Retail and Consumer Losses of Western Pears in Metropolitan New York[1]

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Abstract. **During 1970-73, the condition of western-grown pears (*Pyrus communis* L.) was studied in metropolitan New York supermarkets and in consumer samples. Retail losses totaled 4.9, 2.5, and 1.9%, in 'Bosc', 'd'Anjou', and 'Bartlett' pears, respectively, and waste in consumer samples was 5.2, 1.6, and 4.0%, respectively. Mechanical injury caused the most loss in retail and internal breakdown the most in consumer samples.**

More than 75% of all pears delivered to metropolitan New York originate on the West Coast (3, 5, 6). In 1972, the wholesale value of western pear shipments to the New York market was estimated at $13 million (4). Since a markup of at least 50% is common at retail, the waste of western pears at retail and at the consumer level has a high monetary value even when the percentage wasted is small. Information on the causes of loss in western pears at retail and consumer levels could provide guidelines for devising measures to reduce waste and improve quality.

Marketing losses in western-grown 'Bartlett', 'Bosc', and 'd'Anjou' pears were studied in metropolitan New York, 1970-73. Seven supermarkets were visited weekly, commencing with the marketing of 'Bartlett' in August and ending with 'd'Anjou' in April. Defective pears excluded or removed from retail displays by store clerks during a 1 to 2-day test period were collected to determine why the fruits were culls. Consumer samples (each 6-12 pears) from 6 stores were examined for waste after they had ripened at 21°C, usually for 1 to 3 days. Losses were recorded by number in retail and by weight in consumer samples.

Of the 3 cultivars studied, 'Bosc' had sustained the highest loss at retail and exhibited the poorest condition in consumer samples. These losses totaled 10.1%, divided almost equally between both sample locations (Table 1).

The leading cause of 'Bosc' losses in retail stores was mechanical injury. Prominent impact and pressure bruises, cuts, punctures, and gouges caused a 2.3% loss, almost as much cullage as that produced by plant pathogens, desiccation, and overripeness combined (Table 1). Bull's-eye rot (*Pezicula malicorticis* Jacks., Nannf.), blue mold rot (*Penicillium expansum* Thom), and gray mold rot (*Botrytis cinerea* Pers. ex Fr.) were the most common rots, occurring frequently at open wounds and breaks in the skin.

The loss in consumer samples of 'Bosc' pears was 5.2%, consisting mainly of trimming waste rather than whole fruits (Table 1). Internal breakdown and mechanical damage, each contributing equally, accounted for about two-thirds of the consumer loss. Internal breakdown occurred most frequently towards the end of the 'Bosc' marketing season. The chief mechanical injury was bruising. The remainder of the consumer loss was mostly spoilage produced by blue mold, gray mold, and rhizopus rots.

Losses found in 'Bartlett' pears were less than those of 'Bosc', notably at the retail level. Only 2% 'Bartlett' pears in our retail tests were culled out. About 70% of the culls were severely bruised or punctured. Overripeness and decay were the other defects of note in the retail loss of 'Bartlett' pears (Table 1).

Losses in consumer samples of 'Bartlett' pears were more substantial. Internal breakdown caused more than half of the 4.0% consumer loss, with mechanical injury and pathogens producing most of the remainder (Table 1). Internal breakdown of 'Bartlett' pears usually appeared a month after the 'Bartlett' marketing season started, and the disorder became more frequent as the season progressed.

Pear losses were least in the 'd'Anjou' cultivar, totaling 4.1%. Of the 'd'Anjou' fruits culled out at retail, nearly three-fourths were mechanically damaged. Decay, overripeness, and desiccation caused the remainder of the 2.5% retail loss. Mechanical injuries, mainly bruises, caused half of the consumer waste of 1.6%. Rots and such physiological disorders as cork spot and non-ripening made up the rest. Unlike its magnitude in the other cultivars, internal breakdown caused relatively little waste in consumer samples of 'd'Anjou' pears (Table 1).

