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CHERRY FIRMNESS AND ITS RELATIONSHIP TO PITTER LOSS

R. E. Parker,[1/] J. H. Levin,[1/] and H. P. Gaston[2/]

INTRODUCTION

Record-breaking cherry crops in Michigan in 1964 and 1965 have forced growers to depend more and more on mechanized harvesting. The demand for cherry harvesting machines is so great that some used machines are selling for more than their original price. Increases in mechanized harvesting have been accompanied by increases in the number of inquiries regarding the effects of mechanization on the quality of cherries.

The main problems associated with mechanical harvesting have been: (1) Tree damage from the shaker, (2) excessive number of attached stems in the harvested fruit, and (3) excessive bruising of the fruit.[3/] From the processor's standpoint, bruising is the most serious problem because of its effect on yield of pitted cherries and on drained weight of processed cherries.[4/] Relationships between known bruising treatments and juice losses during pitting have already been established;[4/ 5/] however, processors are interested in determining pitting losses on the basis of the condition of the fruit. In addition, processors are constantly seeking better ways and means of reducing such losses.

The commercially accepted method of processing tart cherries is to soak the cherries in cold water (approximately 50° F.) for several hours before sorting and pitting. The processor desires to soak the cherries long enough to obtain maximum firmness with a minimum of scald.

1/ Agricultural engineers, Agricultural Engineering Research Division.

2/ Horticulturalist, Department of Horticulture, Michigan State Univ.

3/ Whittenberger, R. T., Gaston, H. P., and Levin, J. H. Effect of Recurrent Bruising on the Processing of Red Tart Cherries. Mich. State Univ. Agr. Expt. Sta., Farm Science Res. Rpt. 4, 1963.

4/ Gaston, H. P., Levin, J. H., and Hedden, S. L. Experiments in Harvesting Cherries Mechanically. Mich. Agr. Expt. Sta. Quar. Bul. 41: 805-11. 1959.

5/ LaBelle, R. L., Woodams, E. E., and Bourne, M. C. Recovery of Montmorency Cherries From Repeated Bruising. Proc. Amer. Soc. Hort. Sci. Proc. V. 84: 103-109. 1964.

The objectives of this investigation were: (1) To determine the firming behavior of tart cherries stored in controlled environments, and (2) to find a relationship between cherry firmness and the pitter loss that occurs during processing. Information gained by this investigation should aid in establishing: (1) Optimum environmental conditions in which to store cherries before processing, (2) storage time required for best packout, and (3) a means of predicting pitter loss before pitting.

MATERIALS AND METHODS

Cherry firmness and pitter loss were measured in the experiments. All firmness values for cherries were derived from deflection measurements made by a PL meter. The meter and the technique have been described previously.[6/] Pitter losses were established by weighing a sample of cherries before and after pitting. The pitted cherries were allowed to drain 2 minutes before the final weighing. Cherries were pitted with the hand pitter shown in figure 1.

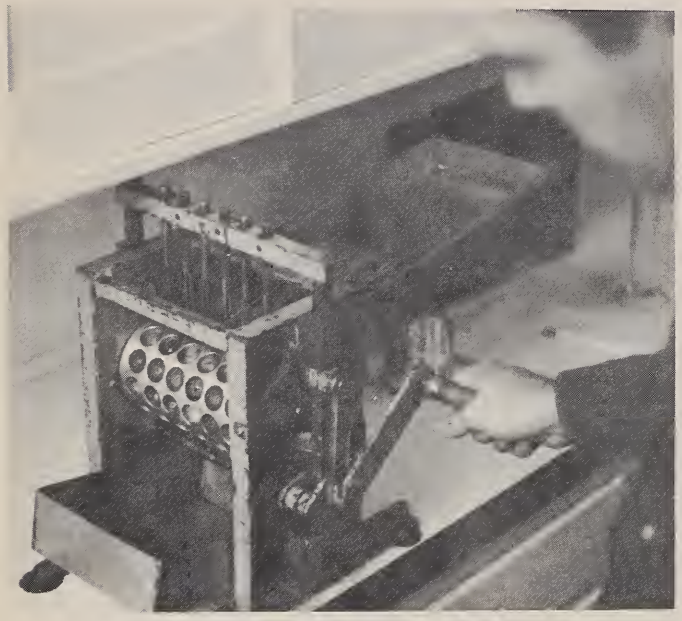

Figure 1. Small hand-operated pitter used to measure pitter losses of tart cherries.

