Maintaining Quality by Brining Sweet Cherries After Harvest
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By *R. T. Whittenberger, J. H. Levin* and *H. P. Gaston*[2]

BECAUSE OF THE DIFFICULTY of recruiting hand pickers and because of potential monetary savings, Michigan sweet cherry growers are beginning to use machines for harvesting. Twenty-eight percent of the 1966 tart cherry crop in Michigan was harvested with machines. The amount increased to 47 percent in 1967 and it is estimated that about 70 percent of the 1968 crop will be machine harvested. Machines used for harvesting tart cherries can, in most cases, also be used for harvesting sweets, and a recent survey shows that 6.5% (2.2 million lbs.) of the Michigan sweet cherry crop was harvested mechanically in 1967. Machine harvesting of sweet cherries is being practiced in California, Oregon and elsewhere.

When Schmidt and Napoleon cherries are allowed to become fully mature, the fruit detachment forces weaken, and the cherries can be separated from the tree without great difficulty. However, when cherries of the Windsor variety are machine harvested before they reach full maturity (as they often are) the detachment forces are high and shaking causes considerable on-the-tree bruising. Is it possible to overcome many of the undesirable effects of bruising through new handling and brining techniques?

Studies made in California and New York, as well as 1961 Michigan studies, indicate that the bruised areas of cherries brined soon after harvest do not discolor nearly as much as when cherries are brined later. In 1966 and 1967 the earlier studies were extended, and the results are reported in this paper. The effects of orchard brining were evaluated in terms of cherry quality, shrinkage, size, firmness and stem tightness. Bruised and unbruised fruit, both with and without stems, were included in the trials.

PROCEDURE

Procedures were identical in 1966 and 1967. During the normal harvest season about 250 pounds of Windsor sweet cherries were carefully hand picked near Fremont, Michigan. Half of the cherries were picked with stems attached and the other half without stems. One half of each of the above lots was bruised immediately after picking by dropping the cherries three times from a height of 3 ft. onto a hard surface. Six treatments, comprising four 1 gallon samples each, were then set up as follows:

[1] Based on work carried out jointly by the Fruit and Vegetable Harvesting Section, Agricultural Engineering Research Division, and the Eastern Utilization Laboratory, USDA; and Departments of Horticulture and Agricultural Engineering, Michigan State University.

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1. Unbruised cherries, brined immediately
2. Bruised cherries, brined immediately
3. Unbruised cherries, brined 4 hours later
4. Bruised cherries, brined 4 hours later
5. Unbruised cherries, brined 8 hours later
6. Bruised cherries, brined 8 hours later.

Half of the cherries of each sample had stems attached, and the other half had no stems. All samples were weighed to the nearest gram within 1 hour after harvest. Stem detachment forces were measured with a pull gauge at 0, 4, and 8 hours after harvest, and readings were made at the same time on cherry diameter and cherry firmness.[3]

Cherries of all treatments were placed in standard brine (pH = 2.8, SO_2 = 13,500 ppm) and held for 3 months at prevailing temperatures. Measurements then were made of cherry weight, size, firmness and stem attachment force, and quality was evaluated by a panel of five experts.

RESULTS

Quality

Since the results of 1966 and 1967 were similar, only those of 1967 will be reported. Quality of the brined product was affected by two main factors: (1) length of delay between harvest and brining and (2) bruising. Highest quality was obtained in samples that were brined immediately after harvest (Table 1). When brining was done at this time, bruise damage in the original cherries did not affect final quality, and panel members were unable to distinguish between bruised and unbruised lots. Both lots were graded A by the panel.

When brining was delayed for 4 hours after harvest, some deterioration in quality occurred (Table 1). It was now possible to distinguish between bruised and unbruised lots. Quality deterioration was more rapid in the bruised cherries, which were assigned a grade of B+ by the panel. In contrast, comparable unbruised lots received a grade of A-.

TABLE 1 - - How bruising and time of brining affected quality

Time between harvest and brining, hours	Quality of brined cherries[a]	
	Unbruised	Bruised
0	A	A
4	A-	B+
8	B	C

a) A is high quality, B is acceptable qualtiy, C is unacceptable.

Holding cherries for 8 hours between harvest and brining caused a definite drop in quality of all samples. Again, the deteriorative changes were more rapid and more serious in the bruised lots (grade C) than in the unbruised lots (grade B). The bruised cherries had discolored considerably and were of unacceptable quality. Although the unbruised cherries were a little darker their quality remained acceptable. The presence or absence of attached stems had no significant effect on the final quality.

Changes in Weight

Harvested cherries that are held in air begin to lose weight almost immediately after harvest. They continue to lose weight as they are held in brine. In the present tests (cherries held in brine for 3 months) overall losses were affected mainly by three factors: (1) bruising, (2) time between harvest and brining and (3) presence or absence of attached stems.

Of the three factors, bruising had the greatest effect, overall weight losses being considerably greater in bruised cherries than in unbruised lots (Table 2). For example, the average overall loss (loss in air plus loss in brine) for unbruised cherries was 10.9 percent and that for bruised lots, 13.3 percent. These results stress the importance of minimizing bruise damage during harvesting and handling operations.

Overall weight losses were somewhat greater when cherries were brined immediately after harvest than when brining was delayed for 4 or 8 hours (Table 2).

