

COST AND EFFICIENCY STUDIES IN MARKETING OREGON PEARS

I. Comparative Costs of Handling Winter Pears In Fiberboard and Wood Containers

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**Miscellaneous Paper 42
May 1957**

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COMPARATIVE COSTS OF HANDLING WINTER PEARS
IN FIBERBOARD AND WOOD CONTAINERS

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Summary and Conclusions

Labor costs and labor requirements were practically the same for the two kinds of fiberboard cartons and the standard wooden box. This included labor used for container assembly, packing, container closing, labeling and car loading.

The cost of materials for the three containers were considerably different. When compared with wood, the "C" box was almost 2 cents higher. The "K" box was 15 cents lower. Other considerations, however, probably are more important than the differences in the cost of the container itself. Among the points that should be considered are:

1. The ability of the fiberboard container to stand up during long storage periods. It is doubtful if either carton would be suitable for high stacking or palletized storage. The "C" carton developed pronounced sidewall bulges and required a different stacking method than wood boxes. (Figures 1 and 2) The chimney stack seemed the best method but used more storage space. This, of course, increased the cost of storage.

2. The ability of the fiberboard container to maintain fruit quality. Tests made by plant physiologists of the U.S.D.A. showed that fruit cooled slower in the fiberboard than in wood.

U.S.D.A. studies² of the condition of the fruit upon arrival in test shipments at terminal markets showed these facts:

- a. Discoloration and pressure bruising was excessive in the "C" carton. Packers indicated that the lack of rigidity in the sidewalls of the "C" carton also undoubtedly contributed toward pressure bruising in lower boxes in storage stacks.
- b. Less discoloration and bruising was found in the "K" carton than in the standard wooden box. Only a limited number of shipments of this carton, however, were included in the terminal market evaluation.
- c. The "K" box was deeper, so some slackness of pack was apparent.
- d. No container failures were observed.

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²Stokes, Donald R. and Hawes, Russell L., Trade Reaction to Winter Pears Packed in Fiberboard Boxes, U. S. Department of Agriculture, Agricultural Marketing Service, Washington, D.C.

3. Trade acceptance of pears in fiberboard has not been fully determined. Not enough pears have been marketed in fiberboard to determine whether some of the resistance found was temporary or more permanent.

Introduction

Since 1936, pears have been Oregon's leading fresh fruit crop in terms of cash farm income. In 1954 this amounted to over 13.5 million dollars. The winter pear crop is shipped to distant markets after a relatively long cold storage holding period. Because of the long storage period and long haul, expensive packing procedures, storage facilities, and shipping containers are needed. These insure delivery of a high quality product to the consumer. Costs of packing and storing pears, however, are greater per box than production costs.

The Oregon pear industry is interested in reducing marketing costs for two reasons. First, a reduction in costs will permit immediate higher grower returns for some. Secondly, cost reductions can be passed on to consumers, and more pears may be sold. Costs include those resulting from a reduction of the amount of high quality fruit offered for sale because of bruising. One of the means by which costs may be reduced is through the use of an improved type of container for packing and handling pears. These containers, made of fiberboard, are now being used successfully in the apple, citrus, and lettuce industries.

In view of high marketing costs and the interest in the fiberboard container, the Research Committee of the Oregon-Washington-California Pear Bureau requested that a study be made by the Oregon and Washington Experiment Stations, and the United States Department of Agriculture. The study makes an evaluation of packing, storing, shipping and selling winter pears in fiberboard versus conventional wood containers.

Objective

Purpose of this study is to determine the comparative packing and handling costs of the different containers at shipping point. Studies relating to cooling rates, maintenance of fruit quality and market acceptance of the containers are being done by the U. S. Department of Agriculture.

Procedure

This study is based on data taken at a packing and shipping plant at Hood River, Oregon, during the fall and winter of 1954.

The studies were limited to the five operations in the packing house where significant differences in costs and efficiencies due to box type might occur. The operations were:

1. Container assembly
2. Packing
3. Container closing
4. Labeling
5. Car loading

Labor cost estimates for container assembly, closing, and labeling operations were based on labor requirements determined by means of time studies.

Description of containers.

The C-Fiber box, the K-Fiber box, and the standard wood box were compared. Both fiberboard containers were pre-labeled. (Figure 3) The C-Fiber box was a multi-wall, two piece fiberboard container. The cover slipped down over the entire box. It was hand assembled and held in shape entirely by folding and pressure.

The K-Fiber box was a single walled, one piece fiberboard container with a veneer liner added to the inside of the box for reinforcement. The box was folded together and held with staples. Lid flaps were closed by taping or gluing. Both fiberboard cartons were made deep enough to eliminate the characteristic bulge of the standard wood box.¹ (Figure 4)

The wooden box used was the standard Western nailed pear box with a nailed wooden lid.

