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Effects of Simulated Shelf-life Conditions on Consumer Acceptance and Weight Loss in 'Clapp's Favorite,' 'Bartlett,' 'Flemish Beauty,' 'Bosc' and 'Anjou' Pears

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Abstract

Fruit of 'Clapp's Favorite,' 'Bartlett,' 'Flemish Beauty,' 'Bosc' and 'Anjou (Buerre d')' were stored in simulated shelf-conditions (5, 18, 22 and 26°C) and consumer acceptance and weight loss were evaluated over 15 days. The 5°C treatment (refrigerator) produced the poorest quality pears. 'Bartlett' pears had a slower decline in quality with increasing temperature. 'Anjou' had higher quality at 18°C than at 22 and 26°C from the third day to the end of the study. 'Bosc' and 'Anjou' attained the highest quality and sustained it for the longest period of time compared to the other cultivars. Weight loss increased with temperature in all cultivars and was most rapid with 'Clapp's Favorite' and 'Bartlett.'.

Introduction

Fruit growers in Nova Scotia have grown primarily 'Clapp's Favorite' and 'Bartlett' pears, which have been utilized to a large extent for processing. Development of the pear industry through cultivar diversity has long been recommended (2) but not adopted. Concern that a short growing season would not support late maturing cultivars led to field performance trial of a full season range of cultivars. It was established by the Agriculture Canada Research Station and found to be productive (1). The consumer acceptability of these cultivars growing under the region's shorter season and handled in various ways in the retail system needed quantitative assessment before additional cultivars could be recommended.

This study was designed to examine the effects of simulated shelf-life conditions of temperatures and time on consumer acceptance of 5 pear cultivars grown in the Annapolis Valley. The rate of weight loss was also determined for each of these cultivars.

Materials and Methods

Pears from five cultivars ('Clapp's Favorite,' 'Bartlett,' 'Flemish Beauty,' 'Bosc' and 'Anjou') were harvested in 1985 on September 6, 16, 18, October 1 and 11 respectively from an orchard planted in 1962, on Bartlett seedling rootstock, at Sheffield Farm, Agriculture Canada, Kentville, Nova Scotia. Approximately 800 pears were randomly harvested from 20 trees of each of the five cultivars at the mature green stage. About 4 to 6 hours after harvest, pears were stored at 0° to -1°C.

To parallel a typical marketing period for pears, fruit with a diameter of 5.72 to 7.62 cm were stored for: 'Clapp's Favorite' - 11 days; 'Bartlett' - 19 days; 'Flemish Beauty' - 36 days; 'Bosc' - 49 days and 'Anjou' - 55 days. Afterward, ripening treatments were initiated to simulate shelf-life in stores or homes.

Four temperature treatments were selected, representing typical refrigeration or counter/display temperatures. These were 5°, 18°, 22°, and 26°C using four low temperature incubators. A

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sample of 108 graded pears were placed in each incubator for the testing period. Five pears of each cultivar were separated for weight loss evaluation. Weight loss measurements were taken at 0, 5, 8, 12, 15 and 19 days.

Twenty four hours prior to quality tasting and observations, five pears/taster of each cultivar were randomly chosen from the incubators and placed on the lab bench to come to room temperature. Six assessments were made over a 15 day ripening period on the follwoing days: 0, 3, 6, 9-10, 12-13, and 14-15.

Quality was based on average scores for texture, juiciness and flavour, with a maximum of 12 for each category (3, 4). The three categories scores were tallied for a maximum score of 36 per pear. The quality of the pears was evaluated on the following scale: 3-7 Unacceptable; 8-14 Poor; 15-22 Fair; 23-29 Good; 30-36 Excellent. Poor to unacceptable quality pears were considered mealy or coarse, dry and flavorless, or exhibited core or cortex discoloration. Good to excellent quality pears were considered buttery in texture, juicy and sweet with a slight tart taste and distinctly aromatic in flavor.

Results and Discussion

Quality Evaluation—Quality in the five cultivars ranged from unacceptable, 3, to excellent, 32, depending on the ripening temperature and time (Tables 1-5). Regardless of the cultivar, the "refrigerator" temperature (5°C) produced only poor or fair quality pears over the 15 day sampling period (Tables 1-5).

