

1993-1994 FINAL PROGRESS REPORT

Project No.: 287

Title: Improved Apple Quality with the Use of Rapid or High CO₂ CA

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Accomplishments: The research reported on here has resulted in several new level agronomical CO₂ results, and a new goal

1. Short term controlled atmosphere storage (<60 days) maintains fruit ('Golden Delicious', 'Jonagold', 'Delicious' and 'Granny Smith') quality in superior condition. Response to CA storage can be documented in 60 days or less. This information can be used to change existing CA laws.
2. 'Delicious' apples can be held in controlled atmosphere storage at 3% CO₂ with no loss in quality. Storage cost can be reduced with the use of higher amounts of CO₂ in the storage environment.
3. Delayed harvest can improve color grade. If properly handled for controlled atmosphere a 10 day harvest delay resulted in no quality loss during storage.

Results:

Controlled atmosphere (CA) storage for 30 or 60 days reduced quality losses for 'Jonagold', 'Golden Delicious', 'Delicious', 'Granny Smith' and 'Fuji' apples (*Malus domestica* Borkh.). After 30 days 'Jonagold' and 'Golden Delicious' apples from CA were firmer, had higher acidity and less yellow (more green) color than apples from regular atmosphere (RA) storage. 'Delicious' and 'Granny Smith' apples had better firmness after 60 days of CA storage than fruit from RA. In addition, 'Granny Smith' apples from CA had more acid and more green color than apples from RA. After eight days ambient storage, little loss in firmness and no loss in acid content occurred with 'Jonagold' or 'Golden Delicious' apples from CA compared to the significant loss in firmness and acid when stored in RA. After ambient storage for 8 days 'Jonagold', 'Golden Delicious' and 'Granny Smith' apples retained a freshly harvested apple color with more green and less yellow development when stored in CA rather than RA. In 'Fuji' apples the treatments had no effect except for improved acid retention if stored in CA. A combination of 30 days CA followed by 30 days

RA produced 'Jonagold', 'Golden Delicious' and 'Delicious' apples that were superior in quality to apples from 60 days RA.

Two strains of 'Delicious' apples were held in controlled atmosphere (CA) storage at various carbon dioxide levels for nine months before removal and evaluation. Oxygen in all atmospheres was 1%, and carbon dioxide levels were 1, 3, or 5% with an additional carbon dioxide treatment that was increased every six weeks from 1 to 5% over the storage period. Storage temperature for all treatments was 1C. Little quality difference was noted for the 'Delicious' apples immediately after storage or after an eight day ripening period regardless of CO₂ level in storage. Mean values for firmness, external and internal color, soluble solids content, titratable acidity and amount of scald did not differ between the apples from the different storage treatments. Total carbohydrates and fructose were higher in apples stored at CO₂ levels above 1%. Sensory panelists found no flavor differences in apple juice after long term CA storage regardless of CO₂ storage level.

Publications:

1. Drake, S.R. 1993. Short-term controlled atmosphere storage improved quality of several apple cultivars. J. Amer. Soc. Hort. Sci. 118:486-489 and Proc. Washington Tree Fruit Postharvest Conference 9:42-44.
2. Drake, S.R., T.A. Eisele and H. Waelti. 1993. Controlled atmosphere storage of 'Delicious' apples in high and variable carbon dioxide. J. Food Pres. and Proc. 17:177-189.