Results

In the summary of the results that follows, it should be noted that only those elements of cost and efficiency are included where a difference could occur due to box type. Costs of storing pears in the three containers were excluded, as they were beyond the scope of this particular study.

The costs and labor requirements presented in each of the following tables are based on productive time only. Delays, or non-productive time, have been excluded in order to make the results more comparable. Wage rates and material costs used were those paid at Hood River during the 1954-55 packing and shipping season.

Total cost differences primarily were due to variations in container material costs. The K-box materials cost the least. (Table 1) Other considerations, however, such as cooling rates, storage costs, changes in fruit quality, and market acceptance may be more important than the costs of packing and handling in an overall evaluation of the fiberboard container.

Table 1. Comparative Labor and Material Costs of Packing and Handling Pears in Wood and Fiberboard Containers
Hood River, Oregon, 1954

Cost Item	Type of Container		
	C-Fiber cents/box	K-Fiber cents/box	Wood cents/box
Labor	15.26	15.54	15.32
Materials	52.00	35.30	50.28
Total	67.26	50.84	65.60

¹They had the same width as the wood box, but were an inch and a half shorter. The C-Fiber box was an inch deeper and the K-Fiber box an inch and a half deeper than the wood container.

Cost of assembling the wood box and lid was slightly more than two-thirds as much for the cartons. (Table 2) This was because machines were used for making the wood box. Also the lids already are assembled when received by the packing house. No machinery other than a stapling machine for the K-box was used for assembly of the fiberboard boxes and lids. The box and lid assembly cost for the wood box as shown in Table 2 was based on an output of 562 boxes per hour for the fully automatic box making machine. For comparison, the labor cost of this same operation for the semi-automatic machine (which requires more hand labor) was 1.27 cents per box, or almost 20 per cent greater than for the fully automatic machine.

Labor costs for packing are the same for all three boxes since packers were paid on a piece rate basis. The wood container was the only box requiring a liner to be added by the packers.

Tape was used to seal the lid flaps on the K-Fiber box. Gluing the flaps down might be another method to accomplish this operation.

Table 2. Comparative Cost of Labor for Packing and Handling Pears in Wood and Fiberboard Containers Hood River, Oregon, 1954

Operation	Type of Container		
	C-Fiber cents/box	K-Fiber cents/box	Wood cents/box
Box and lid assembly	1.66	1.57	.84
Inspection and repairs	--	--	.23
Packing(100 size fruit)	12.75	12.75	12.75
Supplying liners	--	--	.10
Container closing ¹	.57	.94	.70
Labeling ²	--	--	.30
Car loading ³	.28	.28	.40
Total cost per box	15.26	15.54	15.32

¹Includes lidding for C-Fiber and K-Fiber boxes; and soaking and supplying lids, lid tacking, lidding, inspection and repair for wood boxes.

²Includes labeling, label pushing, and label brushing.

³Includes loading, changing stations, adjusting conveyor and stripping.

The C-Fiber box was lidded by hand and then turned over to eliminate the possibility of the top slipping off the box when it was picked up.

Only members of the car loading crew are accounted for in those costs in Table 2. This crew was composed of two men for the fiber cartons and three men for the wood boxes. The extra man for wood boxes stripped the boxes with laths and nails. His labor accounted for the higher car loading cost of the wood box. The cartons were not stripped.

Conveyors and chutes required to move boxes from storage to the car were designed for the wood box and fiberboard boxes did not move freely on this equipment. This, together with the fact that the fiberboard cartons were not stored in groups according to size, meant that the wood containers came down from storage at a much faster rate than did the cartons. The studies were made in such a way as to permit elimination of delays due to poor functioning of equipment. This made it possible to put estimates for loading different types of containers on a comparable basis. Figures for car loading operation are based on fruit coming out of storage at a rate of 800 boxes per hour.

Two different methods of loading fiberboard boxes in cars were observed--one at Medford and one at Hood River. Boxes at Medford, however, were loaded in a chimney style stack, three stacks across the car. This method of stacking allowed considerable room for ventilation between boxes and reduced the necessity of bracing the boxes. (Figure 5) The loading method at Hood River consisted of stacking the containers lengthwise of the car, eight boxes across and five boxes high. Very little space was left between the boxes for air circulation. (Figure 6)

Several of the methods used to handle the cartons were makeshift and would be replaced by more efficient methods if fiberboard containers were used on a major scale. In most cases this would entail a substitution of machinery for labor. For example, mechanical conveyors could be used to replace hand trucking the cartons to conveyor belts and lidding stations. The box closing operation would undoubtedly be done by automatic case sealers or stitching machines as is now done in the citrus and lettuce industries. Conceivably the box assembly operation also could be adapted to machinery. It is likely that improved methods for stamping and marking the filled fiberboard boxes would lead to economies in the packing operation. Conveyors and chutes used to transfer pears from storage rooms to the railroad car could be better designed to facilitate the car loading of fiberboard cartons. This would speed up the car loading operation. All of these suggested methods of improving the handling of the cartons would probably lead to a lower unit cost of labor for the fiberboard boxes, although increased equipment costs would have to be considered.

