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Evaluation of SHIPPING CONTAINERS for Washington CHERRIES

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Agricultural Marketing Service • Transportation and Facilities
Research Division

PREFACE

This is a report on the development and evaluation of alternative shipping containers for Washington sweet cherries. The work was conducted in the Washington State production areas during the 1957, 1958, and 1959 marketing seasons. The study is part of a broad program of research aimed at improving marketing efficiency and expanding markets for farm products.

This report is one of many concerned with improving packages, shipping containers, and packing methods for fruits and vegetables. Related publications include:

Prepackaging California Grapes at Shipping Point,
Marketing Research Report 410, July 1960

Evaluation of New Containers for School Milk,
Marketing Research Report 407, June 1960

Prepackaging Early California Potatoes at Point of Production,
Marketing Research Report 401, June 1960

Fresh Produce Prepackaging Practices in the United States,
Marketing Research Report 341, July 1959

Prepackaging Firm Ripe Peaches,
An Interim Report, AMS-312, June 1959

Evaluation of Shipping Containers for Western Lettuce,
Marketing Research Report 248, July 1958

Evaluation of Shipping Containers for Florida Avocados,
Marketing Research Report 228, May 1958

Packing California Potatoes in Fiberboard Boxes,
Marketing Research Report 214, February 1958

Development of Carrot Prepackaging,
Marketing Research Report 185, June 1957

New Shipping Containers for Plums,
Marketing Research Report 128, June 1956

Prepackaging Tomatoes,
Marketing Research Report 20, October 1952

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Donald R. Stokes, agricultural economist, Transportation and Facilities Research Division, initiated and directed the study.

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SUMMARY

Packing Washington cherries loose in 20-pound boxes instead of facing 15-pound boxes with even rows would save close to \$200,000 a year in packing costs. However, buyers still are willing to pay significantly more per pound for cherries in faced boxes than for those in loose boxes. As a result, it pays the grower to pack a sizable portion of his cherries in faced boxes.

During the 1957, 1958, and 1959 marketing seasons, economic evaluations of shipping containers for fresh Washington State cherries were made. The costs of packing cherries in six plants were studied. Twenty rail test shipments of cherries in 1958 and 7 test shipments in 1959 were examined upon arrival in eastern markets. Prices received for these shipments were recorded, and the trade reaction to them was evaluated.

The 15-pound pack faced with two layers of cherries in even rows was an expensive one. This pack, known in the trade as the double row faced pack, cost 3.4 cents a pound more than the loose pack, mostly because of the very considerable time required by the packers to select 300 or more cherries and hand-fit them into precise alinement to form the double layer row face. The cost of packing and carloading materials and of direct labor averaged 7.4 cents per pound for the 15-pound face pack, and 4.0 cents per pound for the 20-pound and 14-pound loose packs.

All the containers in the 27 test shipments inspected at terminal markets adequately protected the cherries during handling and shipping. The level of bruising and of flesh punctures was not high enough to affect commercial acceptance.

Measurements of the diameters of the cherries indicated that the packers exercised about equal care in sizing the cherries in both the 15-pound face pack and 20-pound loose pack.

Since the extra costs of packing and carloading materials and direct labor were 3.4 cents a pound for cherries in the 15-pound face pack, a carload of 27,720 pounds of cherries would cost \$942 more than the same quantity of cherries packed loose in 20-pound boxes. About 350,000 15-pound face packs were shipped in 1959 and about 500,000 boxes in 1958. If these cherries had been packed loose in 20-pound boxes the savings in packing and carloading materials and direct labor could have amounted to \$180,000 in 1959 and \$225,000 in 1958.

Consideration should be given to other potential savings that could be obtained by plants increasing their output of the 20-pound loose packs. In addition to a reduction of freight costs (because of less tare weight) there is little doubt that significant economies could be obtained in packinghouses that concentrated on the 20-pound loose pack. Specialization of this nature by significantly reducing the packing labor force would also reduce concomitant costs of supervising, training, recruiting, and accounting. The use of the larger box would also mean fewer units needed to market the crop--this would effect savings whenever the fruit was handled. The recent development of cherry sizing machines which lend themselves to the assembly line belt methods of packing loose cherries will tend to increase the pack-out of loose cherries and probably will result in additional savings.

From an analysis of prices received for cherries in the face pack and in the 20-pound loose pack, it was estimated that cherries in the face pack brought a premium of somewhere around $7\frac{1}{2}$ cents a pound. Since the packing and shipping cost of the face pack was about $3\frac{1}{2}$ cents per pound higher than the loose pack, the net return to the grower probably averaged about 4 cents per pound greater on the face pack.

