

FINAL REPORT

WTFRC Project No: PH-02-227

ARS Project No. 5350-43000-004-003T

Project Title: Quality and condition of winter pears as influenced by harvesting, handling, packing and storage

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Objectives:

1. Determine time and type of atmosphere (oxygen, carbon dioxide, temperature) establishment in conjunction with different maturity levels to optimize storage of 'd'Anjou', 'Bartlett', 'Bosc' and 'Concord' pears. Emphasis on packed pears in both controlled atmosphere and modified atmosphere will be addressed.
2. Investigate alternative packing materials (paper type, pear floats) to aid in maintaining pear quality and the relationship of these alternative materials to various storage environments.

Significant findings:

- 'd'Anjou' pears wrapped in paper containing DPA (1000 ppm) not as scald resistant as pears wrapped in paper with ethoxyquin (1000 ppm).
- Paper impregnated with organic oils (3.0 %) do not prevent scald in 'd'Anjou' pears.
- 'Bartlett' pears in modified atmosphere packages maintain good quality and compare favorably with pears in controlled atmosphere storage.
- Ethoxyquin and Scholar can be used in combination as a pre-storage drench with no adverse reaction in fruit quality after long term storage.
- Quality was similar between pears packed in boxes (paper wrap + liner), or poly bags after long term storage.
- 'Concorde' pears are good candidates for 90 days of RA storage or 180 days of CA storage.

Results and Discussion:

'd' Anjou' pears packed after harvest, stored in regular atmosphere (RA) or controlled atmosphere (CA) storage for periods not exceeding 120 days, and wrapped in paper containing either 3 to 9% oil with Copper & Ethoxyquin (C&E) or Biox A or E maintained good quality. Storage of pears in paper containing diphenylamine (DPA) produced acceptable scores for appearance and finish, but some scald should be anticipated. Use of DPA in the paper wrap beyond 120 days of storage resulted in excessive scald damage. Organic oils (lemon, clove, citronella) in pear wraps may produce some benefit for quality retention, but only for short storage periods. Quality of pears in wraps containing organic oils was approximately equivalent to use of dry paper but did not produce the quality of the standard industry wrap (3% oil + C&E). If pears are to be held in long-term CA storage (210 days), only paper wraps containing 3 or 6% oil + C&E should be considered for scald control. After loose storage in bins, the best quality pears were wrapped in paper containing 3% oil + C&E. Pears in paper containing DPA or DPA + Cu displayed excessive amounts of scald.

Commercially mature 'Bartlett' pears for were obtained from local commercial packing facilities (Blue Bird, Inc., Peshastin, WA and Blue Star, Inc., Cashmere, WA). In one study (Blue Star, Inc.), pears were packed in modified atmosphere bags and placed in boxes or packed normally with an individual paper wrap around each pear plus a polyethylene liner in the box. Boxed pears from both types of packaging were stored in RA storage at 33 F, for 30 or 90 days. In a second study (Blue Bird, Inc.), pears were packed normally and stored in both RA and CA storage for 45 or 90 days, or packed in modified atmosphere bags and stored in RA at 33 F. After 45 days, normally packed pears from both RA and CA were removed from storage, placed in modified atmosphere bags and returned to RA storage for an additional 45 days. Pears stored in modified atmosphere bags were superior in quality to normally packed pears stored only in RA storage and equal in quality to pears stored in CA for 90 days. The quality of pears held in modified atmosphere bags under CA conditions deteriorates after short periods of time (<45 days). Pears in modified atmosphere bags should be stored only in RA. After 90 days of RA storage the atmosphere in the MAP averaged 5 % oxygen and 5 % carbon dioxide.