TABLE 2 - - How time of brining, bruising, and attached stems affected cherry weight (samples were held in brine for 3 months)

Hrs. between harvest and brining	Overall weight loss in percent[a]				
	Unbruised[b]	Bruised[b]	With[c] stems	Without[c] stems	Avg.
0	11.4	13.6	12.1	12.7	12.5
4	10.1	13.4	11.6	12.6	11.9
8	11.1	12.9	10.9	11.5	11.6
Avg.	10.9	13.3	11.5	12.3	

a) Based on weight of cherries immediately after harvest.
b) One half of cherries had stems attached.
c) One half of cherries were bruised.

For example, the average overall loss for cherries brined immediately after harvest was 12.5 percent (loss in brine only) whereas the average overall loss for fruit brined 8 hours later was 11.6 percent (loss in air plus loss in brine.) Brine had a greater shrinking effect on freshly harvested cherries than on cherries which had been held in air for 8 hours before brining.

From a quality standpoint, however, the lots brined immediately after harvest were markedly superior. Growers and processors can obtain superior quality by sacrificing about 1 percent in product yield.

[3]Parker, R. E., J. H. Levin and R. T. Whittenberger (1966). An instrument for measuring the firmness of red tart cherries. Mich. Agr. Expt. Stat. Quart. Bul. 48: 471-482.

The removal of stems from cherries exposes tissues that have been protected, slightly weakens fruit microscopic structures, and facilitates the exchange of substances between the cherry and its environment. In the present tests, cherries with stems attached lost an average of 11.5 percent in weight, whereas fruit without stems lost 12.3 percent.

Changes in Size

Cherry size, as indicated by cherry diameter, was affected by the same factors that affected cherry weight (Table 3). Shrinkage in brine was increased by bruising of the fresh cherries, brining immediately after harvest and removal of stems. The average reduction in diameter of cherries brined immediately after harvest was 4.8 percent, and that of cherries held for 8 hours before brining was 4.2 percent. This size difference is so small that it is not considered significant. A 1 percent shrink represents only about 0.01 inch in a cherry that is 1 inch in diameter.

TABLE 3 - - How time of brining, bruising, and attached stems affected cherry size (samples were held in brine for 3 months)

Hrs. between harvest and brining	Reduction in cherry diameter, in percent[a]				
	Unbruised[b]	Bruised[b]	With[c] stems	Without[c] stems	Avg.
0	5.0	5.9	3.6	4.9	4.9
4	4.9	5.5	3.5	4.3	4.6
8	4.3	5.1	3.1	4.2	4.2
Avg.	4.7	5.5	3.4	4.5	

a) Based on diameter of cherries immediately after harvest.
b) One half of cherries had stems attached.
c) One half of cherries were bruised.

Strength of Stem Attachment

Cherries with firmly attached stems are required for a fancy cocktail pack. Strength of stem attachment is influenced by several factors, some of which were evaluated in the present study. Stems on fresh cherries tended to loosen slightly as the cherries were held in air (Table 4). For example, stem detachment forces dropped from 415 grams to 336 grams during the first 8 hours after harvest.

TABLE 4 - - How time of brining and storage in brine affected strength of stem attachment

Hrs. between harvest and brining	Detachment force, grams		
	Before brining	After brining	Avg.
0	415	631	523
4	352	601	477
8	336	588	462
Avg.	368	607	

On the other hand, holding the cherries in brine sharply increased the strength of stem attachment. The increases ranged from 52 to 75 percent, being greatest in cherries whose stems had been relatively loosely attached in the fresh condition. The most tightly attached stems occurred in samples that had been brined immediately after harvest.

Firmness

Fresh Windsor cherries showed no significant changes in firmness during the first 8 hours after harvest. Bruised cherries remained less firm than unbruised fruit. Holding the cherries in brine, however, caused large increases in firmness of all samples. The increases were similar in cherries that had been held for 0, 4, and 8 hours before brining.

CONCLUSIONS

1. Sweet cherries which are bruised (machine harvested) should be brined within 4 hours after harvest (sooner if possible) if they are to be of acceptable quality after being processed. For best quality, the fruit should be brined during the first hour.

2. Unbruised cherries (carefully hand picked) should be brined within 8 hours after harvest if they are to make a product of acceptable quality. For best results they should be brined during the first 4 hours.

3. Cherries that are brined immediately after harvest lose approximately 1 percent more weight than cherries which are brined 8 hours after harvest.

4. Cherries with stems attached lose about 0.8 percent less weight than cherries that are brined without stems.

5. Bruised cherries lose about 2 percent more weight when brined than do unbruised cherries.

6. Although cherries which are brined immediately after harvest shrink slightly more in size than cherries which are brined 8 hours later, the difference is insignificant.

7. Bruised cherries shrink in size more than do unbruised cherries when brined.

8. The force required to detach stems from cherries decreases slightly when the cherries are held in air for several hours after being picked.

9. Brining increases the force required to separate stems by 52 to 75 percent. Brining immediately after harvest gives maximum stem attachment force.

10. The time of brining (up to 8 hours) had no significant effect on the firmness of the fruit.

This study led to the conclusion that machine harvested sweet cherries should be brined as soon after harvest as possible.