The premium that the wholesale trade is willing to pay for the 15-pound faced unit indicates its preference for this pack. It presents a beautiful appearance to the consumer, is conducive to impulse sales, and probably is an important selling aid when the high price per pound of cherries is considered. However, demand for the 20-pound loose pack is increasing. This pack was used for 8 percent of the cherries sold in nine auctions in 1957 and for 22 percent in 1958. In 1959, a short crop year, 20 percent of the cherries shipped to nine auctions were packed loose in 20-pound boxes.

Improved acceptance of the loose pack resulted from better grading and more accurate sizing of the cherries in it following adoption of a Federal marketing agreement. In previous years cherries in the loose pack were not always graded and sized as carefully as cherries in the face pack, in the opinion of receivers. When buyers realized they could obtain top quality cherries of an equivalent "row" size in either pack, trade reaction to the loose pack became more favorable. The stronger demand for the loose pack was reflected in the declining premium paid for the face pack. The premium, as measured by the season average auction price for Bing cherries, was 3.7 cents a pound less in 1959 than in 1958.

A demand by retail organizations for prepacked produce also continues and is encouraging the cherry packers to continue experimenting with shipping-point consumer packaging. Progress in this direction depends on the development of economically suitable consumer packages and efficient means of packing and handling them.

EVALUATION OF SHIPPING CONTAINERS FOR WASHINGTON CHERRIES

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Agricultural Marketing Service 1/

INTRODUCTION

It was estimated that 91 percent of the Washington State Bing and Lambert variety cherries shipped to market in 1957 were face-packed in 15-pound wood boxes, 8 percent were packed loose in 20-pound wood boxes, and 1 percent (mostly smaller cherries) were packed loose in 12- and 14-pound boxes. During the 1958 and 1959 seasons shippers experimented with cherries packed in consumer size plastic baskets.

The Washington State cherry industry, much aware of rising costs of labor and materials, has wanted to ship most of its cherries in less expensive packs. However, the industry has been uncertain about the advantages and disadvantages of changing a substantial part of its production from the more expensive faced pack (generally known as the double row face) to the less expensive but less attractive loose pack. Because of potential savings, the industry has been particularly interested in the larger 20-pound loose cherry pack. This study was undertaken in response to the need for an evaluation of the various cherry packs.

During 1957, preliminary studies were begun on cherry shipping containers then in use. These studies were continued during 1958 and 1959. The three most widely used cherry packs were studied: (1) the 15-pound face, (2) the 20-pound loose, and (3) the 14-pound loose.

Objective

The objective of this study was to evaluate containers used by the Washington cherry industry by comparing container and accessory material costs, labor requirements, arrival condition, and trade acceptance.

Procedure

Time studies in six plants were conducted in June and July of 1957, 1958, and 1959. Direct labor requirements for assembling containers, packing, loading, and preparing the finished box for shipment were determined. Methods of

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packing were studied, and costs of containers, accessory packing materials and loading materials were recorded. Time studies for packing all three kinds of boxes were made in five plants. In the sixth plant only two kinds of boxes were studied.

A total of 27 test shipments of Bing and Lambert cherries were inspected upon arrival in eastern markets during 1958 and 1959 to obtain data on the performance of alternative containers. Information was obtained on (1) discoloration and bruising, (2) stem punctures and cuts, and (3) decay. Diameters of cherries packed in the different containers were measured. Researchers also obtained wholesale trade reaction and comparative prices paid at auction.