Differences in labor requirements were slight for the three containers.

Packing operations required the most labor and were practically identical for the three different containers. (Table 3) The wood boxes took slightly longer to pack because of lining the boxes. Liners were not inserted in the fiberboard cartons. (Figure 7)

The assembly time for the wooden box is for the automatic box making machine, based on an hourly output of 562 boxes. Assembly time for the semi-automatic machine was .41 man minutes per box, based on an hourly output of 438 boxes.

Table 3. Comparative Time Required to Pack and Handle Pears in Wood and Fiberboard Containers, Hood River, 1954

Operation	Type of Container		
	C-Fiber man min. per box	K-Fiber man min. per box	Wood man min. per box
Box and lid assembly	.78	.74	.21
Inspection and repairs	--	--	.11
Packing	1.99	2.06	1.96
Disposing box	.11	.11	.09
Getting box	.08	.08	.08
Lining box	--	--	.16
Miscellaneous ¹	.15	.15	.15
Supplying box liners	--	--	.05
Container closing ²	.27	.44	.24
Labeling	--	--	.15
Car loading ³	.12	.12	.17
Totals	3.50	3.70	3.37

Cost of K-Fiber box was much lower than the others. The wood box is the only one with appreciable costs other than the actual container cost. (Table 4) The wood container costs are an average of the costs of several representative Oregon packing houses. The stripping cost refers to the laths and nails used to strip boxes together in preparation for shipment by rail.

Cost of repair material for box breakage was not taken into account for the wood box. Nor was the cost of shook broken during box making counted.

Machinery and equipment costs for assembling and closing the different containers have not been included in this report. These costs were practically non-existent for the fiberboard cartons because the operations were performed largely by hand. If this type container were adopted in a commercial sense, much of this hand work would be replaced by machinery. Equipment costs for assembling and lidding the wood box are estimated to be relatively small, averaging less than one-third cent per packed box.

¹Includes stamping, getting and adjusting wraps and changing stations.

²Includes lidding for C-Fiber and K-Fiber boxes; and soaking and supplying lids, lid tacking, lidding, and inspection and repair for wood boxes.

³Based on fruit coming out of storage at a rate of 800 boxes per hour. Includes only car loading crew.

Table 4. Comparative Cost of Materials for Packing and Handling
Pears in Wood and Fiberboard Containers
Hood River, Oregon, 1954

Material	Type of Container		
	C-Fiber cents/box	K-Fiber cents/box	Wood cents/box
Box and lid ¹	52.00	35.30	42.12
Liner and pads	---	---	7.06
Paste and labels	---	---	.68
Stripping	---	---	.42
Total	52.00	35.30	50.29

Acknowledgments

The authors wish to extend their appreciation to the following persons and organizations: Members of the research committee, Oregon-Washington-California Pear Bureau; Mr. R. H. Patterson, Manager, Oregon-Washington-California Pear Bureau; the management and personnel of the cooperating pear packing plants located at Hood River and Medford, Oregon.

¹Includes box and lid for C box; box, liner, staples and tape for K box; and box, lid, and nails for wood box.

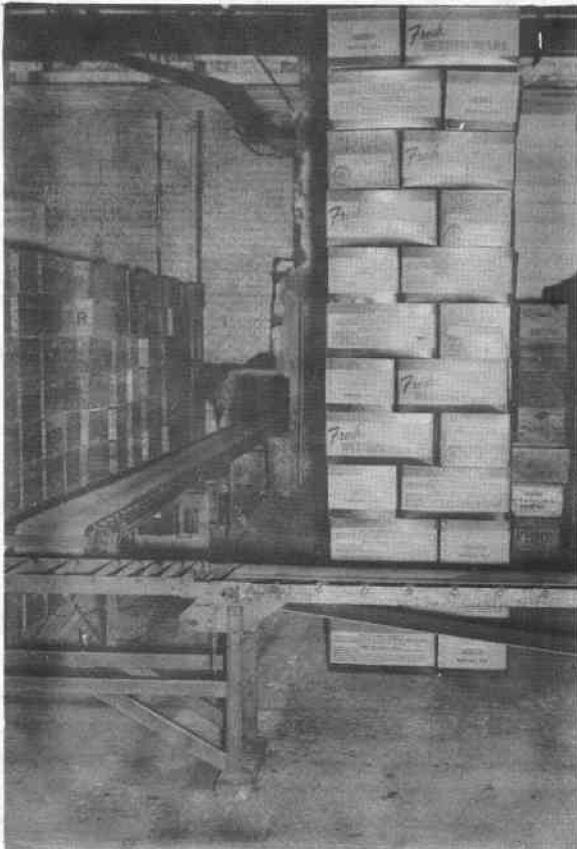


Figure 1. An experimental stack of fiberboard containers in storage. This stack had remained straight for 4 months.