The effect of the three "shelf" temperatures (18°, 22°, and 26°C) varied with the pear cultivar. 'Anjou,' a late winter pear, had higher quality at 18°C than at 22 and 26°C from the third day to the end of the study. 'Anjou' peaked in quality on the tenth day for all three shelf temperatures. 'Anjou' received the highest quality rating of all five cultivars, 32 at ten days and 18°C (Tables 1-5).

'Bartlett' pears produced the earliest peak in quality, at three days and, along with 'Flemish Beauty,' the quickest decline in quality, producing unacceptable and poor pears after 12 days at all "shelf" temperatures.

'Anjou' and 'Bosc' obtained the highest overqll quality ratings, while 'Flemish Beauty,' had the lowest. 'Clapp's Favorite' and 'Bartlett' had mid range scores.

Table 1. Quality rating for 'Clapp's Favorite' as affected by ripening temperatures and time.

	Temperature (°C)				
Day	5	18	22	26	SD[z]
0	17.40[y]	16.27	17.40	16.27	2.18
3	15.80	23.27	21.80	19.87	1.90
6	12.33	24.53	23.27	24.40	1.22
9	14.20	22.67	23.73	22.27	1.54
13	14.27	16.87	18.20	15.07	1.93
15	14.07	13.00	11.60	5.40	1.43
SD	1.59	1.67	1.65	1.89	

[z]SD—Standard Deviation.
[y]Quality rating scale = 3-7 unacceptable; 8-14 poor; 15-22 fair; 23-29 good; 30-36 excellent.

Table 2. Quality rating for 'Bartlett' as affected by ripening temperatures and time.

	Temperature (°C)				
Day	5	18	22	26	SD[z]
0	14.40[y]	19.53	14.67	13.47	2.97
3	18.53	26.33	23.53	23.67	3.67
7	18.73	17.47	23.40	21.60	5.12
9	19.27	10.27	15.33	22.13	5.54
13	16.73	3.00	9.47	13.00	4.50
15	18.47	3.00	3.73	9.47	2.84
SD	2.97	4.13	4.67	4.66	

[z]SD—Standard Deviation.
[y]Quality rating scale = 3-7 unacceptable; 8-14 poor; 15-22 fair; 23-29 good; 30-36 excellent.

Table 3. Quality rating for 'Flemish Beauty' as affected by ripening temperatures and time.

Day	Temperature (°C) 5	18	22	26	SD[z]
0	10.60[y]	10.93	11.33	11.07	1.17
3	10.80	20.13	24.13	22.80	2.80
6	10.00	24.93	26.93	22.73	2.88
10	14.20	22.27	17.27	11.60	3.94
12	14.87	7.73	4.13	3.40	2.64
14	17.00	7.78	5.27	3.00	2.65
SD	2.80	3.27	2.94	1.57	

[z]SD—Standard Deviation.
[y]Quality rating scale = 3-7 unacceptable; 8-14 poor; 15-22 fair; 23-29 good; 30-36 excellent.

Table 5. Quality rating for 'Anjou' as affected by ripening temperatures and time.

Day	Temperature (°C) 5	18	22	26	SD[z]
0	14.73[y]	14.33	14.33	15.80	1.17
3	14.67	23.53	22.80	21.73	2.60
6	15.33	30.07	29.20	27.33	2.88
10	15.20	32.47	30.60	28.67	3.94
12	14.87	30.87	23.60	23.27	2.64
14	14.53	28.80	24.27	18.53	2.65
SD	2.80	3.27	.294	1.57	

[z]SD—Standard Deviation.
[y]Quality rating scale = 3-7 unacceptable; 8-14 poor; 15-22 fair; 23-29 good; 30-36 excellent.

'Bosc' and 'Anjou' started at similar quality levels as 'Bartlett' and between 'Flemish Beauty' and 'Clapp's Favorite' on the first day at 5°C, peaked at 6 and 10 days respectively and gradually declined again. Both 'Bosc' and 'Anjou' had higher quality ratings at the end of the testing period than at the beginning, while 'Clapp's Favorite,' 'Bartlett' and 'Flemish Beauty' had dramatically lower ratings at the end than at the beginning.