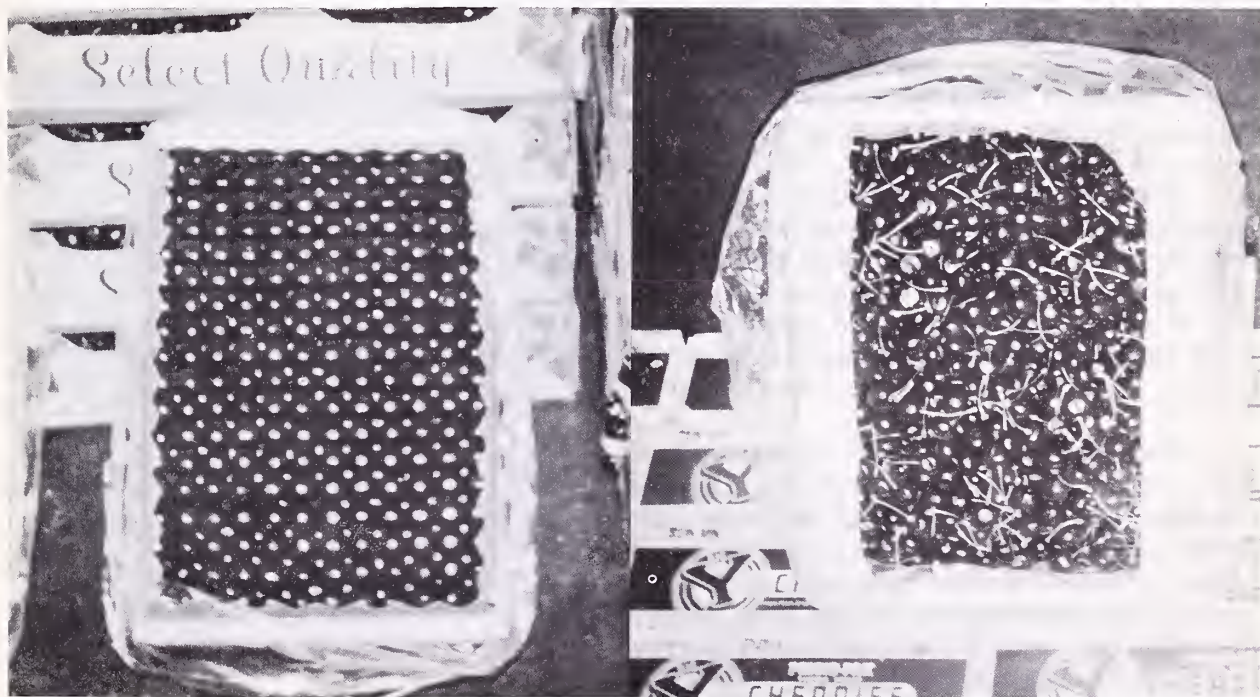
DESCRIPTION OF CONTAINERS STUDIED

15-Pound Wood Box

The container used for the face pack of cherries was a six-piece nailed wood box with inside dimensions of 3-5/8 by 10-1/2 by 15 inches. The ends were 1/2 inch thick and the sides 1/4 inch thick. This container had a capacity of 571 cubic inches and held 15 pounds of cherries (fig. 1).

20-Pound Wood Box

The containers used for 20 pounds of loose-packed cherries were six-piece nailed wood boxes (fig. 2). The most commonly used box had inside dimensions



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Figure 1.--The 15-pound double row faced pack.

Figure 2.--The 20-pound loose pack of cherries.

of 3-3/4 by 13-1/2 by 16 inches. The ends were 1/2 inch thick and the sides 1/4 inch thick. To the top of this box were added cleats 1/2 inch thick (1/2 by 11/16 by 13-1/2 inches) which increased the depth to 4-1/4 inches. This container had a capacity of 918 cubic inches and held 20 pounds of cherries packed loose. One plant used a box with inside dimensions of 5 by 11-1/2 by 16 inches and a capacity of 920 cubic inches.

14-Pound Wood Box

The third container was a six-piece nailed wood box with inside dimensions of 3-3/8 by 10-1/2 by 15 inches. It was used for the 12-, 13-, and 14-pound loose packs by adding shims to the lid to accommodate different net weights. The ends were 1/2 inch thick and the sides 1/4 inch thick.

PRELIMINARY EVALUATION OF EXPERIMENTAL CHERRY CONTAINERS

During the 1958 and 1959 cherry marketing seasons some shippers experimented with consumer size plastic baskets. The plastic baskets were placed in a one-piece corrugated fiberboard tray which was folded to shape. When folded, the tray had single sides and double ends, with a double wall divider down the middle. Inside dimensions were 4-1/8 by 15-1/2 by 18-3/4 inches. The double-face cover of corrugated fiberboard was 15-1/2 by 19-1/2 inches. Eight plastic baskets, each holding 1-3/4 pounds, were placed in a tray, making a total net weight of 14 pounds (fig. 3). Wire inserts in each end of the tray extended upward 6-1/4 inches from the top to accommodate another tray which was slotted to accept the wire loops. In this manner these trays were shipped as a set of 2 trays holding 16 baskets of cherries with a net weight of 28 pounds.

The costs of materials for this container are reported in table 1. The average cost was 33 cents for one tray holding 14 pounds, or 66 cents for a set of two trays holding 28 pounds net. Costs averaged 2.4 cents per pound of fruit.