Bruising treatments were accomplished by dropping the cherries 3 feet onto a flat board a specified number of times. A 6x bruise treatment means that the cherries were dropped 3 feet six times; a 3x treatment, 3 feet three times, etc.

The controlled environment-storage study was conducted at East Lansing, Michigan, with carefully hand-picked red tart cherries as the control. Two tests were carried out on two separate days.

6/ Parker, R. E., Levin, J. H., and Whittenberger, R. T. An Instrument for Measuring Cherry Firmness. Mich. Agr. Expt. Sta. Quar. Bul. 48: 471-482. 1966.

In the first test, 24 unbruised cherries approximately equal in color and size were divided into four lots of 6 cherries each. All cherries were measured for firmness immediately after harvest.
The four lots were then subjected to the following treatments:

Unbruised check stored in 40° F. water
Bruised 3x and stored in 40° F. water
Unbruised check stored in 40° F. air
Bruised 3x and stored in 40° F. air

The same procedure was followed in the second controlled environment-storage test except for treatment changes as follows:

Bruised 3x and stored in 40° F. water
Bruised 3x and stored in 40° F. air
Bruised 6x and stored in 40° F. water
Bruised 6x and stored in 40° F. air

Firmness measurements were taken on the same 6 cherries at specified intervals up to 17 hours for the 6x treatment and 18 hours for the 3x treatment.

In addition, three tests were conducted at the Cherry Growers, Inc., processing plant at Traverse City, Mich., in an effort to determine the relationship between firmness and pitter loss of red tart cherries. Procedures were as follows:

Test A. Twenty hand-picked cherries were selected at random from lugs as they were received at the plant. Firmness measurements were taken on the entire sample.

Half the cherries were pitted immediately to determine pitter loss. The remaining 10 cherries were held in one of the processing plant's soak tanks for 5 hours, and firmness measurements were taken again. The cherries were then pitted.

Test B. Twenty cherries were taken from one of the plant's soak tanks. History of the cherries was unknown but the plant manager believed that the fruit was firm enough to process. Firmness measurements were taken on the 20 cherries, and half of them were pitted immediately. The remaining 10 were subjected to a 1x bruising treatment to simulate the in-plant bruising that normally occurs after soaking. Firmness measurements were taken again, and the cherries were then pitted to determine pitter loss.

Test C. Thirty cherries were carefully hand picked (with essentially no bruising) and divided into three lots of 10 cherries each. Treatments on the lots were: Lot 1, pitted immediately; lot 2, soaked at the plant for 4 1/2 hours before pitting; and lot 3, bruised 1x and soaked 5 hours at the plant before pitting. Again, initial and final firmness measurements were taken on all lots, along with an intermediate measurement after the 1x bruising treatment on the third lot only.

RESULTS AND DISCUSSION

Controlled Environment-Storage Tests

Results from the first controlled environment-storage test are presented in figure 2. There was essentially no change in the firmness of unbruised cherries when stored in either water or air at 40° F. Cherries bruised 3x tended to firm up during the early hours of storage in either air or water but never regained their initial firmness even after 32 hours. Although it appeared that the bruised cherries firmed up more when stored in air than when stored in water, the difference may have been due to the initial firmness immediately after bruising. No definite conclusion regarding air or water storage can be made, based on the results in this particular test. It was noted visually that the cherries stored in 40° F. air had a dull, rough-looking skin surface whereas the cherries stored in water maintained their glossy skin surface. If skin appearance is more important than cherry firmness, then air storage may be detrimental to the final quality of the end product.

The 3x bruising treatment was repeated in the second environment-storage test and compared with a much more severe 6x treatment (fig. 3). The severity of the 6x treatment caused most of the cherries to split, and about 60 percent of them were classified as unacceptable for processing. For both bruising treatments, the cherries stored in air firmed up more than those stored in water. Air again had a detrimental effect on skin appearance.