In our 3-year study, more than half of the pear culls in retail were mechanically damaged. Such damage also caused one-third of the waste in consumer samples. From our observations, much of the damage occurred in the stores, mostly from careless or excessive handling of the loose fruits on display counters. Mechanical injury might be reduced if pears were retailed in packaged units that prevent movement of individual fruits (1). Such packaged units, found occasionally in a few stores, exhibited little mechanical damage to their contents.

Internal breakdown caused the most waste in consumer samples, especially of 'Bosc' and 'Bartlett' pears. The specific cause of the disorder, also called "core breakdown", is not known. However, fruits harvested after optimum maturity appear to be most susceptible (2). The higher incidence of internal breakdown in pears marketed late in the season suggests the possible involvement of a

Table 1. Losses of western pears in metropolitan New York retail outlets and in consumer samples.

Causes of loss	Losses (%) in pear cultivars					
	'Bosc'[z]		'Bartlett'[z]		'd'Anjou'[z]	
	Retail samples	Consumer samples	Retail samples	Consumer samples	Retail samples	Consumer samples
Pathogenic						
Blue mold rot	0.2	0.4	trace	0.1	0.2	0.2
Gray mold rot	0.2	0.2	0.1	0.2	0.1	trace
Rhizopus rot	trace	0.4	trace	0.1	trace	0.1
Other rots[y]	0.6	0.2	0.1	0.1	0.1	0.1
Total	1.0	1.2	0.2	0.5	0.4	0.4
Non-pathogenic						
Mechanical injuries	2.3	1.8	1.3	0.8	1.8	0.8
Internal breakdown	trace	1.8	trace	2.5	0.	0.2
Desiccation	0.9	0.1	trace	trace	0.1	0.
Overripeness	0.7	trace	0.3	0.	0.2	0.
Other[x]	trace	0.3	0.1	0.2	trace	0.2
Total	3.9	4.0	1.7	3.5	2.1	1.2
Combined totals	4.9	5.2	1.9	4.0	2.5	1.6

[z]Observed in retail and consumer samples, respectively: 60,219 and 3,557 (615 kg) 'Bosc' pears; 76,519 and 2,199 (369 kg) 'Bartlett' pears; 104,083 and 4,597 (784 kg) 'd'Anjou' pears.

[y]Mainly bull's-eye rot and alternaria rot.

[x]Includes field scars, freezing injury, insect and chemical injuries, scald, immaturity, boron-deficiency, russet, sunscald, cork spot, and failure to ripen.

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senility factor.

Only about one-fifth of all pear losses was caused by plant pathogens. Western pears are routinely treated with a postharvest fungicide to control pathogenic activity. The relatively small loss from fungal rots found in our study attests to the soundness of that commercial practice.

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Ethephon Improves Marketability of 'Schmidt' Sweet Cherries Picked without Stems[1]

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Abstract. **Orchard application of 300 ppm (2-chloroethyl)phosphonic acid (ethephon) to sweet cherries (*Prunus avium* L. cv. Schmidt) enhanced fruit abscission and decreased fruit injury from stem scar tearing when harvested without stems. Postharvest pitting of the fruit at the stem scar and the development of brown rot were reduced by ethephon. Even so, treated fruit picked without stems was unmarketable after 5 days at room temperature because of excessive amounts of decay, regardless of fungicidal treatment or storage for 0 to 6 weeks at 0 and 5°C.**

Michigan sweet cherries are seldom harvested with stems attached. Those intended for fresh use, mostly of the 'Schmidt' cultivar, are generally suitable only for immediate marketing and consumption. Removing the stem often tears the skin and flesh resulting in exudation of juice, increased susceptibility to decay, and rapid browning and dehydration of the damaged tissues. Bukovac et al. (1) have shown that fruit abscission of sweet cherries, for brining purposes, is promoted by the preharvest application of ethephon. A similar effect for fresh market fruit might help overcome some of the difficulties encountered in marketing stem-less fruit.