Some shippers in 1959 experimented with a full telescope fiberboard lid for the 20-pound loose pack, to replace the wooden lid. It may be possible to use a less expensive wood box with such a cover. Inside dimensions of the 20-pound box used in one shipment were 3-3/4 by 13-1/2 by 16 inches. The full telescope fiberboard lid measured 4-1/8 by 14 by 17-1/2 inches. It had a hinged hand hold on each end measuring 1 by 3-1/2 inches. The cost of the lid, based on estimates from the



EN-10912

Figure 3.--Each of these experimental shipping containers holds eight consumer size plastic baskets, each with 1-3/4 pounds of cherries.

suppliers, was \$73 per 1,000. There was an added cost of \$9.25 per 1,000 for one- or two-color printing on quantities under 5,000.

Table 1.--Cost of materials for packing Washington cherries in plastic baskets, Yakima, 1959 ^{1/}

Materials	:	Cost per tray (14 pounds of fruit in 8 baskets)	:	Cost per pound of fruit
	:	<u>Cents</u>	:	<u>Cents</u>
Fiberboard trays.....	:	16.8	:	1.20
Glue.....	:	.6	:	.04
Cover ^{2/}	:	3.0	:	.21
Wire inserts.....	:	1.6	:	.12
Plastic baskets.....	:	11.2	:	.80
Total cost per tray.....	:	33.2	:	2.37

^{1/} Costs are based on estimates from manufacturers on materials purchased in reasonable quantities delivered to Yakima, Wash.

^{2/} Some shippers used 1 cover for every 2 sets, and 1 shipper used 1 cover for each tray.

COSTS OF PACKING MATERIALS

Costs of containers and accessory packing materials for the three principal shipping containers for cherries are shown in table 2. These figures are based on quotations from packers and manufacturers. Total costs for containers and accessory packing materials averaged 42.3 cents for the 15-pound face pack, 43.8 cents for the 20-pound loose pack, and 29.1 cents for the 14-pound loose pack. These costs averaged 2.8 cents per pound of fruit for the 15-pound box, 2.2 cents for the 20-pound box, and 2.1 cents for the 14-pound loose pack.

The equivalent cost of materials for 20 pounds of cherries packed in 15-pound units would be 56.5 cents, 12.7 cents more than for the 20-pound loose pack.

AMOUNT AND COST OF DIRECT LABOR FOR PACKING

Labor requirements were determined by time studies conducted in six packing sheds located in the Yakima and Wenatchee production areas. The time studies for plant operations began with the labor required to pack and fill the various containers. As part of the packing operation, the worker in the plant using the bin method not only packed the box but selected and sized the cherries. The worker in the plant using the belt method packed cherries that were already sorted and sized. Since this report is an evaluation of different containers and not packing methods, times used for packing by both methods have been averaged and are called packing and filling. The labor requirements have been increased 15 percent to compensate for personal time and fatigue.

Table 2.--Cost of materials for packing Washington cherries in 3 sizes of wood boxes, 1959

Item	15-pound	20-pound	14-pound			
	face pack	loose pack	loose pack			
	Cost per box	Cost per pound	Cost per box	Cost per pound	Cost per box	Cost per pound
	Cents	Cents	Cents	Cents	Cents	Cents
Containers:						
Shook.....	26.4		27.2		18.4	
Nails.....	.7		.8		.7	
Glue.....	.2		.2		.2	
Label.....	.3		.3		.3	
Total.....	27.6	1.8	28.5	1.4	19.6	1.4
Accessory materials:						
^{1/} Side and end guards.....	1.7		1.6		---	
Curtain or collar.....	3.0		3.4		3.4	
Facing tray.....	2.3		---		---	
Pads.....	1.7		3.4		.8	
Polyethylene liner.....	6.0		6.9		5.3	
Total.....	14.7	1.0	15.3	.8	9.5	.7
All packing material costs...	42.3	2.8	43.8	2.2	29.1	2.1

^{1/} Not all plants studied used all the accessory materials listed in the table.

Description of Packing Operations

In all the plants studied the containers were assembled and either a part or all of the accessory packing materials were placed in the box before they were delivered to the packing lines.

15-Pound Face Pack

The 15-pound face pack of cherries consists of a face of two layers of cherries carefully placed in the top of the inverted box with stems pointing toward the bottom of the box. After the face is completed the box is filled with sorted and sized cherries and the bottom secured.

Two different methods of packing were found in the plants studied. These were the bin and the belt methods.