Figure 2. Fiberboard cartons stacked by this method developed a pronounced lean in storage.

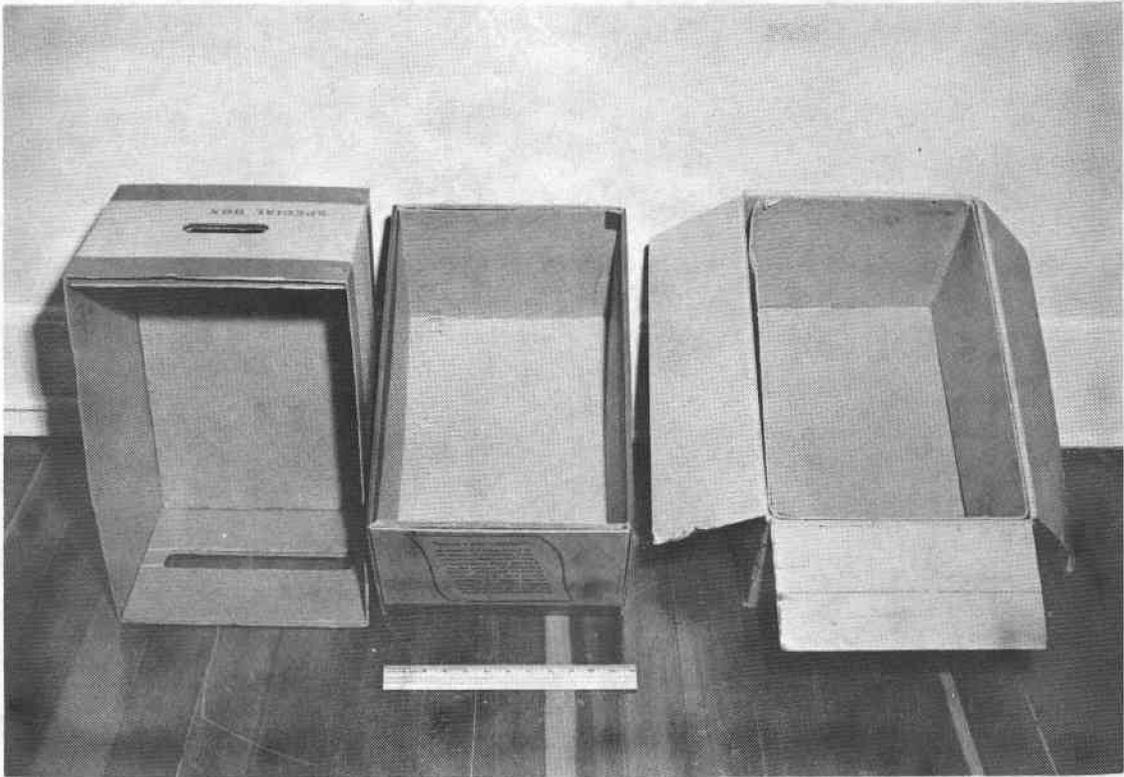


Figure 3. C box is in middle with top at left. K box with veneer liner inserted at right.



Figure 4. Packers were asked to make a flat pack in the fiberboard container.



Figure 5. The chimney style stack in car at Medford allowed space for ventilation.

Figure 6. This method of loading fiberboard cartons was used at Hood River.

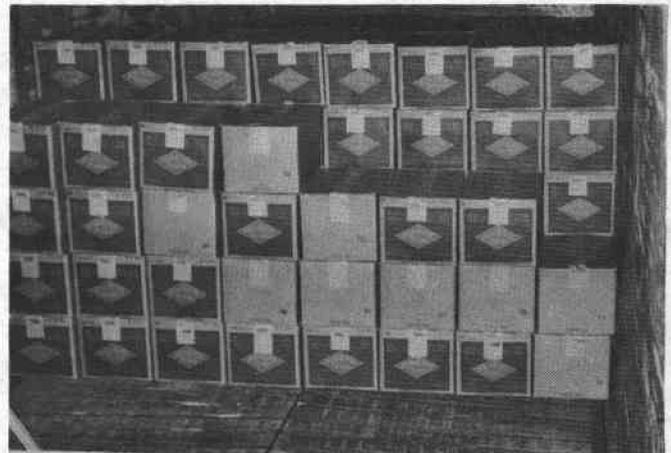


Figure 7. Packers liked fiberboard containers because they did not have to line boxes.