid-February in <1%CO_2 + 1%$O_2$and until the beginning of April in 5%CO_2 + 1%O_2.
- Apples stored in 8%CO_2 + 13%O_2 (ventilated gas storage) have a high firmness immediately out of store but soften rapidly at room temperature in air. It is recommended that ventilated gas storage should be terminated in early November.
- Storage in air at 0°C should also be terminated in early November.
- After Christmas, samples should be withdrawn from store to test for the development of scald and breakdown during one week at room temperature.
- Future work on Gala is needed to refine the picking date criteria and test the storage potential of the various clones of the variety that are now in use.

Publications:

The optimum harvest date for storage of Gala apples, PM Genge and J Stow, APRC News, July 1995, pp 11-14.

Storage of Gala apples, J Stow, APRC News, July 1996, pp 9-10.

Update on the storage of Gala apples, J Stow, APRC News, July 1997, pp12-13.

Gala breaks through the storage barrier, John Stow, Grower 24 October 1996, pp 26-27.