Packing from Bins

Plants using the bin method hired 200 to 300 packers; each packer worked at her own individual table or bin.

Cherry supply.--One worker supplied 20 to 30 packers with cherries by carrying a field lug of cherries to each table. He also supplied the packer with packing materials. This labor is not included in the time studies of packing operations since it would be the same for all containers.

Packing.--Each packer sorted, sized, and packed her own cherries in an upside down box with cover in place and bottom open. (One plant used a machine to size the cherries.) As a guide for the face, the packers used a pulpboard tray with cherry-sized indentations. The packer completed the face and then filled it with sized and sorted loose cherries.

Weighing.--After the box was packed it was sent to a station where a worker weighed it and adjusted the contents to the correct net weight.

Stamping.--One to two workers stamped the variety, name, grade, size, and lot number on each box.

Prepare for closure.--Two to four workers (1) settled the cherries in the box, (2) folded and tied a polyethylene liner, and (3) in some plants, added guards and pads.

Closing.--The bottoms were nailed to the boxes by a lidding machine operated by one worker.

Inspection.--After the bottom was nailed on, the box was turned right side up, and a worker opened the lid. The box then went to the inspection station where three to five workers opened the polyethylene liner, examined the face, and closed the liner. If a face was faulty it was repacked at this station. The worker who opened the box renailed the lid.

A variation in this method was found in one plant where the face was inspected before the fill was added. One worker supervised 15 packers and approved each face before it was filled. This eliminated inspection of the face after the box was closed.

Packing from Belts

A "straight line" method was used in packing from belts. Weighing, stamping, preparing to close, closing, and inspecting were the same whether the cherries were packed from bins or belts.

Cherry supply.--A two- or three-man team carried field lugs of cherries from the supply pallet, dumped the fruit on the belt, and took away the empty field lugs.

Sorting and sizing.--Thirty to forty workers sorted and sized the cherries from the belt. In those plants where sizing was done by machines, only the sorting was done by hand. When a lot of cherries contained a high percentage of culls the rate of production decreased.

Packing.--The packing operation was divided into two parts. The facing operation was accomplished by 15 to 35 packers who stood on either side of the belt and placed the face only. When the face was placed the box continued to the end of the line where it was filled with sorted and sized cherries--off the belt--which the packers had let by. The packers could not face enough boxes to use up the sorted and sized cherries, so at this point 20-pound boxes of loose cherries were packed whenever 15-pound boxes with the face were not ready for filling. The production rate of the 15-pound faced boxes depended primarily on the facing operation.

20-Pound Loose Pack

The 20-pound container was jumble packed with sorted and sized cherries. Whereas the 15-pound face pack was always filled with cherries the size of those in the face, the 20-pound loose pack was usually packed with cherries $5\frac{1}{4}/6\frac{1}{4}$ inch in diameter or larger. However, a few plants sized and packed 10-, 11-, and 12-row size cherries in the 20-pound pack. (The 12-row size cherry is $5\frac{6}{64}$ inch in diameter; 12 rows fit precisely into the $10\frac{1}{2}$ -inch width of the standard 15-pound box. The 11-row and 10-row cherries are slightly larger).

The belt and bin methods of packing were also used for the 20-pound loose pack. The operations performed in each plant were the same as for the 15-pound face pack except that it was not necessary for the packers to pack a face and the inspection operations were eliminated.

14-Pound Loose Pack for Smaller Cherries

The 14-pound container was jumble packed with sorted cherries $4\frac{8}{64}$ inch in diameter and larger. The packing operation in each plant, whether by the bin or belt method, was the same as for the 20-pound loose pack.

Direct Labor Requirements

The average amount of direct labor used to pack cherries in the three containers is shown in table 3. The three kinds of packs required essentially the same amount of labor to assemble the box, place accessory materials in box, and to weigh, stamp, prepare for closing, and close the box in the six plants studied, whether the plants used the bin or belt method or both.

After the study was begun in 1957, some plants changed from the bin to the belt method. The average labor requirements for the three types of cherry packs combine the bin and belt methods of packing and include hand and mechanical sizing of cherries under "packing or filling."

Table 3.--Direct labor used in packing Washington cherries in 3 sizes of wood boxes, 1957-59 1/

Operation	15-pound face pack	20-pound loose pack	14-pound loose pack
	<u>Man-minutes</u>	<u>Man-minutes</u>	<u>Man-minutes</u>
Assemble box.....	0.30	0.30	0.30
Place accessory materials in box.....	.33	.33	.33
Pack or fill.....	21.47	10.24	6.78
Weigh.....	.42	.42	.42
Stamp.....	.48	.48	.48
Prepare for closing.....	1.84	1.84	1.84
Close.....	.12	.12	.12
Inspect face.....	1.80	---	---
Total.....	26.76	13.73	10.27

1/ Average, 6 plants.