Quality ratings for 'Clapp's Favorite,' 'Flemish Beauty' and 'Bartlett' only stayed in the Good range for 4-5 days, whereas ratings for 'Bosc' and 'Anjou' stayed in the Good range for 8-12 days respectively. In fact, one third of 'Anjou's' quality ratings were higher than the highest scored by either 'Clapp's Favorite,' 'Flemish Beauty' or 'Bartlett.'

Table 4. Quality rating for 'Bosc' as affected by ripening temperatures and time.

Day	Temperature (°C) 5	18	22	26	SD[z]
0	13.73[y]	14.07	14.53	13.27	1.43
3	11.73	22.07	21.13	23.20	3.79
6	14.13	27.80	28.00	28.33	1.61
9	12.87	26.07	25.40	25.93	2.70
13	13.20	20.00	21.67	23.53	3.55
15	14.13	21.67	20.40	22.80	3.12
SD	1.98	3.58	3.20	2.02	

[z]SD—Standard Deviation.
[y]Quality rating scale = 3-7 unacceptable; 8-14 poor; 15-22 fair; 23-29 good; 30-36 excellent.

Weight Loss—Pear weight loss was affected by temperature and time (data not shown). As temperature increased, all five cultivars lost weight. There appeared to be two different responses (Table 6). The two earliest cultivars, 'Clapp's Favorite' and 'Bartlett' had much higher rates of weight loss than the three later cultivars, 'Flemish Beauty,' 'Bosc' and 'Anjou.' The loss of weight over time showed a similar response (data not shown). The higher the temperature, the greater the weight loss over 15 days for all five cultivars (data not shown).

Table 6. Pear fruit weight loss as affected by cultivar.

Cultivar	Weight Loss (% of initial fresh weight)	SD[z]
'Clapp Favorite'	10.99	1.75
'Bartlet'	10.94	3.12
'Flemish Beauty'	7.38	0.99
'Bosc'	8.33	0.66
'Anjou'	6.20	0.74

[z]SD—Standard Deviation.

The observed cultivar differences in quality deterioration, including the unique response of 'Bartlett' to warmer temperatures, could be related to

water loss and further studies should be conducted to examine this relationship. Satisfactory yields on mature trees and adequate consumer acceptance implies that the late maturing cultivars, 'Bosc' and 'Anjou,' could be grown and marketed through the present distribution system.

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Inbreeding and Co-ancestry of Low Chill Short Fruit Development Period Freestone Peaches and Nectarines Produced by the University of Florida Breeding Program

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Abstract

Inbreeding coefficients and coefficients of coancestry were calculated for low chill requiring, short fruit development period (FDP) peaches released from the University of Florida (UF) breeding program. Inbreeding was relatively low for most cultivars as were coefficients of coancestry for most parental combinations. The UF cultivars represent a diverse pool of germplasm with potential for commercial production or for extending the genetic base of breeding programs in the tropical highlands and subtropics.

The peach (*Prunus persica* (L.) Batsch) is self fertile and naturally self pollinates. It is considered tolerant of inbreeding, and open pollination usually results in less than 5% outcrossing (2, 4, 5). The peach's natural tolerance of inbreeding and the repeated use of germplasm of high fruit quality has led to the development of a limited germplasm base for the major freestone cultivars grown in the eastern U.S. The relatively narrow range of variation in disease, insect, cold, and other stress resistance has been cited as a function of this limited genetic base (8).

Since the early 1950's the University of Florida (UF), Gainesville, Florida, has developed a breeding program for the production of low chill requiring, short fruit development period (FDP) peaches. Low chill requirement is not desirable for peaches grown in the major temperate zone production areas due to the tendency of low chill genotypes to bloom during warm periods that can occur in late winter. Thus, the character was generally not available in germplasm in most other U.S. breeding programs. A short FDP (<100 days) is important in Florida because fruit must be harvested before