Neither Scholar nor Ethoxyquin, applied as a pre-storage drench, influenced the peel color and firmness of pears stored for 4 months in CA. This lack of difference in color and firmness was evident in both packed pears and pears in poly bags after 90 days additional RA storage. Use of Ethoxyquin + Scholar combined reduced the green color (hue) in packed pears. This color difference for pears treated with Ethoxyquin + Scholar was greater than one color unit when compared to control fruit and would be visible to the consumer. Treating pears with Ethoxyquin alone resulted in some color loss, but differences were not significant. Time in RA storage, after bin storage in CA, resulted in lighter color, loss of green color and loss of firmness for pears packed in boxes or poly bags regardless of bin treatment. This change in color and loss of firmness was very pronounced between 30 and 60 days of storage for packed pears and to a lesser extent after 90 days of storage. Color and firmness values were similar between pears in packed boxes and pears in poly bags after 90 days of storage. Pears ripened for 7 days lost similar color and firmness in both packed boxes and poly bags. Pears in packed boxes or poly bags had an excellent firmness level (3 lbs., or less) for eating after 7 days.

'Concorde' pears were harvested at multiple maturities from three growers, stored in RA or CA and quality evaluated. 'Concorde' pears can be harvested (14/15 lbs) over a period of 14 days with no quality loss and be good candidates for either RA or CA storage. A 14-day delay in harvest resulted in an increase of one-box size. Regardless of harvest, 'Concorde' pears can be stored in RA for periods not to exceed 90 days. RA storage beyond 90 days resulted in reduced finish, reduced pedicel condition and enhanced internal breakdown. Early harvest should be considered when RA storage is expected to exceed 90 days; however astringency (taste) may develop. Regardless of harvest, 'Concorde' pears can be stored for 180 days in CA with no quality loss, particularly if the CA is maintained at 1.5% oxygen and 1.0% carbon dioxide. Internal breakdown can be a major problem in CA if the carbon dioxide exceeds 1.0%. Low oxygen (<1.5%) is not recommended for 'Concorde' pears due to internal breakdown.

DO NOT MIX ETHOXYQUIN WITH CAPTEX = BURN

BUDGET:

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PI: Stephen R. Drake

Project duration: 2002-2004

Current year: 2004-2005

Project total (3 years): \$112,948

Year	Year 1 (2002)	Year 2 (2003)	Year 3 (2004)
Salaries	\$29,178	\$31,500	\$13,700
Benefits	12,460	13,500	4,110
Supplies	5,000	1,500	2,000
Miscellaneous	100		
Total	\$46,638	\$46,500	\$19,810
Total for all years:	\$112,948		

PUBLICATIONS:

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- Drake, S.R. and R.D. Gix. 2002. Quality of 'Anjou' pears from variable oxygen and high carbon dioxide controlled atmosphere storage. *J. Food Qual.* 25:155-164.
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- Drake, S.R., D.C. Elfving and R.D. Gix. 2002. Quality of 'Anjou' pears from variable oxygen and high carbon dioxide controlled atmosphere storage. *J. Food Qual.* 25:155-164.
- Drake, S.R., L.G. Neven and P.G. Sanderson. 2003. Carbohydrate concentrations of apples and pears as influenced by irradiation as a quarantine treatment. *J. Food Proc and Pres.* 27:165-172.
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- Drake, S.R. and D.C. Elfving. 2004. Quality of packed and bin stored 'Anjou' pears as influenced by storage atmosphere and temperature. *J. Food Qual.* 27:141-152.
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- Drake, S.R., D.C. Elfving, S.L. Drake and D.B. Visser. 2004. Quality of modified atmosphere packaged 'Bartlett' pears as influenced by time and type of storage. *J. Food Proc. and Pres.* (In press)
- Mielke, E.A. and S.R. Drake. Control of storage-related physiological disorders of 'd'Anjou' pears by integrated reduced dosage of Ethoxyquin and low oxygen treatments. *J. Food Qual.* (In press)
- Sincere appreciation is expressed to: Blue Bird, Blue Star, Stemilt, Independent, Hi Up and McDougal packing, for their cooperation, suggestions and interest in this project.**