The significant difference in labor requirements between the three types of cherry packs is in the packing or filling operation. Because of the time-consuming double face, the 15-pound box required 21.47 man-minutes, whereas the 20-pound loose pack took 10.24 minutes and the 14-pound loose pack took 6.78 minutes. The 15-pound packs also required an average of 1.80 man-minutes for inspecting the face, whereas the loose packs were not inspected after the boxes were closed.

Direct Labor Costs

Because some of the workers were paid piece rates and others were paid by the hour, all labor costs were calculated at an assumed rate of \$1.50 per hour. The costs of direct packing labor are shown in table 4. The effect of the greater amount of time required to face the 15-pound pack is apparent. Labor to pack 15 pounds of cherries with a face cost twice as much as labor to loose-pack 20 pounds of cherries. This additional labor cost was 2.74 cents per pound.

COMBINED COSTS OF PACKING MATERIALS AND DIRECT LABOR

The costs of direct labor and of packing materials used to pack cherries loose or faced are shown in table 5. The cost of labor and packing materials for the 15-pound face pack was 3.4 cents per pound higher than for the 20-pound or 14-pound loose packs, or 68 cents per 20 pounds of cherries.

Table 4.--Cost of direct labor used in packing Washington cherries in 3 sizes of wood boxes, 1957-59 ^{1/}

Operation	15-pound		20-pound		14-pound	
	face pack	Per pound	loose pack	Per pound	loose pack	Per pound
	Per box	Per pound	Per box	Per pound	Per box	Per pound
	Cents	Cents	Cents	Cents	Cents	Cents
Assemble box.....	0.750	0.050	0.750	0.038	0.750	0.054
Placing accessory material in box.....	.825	.055	.825	.041	.825	.059
Packing or filling.....	53.675	3.578	25.600	1.280	16.950	1.211
Weighing.....	1.050	.070	1.050	.052	1.050	.075
Stamping.....	1.200	.080	1.200	.060	1.200	.086
Preparing for closure..	4.600	.307	4.600	.230	4.600	.328
Close.....	.300	.020	.300	.015	.300	.021
Inspection.....	4.500	.300	---	---	---	---
Total.....	66.900	4.460	34.325	1.716	25.675	1.834

^{1/} Average, 6 plants. Labor costs calculated at \$1.50 per hour.

Table 5.--Combined costs of packing materials and direct labor used in packing Washington cherries in 3 sizes of wood boxes, 1959 ^{1/}

Item	15-pound		20-pound		14-pound	
	face pack	Per pound	loose pack	Per pound	loose pack	Per pound
	Per box	Per pound	Per box	Per pound	Per box	Per pound
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
Packaging materials.....	0.423	0.028	0.438	0.022	0.291	0.021
Direct labor.....	.669	.045	.343	.017	.257	.018
Total.....	1.092	.073	.781	.039	.548	.039

^{1/} Labor costs are calculated on an assumed wage of \$1.50 per hour.

COMPARATIVE COSTS OF CARLOADING

Material Costs

The cost of materials used in loading a railroad car with three types of cherry packs is shown in table 6. The 1959 cost of laths for strips was 80 cents a bundle. Lumber for bracing (2 by 4's) cost 2.2 cents a foot. For the 15-pound face pack, 10 bundles of car strips and 166 feet of 2 by 4's were used in a car. For the 20-pound loose box, 7 bundles of car strips and 156 feet of 2 by 4's were used. The 14-pound box required 7 bundles of laths and 166 feet of 2 by 4's. More lathing was used for the face pack in order to protect the face. The average cost of material per car was \$11.65 for the 15-pound face pack, \$9.25 for the 14-pound loose pack, and \$9.03 for the 20-pound loose pack.

Table 6.--Cost of materials per rail car for loading Washington cherries packed in 3 sizes of wood boxes, 1959 1/

Material	15-pound	20-pound	14-pound
	face pack	loose pack	loose pack
	<u>Dollars</u>	<u>Dollars</u>	<u>Dollars</u>
Car strips:			
10 bundles.....	8.000	---	---
7 bundles.....	---	5.600	5.600
2 by 4's:			
8 8-foot lengths.....	1.408	1.408	1.408
10 6-foot lengths.....	1.320	---	1.320
10 5-foot lengths.....	---	1.100	---
14 3-foot lengths (center brace spreaders).....	.924	.924	.924
Total.....	11.652	9.032	9.252

1/ Average, 4 plants.

