

**Effect of Two Polymeric Coatings on Fruit Quality in  
'd'Anjou' and 'Bartlett' Pears**

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**Abstract:** 'Bartlett' and 'd'Anjou' pears coated with Pro-long, a sucrose-fatty acid ester, and Nutri Save were firmer, had higher acid levels and greener skin color than comparable control fruit at different storage durations in 0°C air. Incidence of breakdown in 'Bartlett' and scald in 'd'Anjou' were significantly reduced by the coating materials. However, ripening was adversely affected by the coatings, particularly in 'Bartlett', and many fruit failed to ripen properly even after 10 days at 20°. 'Bartlett' pears also developed a blotchy appearance (areas of green and yellow) when held at the ripening temperatures.

**Introduction**

Reduction of fungal rots and better retention of fruit quality are benefits derived from the use of film coatings on fruits. Ben-Yehoshua (1) has done an extensive review of the subject and it is obvious from his report that more work has been done with citrus crops than with any other fruit commodity. Other advantages listed by the author from film coatings include substitution of refrigeration, reduced refrigeration needs, refrigeration at lower temperatures, reduction of water loss and inhibition of the ripening process. Work by Magness and Diehl (2) in 1924 showed that apples coated with paraffin or oil and stored at 0°C had a reduced rate of respiration. Thick coatings, however, caused anaerobic respiration and the accumulation of high levels of ethanol. Encouraging results were obtained by Park (3) with plastic film on 'Permain' and 'McIntosh' apples. No beneficial effect was reported by Smith and Stow (4) with a sucrose-fatty acid ester coating on 'Cox's Orange Pippin' apples stored in 3.5° air for 5 months. Skin yellowing and softening were, however, reduced in coated fruit provided treatment occurred after storage. Earlier work by Trout et al. (5) showed that beneficial effects of apple coatings were dependent upon cultivar, coating type, coating thickness, and temperature at which the fruit was held.

This paper reports the results obtained with two polymeric coatings on quality parameters in stored 'd'Anjou' and 'Bartlett' pears. Pro-long, a sucrose-fatty acid ester, is manufactured by Tal Chemicals Co. of London, England and Nutri Save is manufactured by Nova Chem Limited of Halifax, N.S., Canada.

**Methods**

Pears obtained from commercial growers or from the research station in Summerland were cooled to 0°C before treatment. The coatings were prepared in tap water and dispersed into solution with an Omnimixer. Fruit were

dipped by hand and allowed to dry for several days in 0°C air. They were then placed in polyethylene box liners to reduce moisture loss as previous studies had shown appreciable moisture loss in coated pears, particularly in 'Bartlett'. Control and treated fruit were stored in 0° air or under two controlled atmospheres (2% CO<sub>2</sub> + 2% O<sub>2</sub> and <0.5% CO<sub>2</sub> + 1% O<sub>2</sub>). Concentrations of the coatings varied from 0% to 1.3%. Firmness was determined with a Ballauf penetrometer (7.9 mm tip), skin color with a Techwest Golden Delicious apple meter, acidity by titration of the juice with alkali to pH 8.1 and disorders were assessed after a 5 or 7 day ripening period at 20°.

### Results and Discussion

**'Bartlett' pears:** Both coatings inhibited ripening to the extent that many of the treated fruit failed to attain the buttery texture and bright yellow color of the control fruit. Firmness values were usually higher for Pro-long treated fruit than for comparable control fruit (Tables 1 and 3) but not always with Nutri Save treated fruit (Tables 2 and 3). Higher acid levels in coated pears suggested a lower rate of respiration induced by the modified atmospheres within the fruit. Skin color was always greener in treated fruit at all removal dates and ripened fruit also remained greener than in control fruit (Table 3). Breakdown was consistently lower in coated fruit, perhaps a consequence of incomplete ripening in many of the coated fruit. An undesirable feature of ripened pears coated with either polymer was their blotchy appearance caused by areas of green and yellow pigmentation on the fruit. In organoleptic quality control fruit in air or CA storage were always preferred to the coated fruit by participants in taste panels (data not shown). The latter observation is perhaps not surprising in view of the variable ripeness encountered in the coated pears, from green hard pears to blotchy partially softened fruit.

**'Anjou' pears:** Firmness values were always higher in coated fruit than in control fruit stored in 0° air (Tables 4, 5, 6). Acid levels tended to be higher and skin color greener in treated fruit. Scald was appreciably reduced with the coatings but was lowest in the CA fruit. Ripening was not retarded to the same degree in coated 'd'Anjou' as it was in coated 'Bartlett' pears. However, some of the Nutri Save pears did not develop a buttery texture even when held for 10 days at 20°. No distinct trend was evident from the limited taste panels conducted. Texture was of a chewy consistency in the coated pears and some individuals preferred this aspect to the buttery consistency in control fruit. CA fruit, however, tended to score higher at taste panels in the late removal dates.