Fruit from mature 'Schmidt' trees of similar vigor and crop load at 2 locations in northwestern lower Michigan with and without ethephon at 300 ppm were harvested at 6 and 8 and at 10 and 12 days after spraying. Removal force to separate the fruit and stem was measured with a Hunter Mechanical Force Gauge in the orchard. Other samples were hand-picked without stems at random from all sides and up to 3.7m from 2 trees of each treatment and evaluated the following day for damage at the stem scar and skin color. Control and ethephon-treated fruit were assigned to each of three 50-fruit replicates for 16 storage treatments. Fruit treated with fungicide was submerged in a suspension of dichloran[3] (450 ppm) plus benomyl (150 ppm) for 15 sec and drained. Nontreated fruit was not moistened. Storage at 0 and 5°C for periods of 0, 2, 4, and 6 weeks was employed.

After storage in a perforated polyethylene bag for the designated period, each sample was held 5 days at room temp and decay development recorded as no of fruit with visual symptoms of brown rot caused by *Monilinia fructicola* (Wint.) Honey; the remaining decayed fruits were counted as rots caused by other organisms (primarily *Rhizopus* sp. and *Alternaria* sp.). Pitting at the stem scar included fruit with slight surface darkening and dehydration of the surrounding tissue. Weight losses during storage and the simulated marketing period at room temp were recorded.

Either preharvest application of ethephon or delay in time of harvest resulted in riper fruit at harvest-time as measured by darkening of skin color and decrease in fruit removal force, see Table 1. This ripening effect of ethephon (1) resulted in the promotion of fruit abscission (2, 3) and thereby reduced stem scar damage as a result of separation of the stem from the fruit. These effects were more pronounced for ethephon than for delay in harvest, whereas, the effects on red coloration were similar. The reduction in fruit damage at harvest from ethephon resulted in a decrease in the subsequent development of stem scar pitting of the fruit due to desiccation of the flesh tissue damaged by stem detachment (Table 2). Pitting differences, however, were not reflected in the overall weight losses, which ranged up to an average of 4.4% after 6 weeks of storage.

Table 1. At harvest maturity and injury of 'Schmidt' sweet cherry fruit.

Factor	Fruit removal force (g)	Stem scar damage (% of fruit)	Skin color (rating)[z]
No ethephon	348	18.6	1.70
Ethephon	242	6.4	1.51
1st harvest	316	15.2	1.72
2nd harvest	272	10.0	1.49

[z]Scale of 1 (black to 5 (light red).

Table 2. Percentage of fruit affected by disorders after a simulated marketing period of 5 days at room temp.

Factor or treatment	Stem scar pitting	Brown rot	Other rots
No ethephon	44.1	33.4	22.0
Ethephon	27.6	29.0	22.4
	**	**	NS
1st harvest	35.6	17.4	28.6
2nd harvest	36.1	44.8	15.6
	NS	**	**
No fungicide	36.2	35.2	20.2
Dicloran + benomyl	35.5	27.2	24.0
	NS	**	**
Storage at 0°C	36.8	24.8	21.4
Storage at 5°C	35.0	37.6	22.8
	NS	**	NS

NS - Not significantly different.
*Significantly different at 5% level.
**Significantly different at 1% level.

The simulated marketing period at room temp to which the cherries were subjected prior to evaluation resulted in excessive deterioration (Table 2). Control fruit not stored and examined 5 days following harvest developed an average of 35.1% stem scar pitting, 28.8% brown rot, 13.2% other rots and 1.5% weight loss; none of them was considered to be marketable. In spite of the high incidence of decay, there was a measurable retardation of brown rot by ethephon, early harvest, fungicidal treatment, and 0°C storage. The other rots were not affected by ethephon or storage temperature, but unaccountably were decreased by early harvest and fungicidal treatment. Prolonging the cold storage period of the fruit up to 6 weeks significantly increased deterioration from all causes.

The possibilities for marketing

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[3]2,6-dichloro-4-nitroaniline.