Direct Labor Costs

Only the handtruck method of loading cars was timed. Two workers picked up readymade stacks and trucked the fruit a distance of 90 feet. Four workers stacked the boxes in the car and nailed the layer strips in place and three workers braced the stacks. Table 7 shows the labor requirements for carloading in man-minutes per box.

Table 7.--Direct labor required per box for loading Washington cherries on rail cars, by 3 sizes of wood boxes, 1959 1/

Operation	15-pound	20-pound	14-pound
	face pack	loose pack	loose pack
	<u>Man-minutes</u>	<u>Man-minutes</u>	<u>Man-minutes</u>
	<u>per box</u>	<u>per box</u>	<u>per box</u>
Hand trucking.....	0.14	0.18	0.14
Stacking and stripping....	.40	.48	.36
Bracing.....	.06	.06	.06
Total.....	.60	.72	.56

1/ Average, 4 plants.

Handtrucks carried 12 of the 15-pound or 14-pound boxes per load or 10 of the 20-pound boxes. This variation in truckloads accounts for the variation per box in man-minutes and cost of handtrucking. The average cost of direct labor for loading the 14- and 15-pound boxes was 0.1 cent per pound and for the 20-pound packs 0.09 cent (table 8).

Combined Costs of Carloading Materials, and Labor

The average combined cost of materials and direct labor used in loading the car was 0.14 cent per pound of fruit for the 15-pound and 14-pound boxes and 0.12 cent per pound for the 20-pound boxes (table 8).

In order to compare carloading costs, hypothetical carloads of 27,720 pounds of cherries are used. This is based on a car of 1,848 of the 15-pound face packs stacked in 22 stacks, 7 boxes wide and 12 boxes high. This quantity of cherries would require 1,386 20-pound loose packs or 1,980 14-pound loose packs. On this basis, the carloading costs (labor and materials) would amount to \$38.81 per carload for the 14- or 15-pound boxes and \$33.26 for the 20-pound box.

Table 8.--Cost of material and direct labor for loading Washington cherries on rail cars, by 3 sizes of wood boxes, 1959 ^{1/}

Item	15-pound		20-pound		14-pound	
	face pack	loose pack	face pack	loose pack	face pack	loose pack
	Per box	Per pound	Per box	Per pound	Per box	Per pound
	Cents	Cents	Cents	Cents	Cents	Cents
Materials:						
Laths.....	0.432	0.0288	0.404	0.0202	0.303	0.0216
2 by 4's.....	.198	.0132	.248	.0124	.198	.0141
Direct labor.....	1.500	.1000	1.800	.0900	1.400	.1000
Total.....	2.130	.1420	2.452	.1226	1.901	.1357

^{1/} Average 4 plants. Labor costs are calculated on the basis of an assumed wage rate of \$1.50 per hour.

COMBINED PACKING AND CARLOADING COSTS

The combined costs of materials and direct labor for packaging and loading cherries are shown in table 9.

The cost of material and labor for packing and loading cherries in the 15-pound faced pack was 3.4 cents higher per pound than for the 14- or 20-pound loose packs. On an equivalent 20-pound basis, the packing and loading costs of the 15-pound face pack averaged \$1.48 and the 20-pound loose pack averaged 80 cents--a difference of 68 cents for each 20 pounds of cherries packed.

COMPARATIVE TRANSPORTATION COSTS

The 15-pound face pack was billed at 17-1/2 pounds, the 20-pound loose pack at 23 pounds, and the 14-pound loose pack at 16-1/2 pounds. The gross billing weight for 27,720 pounds of cherries packed in 1,848 15-pound boxes amounted to 32,340 pounds. The gross billing weight for the same quantity of cherries packed in 1,386 20-pound boxes amounted to 31,878 pounds, and the billing weight in

1,980 14-pound boxes was 32,670 pounds. In order to ship 27,720 pounds of cherries in the 15-pound faced boxes, the shipper must pay for 462 pounds more tare weight than if he ships in 20-pound packs; to ship 14-pound loose packs the shipper must pay for 792 pounds more weight than if he ships 20-pound loose packs.