The more severely bruised cherries underwent a greater change in firmness during storage but never became as firm as the less severely bruised (3x) cherries, and the less severely bruised cherries never attained the firmness of unbruised cherries. If cherry firmness were the only factor upon which pitter loss depended, the results from these two tests may indicate that more severely bruised cherries should be soaked for a longer period of time at the processing plant before pitting, and that unbruised cherries need not be soaked at all.

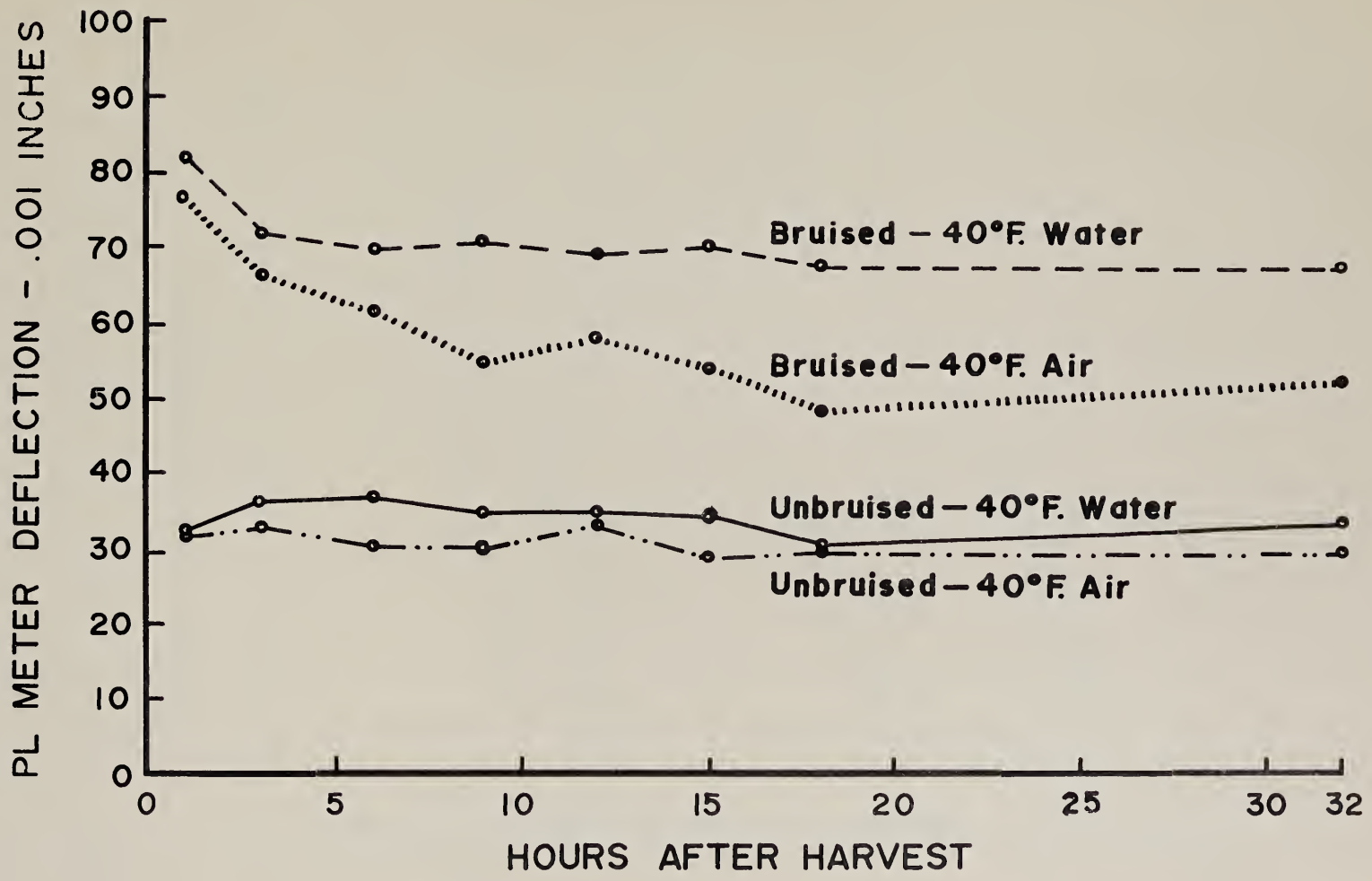

Figure 2. Firmness behavior of unbruised and bruised (3x) cherries when held in air and in water at 40° F. for 32 hours after picking. Each curve represents the average firmness of 6 hand-picked cherries.