**General comments:** Inadequate ripening currently precludes commercial application of the two polymeric coatings on pears. However, the coatings do have the ability to retain green skin color, higher firmness values and higher acid levels. Washing the fruit immediately after storage resulted in numerous scuff spots on 'Bartlett' pears and did not improve the ripening characteristics in either cultivar. Both polymers yield slippery solutions which may be troublesome if spilled in the work area. If means are found to overcome the ripening problems then considerable potential exists for the use of both Pro-long and Nutri Save in retention of quality in stored 'Bartlett' and 'd'Anjou' pears.

**Literature Cited**

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Table 1. Fruit quality in control and Pro-long coated 'Bartlett' pears stored at 0°C in air or controlled atmospheres.

Treatment <sup>z</sup>	Storage (days)	Firmness (N)	Acidity (mg) <sup>y</sup>	Skin color <sup>x</sup>	Breakdown (%)
Control + CS	60	75.9 a <sup>w</sup>	254 a	1.37 a	59 b
Pro-long + CS	60	78.4 b	291 b	1.02 a	0 a
Control + CS	90	66.4 a	191 a	2.24 b	93 b
Pro-long + CS	90	71.4 b	254 b	1.18 a	16 a
Control + CS	120	67.3 a	172 a	2.67 b	90 b
Pro-long + CS	120	69.3 ab	224 b	1.48 a	45 a
Control + CA	120	75.2 c	263 c	0.92 a	21 a
Control + LO	120	71.6 bc	258 c	0.93 a	39 a

<sup>z</sup> CS = cold storage, CA = 2% CO<sub>2</sub> + 2% O<sub>2</sub>, LO = 1% O<sub>2</sub> + <0.5% CO<sub>2</sub>, Prolong = 1.3%.

<sup>y</sup> Acidity = mg malic acid in 100 ml juice.

<sup>x</sup> Range of 0-10 (very green to bright yellow).

<sup>w</sup> Separation of means within columns for each storage period at P = 0.05.

Table 2. Fruit quality in control and Nutri Save coated 'Bartlett' pears stored at 0°C in air or controlled atmospheres.

Treatment <sup>z</sup>	Storage (days)	Firmness (N)	Acidity (mg) <sup>y</sup>	Skin color <sup>x</sup>	Breakdown (%)
Control + CS	60	78.5 a <sup>w</sup>	291 a	1.13 b	8 b
Nutri Save + CS	60	78.0 a	341 b	0.70 a	0 a
Control + CS	90	76.8 a	228 a	1.46 c	12 b
Nutri Save + CS	90	76.6 a	313 b	0.93 b	0 a
Control + CA	90	77.2 a	307 b	0.65 a	0 a
Control + LO	90	78.1 a	318 b	0.65 a	0 a
Control + CS	120	73.1 a	225 a	2.23 c	53 b
Nutri Save + CS	120	74.5 ab	319 b	1.20 b	0 a
Control + CA	120	75.9 bc	296 b	0.74 a	5 a
Control + LO	120	76.6 c	315 b	0.78 a	9 a

<sup>z</sup> CS = cold storage, CA = 2% CO<sub>2</sub> + 2% O<sub>2</sub>, LO = 1% O<sub>2</sub> + <0.5% CO<sub>2</sub>, Nutra Save = 1%.

<sup>y</sup> Acidity = mg malic acid in 100 ml juice.

<sup>x</sup> Scale of 0-10 (very green to bright yellow).

<sup>w</sup> Separation of means within columns for each storage period at P = 0.05.

Table 3. Effect of two concentrations of Pro-long and Nutri Save on fruit quality in 'Bartlett' pears stored for 90 days at 0°C.

Treatment	Firmness (N)	Skin color <sup>z</sup>	Firmness (N) <sup>y</sup>	Skin color <sup>yz</sup>	Breakdown (%)
Control	59.7 b <sup>w</sup>	2.76 a	17.3 cd	5.89 a	32 a
0.5% Pro-long	59.7 b	2.64 a	23.3 b	3.93 b	0 b
1.0% Pro-long	67.0 a	1.88 b	31.6 a	2.68 c	0 b
0.5% Nutri Save	66.5 a	2.03 b	15.2 d	3.85 b	0 b
1.0% Nutri Save	65.8 a	1.98 b	22.7 bc	2.58 c	0 b

<sup>z</sup> Scale of 0-10 (very green to bright yellow).

<sup>y</sup> Assessed after 5 days at 20°C.

<sup>w</sup> Means separated within columns at P = 0.05.

Table 4. Fruit quality in control and Pro-long coated 'd'Anjou' pears stored at 0°C in air or controlled atmospheres.