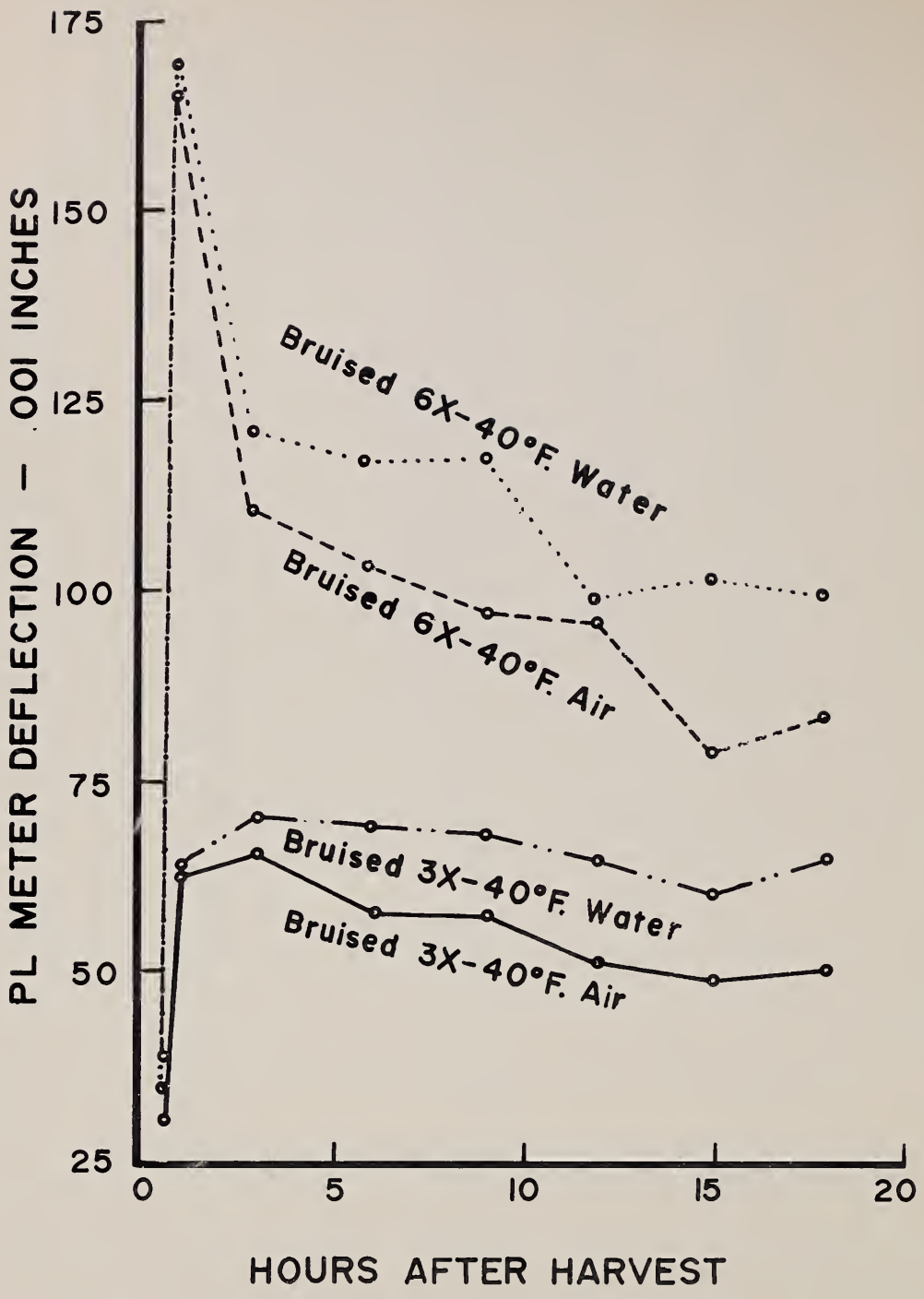

Figure 3. Firmness behavior of cherries bruised 3x and 6x and held at 40° F. in air and in water. Each curve represents the average firmness of 6 cherries hand-picked at East Lansing, Mich., on July 23, 1965.

Firmness Versus Pitter Loss

The results of firmness-pitter loss tests A, B, and C at the processing plant in Traverse City, Mich., are presented in condensed form in table 1. The data show that soaking the hand-picked, lug-hauled cherries for 5 hours in water at the processing plant reduced pitter loss from 16.1 percent to 14.0 percent. Initial firmness measurements indicated (by comparison with previous values for cherries subjected to known treatments) that the cherries had previously been subjected to an equivalent 1x to 3x bruising action during harvesting and hauling. The cherries firmed up slightly during the 5-hour soak time (test A, table 1).

Table 1. Results of tests A, B, and C on pitter loss and cherry firmness for cherries subjected to specified treatments. Data refer to averages for 10 cherries in each treatment. Traverse City, Mich., August 1965

Test	Treatment description	PL meter deflection--0.001 inches		Pitter loss
		Before treatment	After treatment	
				Percent
A	As received in lugs:			
	Pitted immediately	57.5	--	16.1
	Soaked 5 hours	57.0	47.6	14.0
B	Extracted from soak tank after soaking time:			
	Pitted immediately	61.5	--	18.5
	Bruised 1x immediately	60.6	77.0	20.1
C	Hand harvested (no bruising)			
	Pitted immediately	40.4	--	18.0
	Soaked 4 1/2 hours	35.2	31.0	15.7
	Bruised 1x immediately	37.2	57.3	--
	Then soaked 5 hours	57.3	48.7	14.1

Subjecting cherries to a 1x bruise after the normal soaking period at the processing plant increased pitter loss from 18.5 up to 20.1 percent (test B). In comparison, pitter losses for commercially processed cherries vary between extremes of 14 and 20 percent and average about 16.5 percent. Based on tests A and B only, cherry firmness by PL meter readings varies inversely with pitter loss. This relationship, however, apparently applies to bruised fruit only, according to the results from test C.

Pitter loss for unbruised cherries was reduced from 18.0 to 15.7 percent by soaking the cherries 4 1/2 hours. During the soak period, there was essentially no change in the firmness of the cherries. This agrees with the curves in figure 2 for unbruised cherries. Cherries bruised 1x before soaking 5 hours had 1.6 percent less pitter loss than the unbruised cherries that were soaked 4 1/2 hours, even though the unbruised cherries were firmer than the bruised cherries before pitting. The 30-minute-longer soak period may have caused the 1.6 percent difference in pitter loss, but the 1x bruising treatment had no detrimental effect on pitter loss.

Note the similarity of deflections and pitter losses for the last treatments of tests A and C (table 1). It is highly probable that the cherries in test A had received an equivalent of at least a 1x bruise before delivery at the plant. In these two instances, pitter losses were the lowest for all tests. This indicates that minor bruising before soaking may actually be beneficial with respect to pitter loss. Minor bruising after soaking, however, was highly detrimental to pitter loss (test B).

SUMMARY

Controlled environment-storage tests and firmness-pitter loss tests were conducted at East Lansing, Mich., and Traverse City, Mich., respectively, in an effort to improve the efficiency of processing red tart cherries.

Firmness of bruised and unbruised cherries stored in 40° F. air and in water was measured at specified intervals relative to time of harvest. The degree of firming during the storage period varied directly with the severity of initial bruising. However, bruised cherries never totally regained their original firmness. Firmness of unbruised cherries remained relatively constant during storage.

Firmness-pitter loss tests showed that firmness of unbruised cherries does not change during soaking time at the plant. However, the soak period reduced pitter loss of unbruised cherries--indicating that pitter loss depends not only upon firmness but also upon aging. As expected, firmness increased and pitter loss decreased when bruised cherries were soaked conventionally for 5 hours. Also, a slight bruise after the normal soak period had a detrimental effect on both firmness and pitter loss.

ACKNOWLEDGMENTS

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