Treatment <sup>z</sup>	Storage (days)	Firmness (N)	Acid (mg) <sup>y</sup>	Skin color <sup>x</sup>	Scald (%)	Sensory score <sup>w</sup> Flavor Texture	
Check + CS	90	62.1 a	319 a	0.89 b	0 a	-	-
Pro-long + CS	90	62.5 ab	338 a	0.75 a	0 a	-	-
Check + CA	90	65.4 c	318 a	0.89 b	0 a	-	-
Check + LO	90	63.7 b	303 a	0.76 a	0 a	-	-
Check + CS	150	54.2 a	296 a	1.39 b	58 c	4.5 c	4.4 b
Pro-long + CS	150	60.2 b	324 ab	0.93 a	13 b	5.8 ab	5.2 ab
Check + CA	150	63.0 b	350 b	0.87 a	2 a	6.6 a	6.3 a
Check + LO	150	63.3 b	346 b	0.91 a	0 a	5.3 bc	6.0 a
Check + CS	210	52.7 a	212 a	1.64 b	84 c	4.7 b	4.6 b
Pro-long + CS	210	59.0 b	238 b	1.04 a	27 b	2.8 c	2.1 c
Check + CA	210	61.8 c	276 c	1.09 a	1 a	7.0 a	5.6 ab
Check + LO	210	64.5 c	278 c	1.00 a	7 ab	6.5 a	6.0 a

<sup>z</sup> CS = cold storage, CA = 2% CO<sub>2</sub> + 2% O<sub>2</sub>, LO = 1% O<sub>2</sub> + <0.5% CO<sub>2</sub>, Prolong = 1%.

<sup>y</sup> Acidity = mg malic acid in 100 ml juice.

<sup>x</sup> Scale of 0-10 (very green to bright yellow).

<sup>w</sup> Hedonistic scale of 1-9 (dislike very much to like very much).

<sup>v</sup> Separation of means within columns for each storage period at P = 0.05.

Table 5. Fruit quality in control, Pro-long coated and Nutri Save coated 'd'Anjou' pears stored at 0°C in air or controlled atmospheres.

Treatment <sup>z</sup>	Storage (days)	Firmness (N)	Acid (mg) <sup>y</sup>	Skin color <sup>x</sup>	Scald (%)	Sensory score <sup>w</sup>	
						Flavor	Texture
Check + CS	90	63.6 a <sup>v</sup>	313 a	0.86 b	5 a	4.8 bc	4.6 ab
Nutri Save + CS	90	66.2 b	337 a	0.70 a	0 a	6.5 ab	5.7 ab
Pro-long + CS	90	66.4 b	312 a	0.70 a	0 a	4.1 c	4.4 b
Check + CA	90	66.6 b	335 a	0.78 b	0 a	6.6 a	6.6 a
Check + LO	90	67.4 b	329 a	0.81 b	0 a	5.5 abc	5.5 ab
Check + CS	150	48.8 a	203 a	1.27 b	42 b	6.2 a	6.6 a
Nutri Save + CS	150	64.6 b	249 bc	1.07 ab	6 a	3.1 b	3.1 b
Pro-long + CS	150	64.6 b	235 b	1.07 ab	19 ab	4.0 b	3.6 b
Check + CA	150	64.1 b	241 bc	0.97 a	0 a	6.1 a	6.8 a
Check + LO	150	64.9 b	253 c	0.99 a	0 a	6.6 a	6.6 a
Check + CS	210	43.0 a	209 a	1.98 c	62 c	5.3 b	5.1 bc
Nutri Save + CS	210	59.7 b	269 b	1.01 a	32 b	5.3 b	4.8 bc
Pro-long + CS	210	59.1 b	248 b	1.04 a	36 b	5.1 b	4.4 c
Check + CA	210	62.9 b	243 b	1.31 b	5 a	6.5 ab	6.2 ab
Check + LO	210	61.2 b	258 b	1.25 b	1 a	7.4 a	7.1 a

<sup>z</sup> CS = cold storage, CA = 2% CO<sub>2</sub> + 2% O<sub>2</sub>, LO = 1% O<sub>2</sub> + <0.5% CO<sub>2</sub>, Prolong and Nutri Save at 1% each.

<sup>y</sup> Acidity = mg malic acid in 100 ml juice.

<sup>x</sup> Scale of 0-10 (very green to bright yellow).

<sup>w</sup> Hedonistic scale of 1-9 (dislike very much to like very much).

<sup>v</sup> Separation of means within columns for each storage period at P = 0.05.

Table 6. Effect of two concentrations of Pro-long and Nutri Save on fruit quality in 'd'Anjou' pears stored at 0°C.

Treatment	90 days storage		148 days storage		
	Firmness (N)	Skin color <sup>z</sup>	Firmness (N) <sup>y</sup>	Skin color <sup>y,z</sup>	Scald (%)
Control	60.5 b <sup>y</sup>	1.12 a	47.5 c	1.29 a	28 a
0.5% Pro-long	63.6 a	0.97 b	56.9 b	1.04 bc	4 b
1.0% Pro-long	64.3 a	0.89 bc	60.2 a	0.98 cd	3 b
0.5% Nutri Save	62.9 a	0.88 bc	55.4 b	1.10 b	3 b
1.0% Nutri Save	63.7 a	0.84 c	59.7 a	0.95 d	4 b

<sup>z</sup> Scale of 0-10 (very green to bright yellow).

<sup>y</sup> Means separated within columns at P = 0.05.