Table 9.--Costs of labor and materials for packing Washington cherries and loading on rail cars, 3 sizes of wood boxes, 1959 ^{1/}

Item	15-pound face pack		20-pound loose pack		14-pound loose pack	
	:Per box:	:Per pound	:Per box:	:Per pound	:Per box:	:Per pound
	: Dol.	Dol.	Dol.	Dol.	Dol.	Dol.
Packaging materials..:	0.423	0.028	0.438	0.022	0.291	0.021
Packaging labor.....:	.669	.045	.343	.017	.257	.018
Loading material.....:	.006	2/	.006	2/	.005	2/
Loading labor.....:	.015	.001	.018	.001	.014	.001
Total.....:	1.113	.074	.805	.040	.567	.040

^{1/} Direct labor costs are calculated at an assumed wage of \$1.50 per hour.
^{2/} Less than 1/10 cent.

Table 10 shows freight and express charges for theoretical carloads of 1,848 15-pound boxes, 1,386 20-pound boxes, and 1,980 14-pound boxes of cherries shipped to New York and Chicago. Because of less tare weight, it cost less to ship cherries in the 20-pound boxes. For the 15-pound boxes, freight charges to New York City were \$10.44 higher than for the 20-pound boxes, and the express charges were \$20.23 higher; for the 14-pound boxes, freight charges were \$17.90 higher and express charges were \$34.69 higher. Refrigeration costs were not included.

EVALUATION OF CHERRIES AND CONTAINERS AT TERMINAL MARKETS

In order to evaluate the effects of using the different containers, 27 rail test shipments to eastern markets were initiated in 1958 and 1959. Research workers measured the diameters of the cherries packed in the different containers, obtained the prices received for cherries packed in the different containers, and observed the reaction of the trade to the different types of packs.

Arrival Condition of Test Shipments

The conventional 15-pound face pack was used as the standard for comparing the 20-pound and the 14-pound loose packs and the experimental consumer size plastic baskets packed in 28-pound units. Ten test shipments contained more than two container types so that 23 comparisons were made of the 15-pound face pack and the 20-pound loose packs, 8 comparisons were made of the 15-pound pack and the 14-pound loose pack, and 6 comparisons were made of the 15-pound face pack and the 28-pound pack of plastic baskets.

Table 10.--Railroad freight and express charges for shipping 27,720 pounds (net weight) of Washington cherries from Yakima Valley to Chicago and New York, in 3 sizes of wood boxes, July 1959 1/

Rate and destination	15-pound face	20-pound loose	14-pound loose
	pack (32,340 pounds gross billing weight)	pack (31,878 pounds gross billing weight)	pack (32,670 pounds gross billing weight)
	Dollars	Dollars	Dollars
Freight rates to:			
Chicago (\$2.20 per cwt.)....:	711.48	701.32	718.74
New York City (\$2.26 per cwt):	730.88	720.44	738.34
Express rates to:			
Chicago (\$3.80 per cwt.)....:	1,228.92	1,211.36	1,241.46
New York City (\$4.38 per cwt):	1,416.49	1,396.26	1,430.95

1/ Hypothetical carloads: 1,848 15-pound boxes billed at 17½ pounds, 1,386 20-pound boxes billed at 23 pounds, and 1,980 14-pound boxes billed at 16½ pounds. Rates based on minimum of 30,000 pounds.

When the test shipments arrived at terminal markets Department packaging specialists examined the condition of the cherries and the containers. The results of these examinations are shown in table 11.

The arrival condition of the cherries in all containers was excellent. The level of injury and decay was low and did not affect commercial acceptance. There was no significant difference between the arrival condition of the new containers studied and the arrival condition of the 15-pound pack.

In the terminal markets the buyers pay particular attention to the firmness, stem color, and overall appearance of the cherries. The buyers want firm, bright-looking cherries with green stems. In this connection, polyethylene liners appear to be an important factor in the preservation of moisture, brightness, and fresh stems. 2/ For example, it was noted that several shipments of cherries packed in the plastic baskets without polyethylene film liners arrived at eastern terminal markets with a dull appearance and browning stems. Buyers prefer cherries packed in polyethylene liners and are apt to be very critical of Washington cherries not shipped in them.

Only one test shipment included the experimental full telescope fiberboard lid on the 20-pound loose packs in wood boxes. The cherries packed in this box sustained somewhat more bruising than in the 15-, 20-, or 14-pound boxes. Most of this bruising occurred under the lid at the center of the box. The percentage of stem punctures, cuts, and skin breaks paralleled the good record of the cherries packed in standard boxes.

2/ Gerhardt, Fisk; Schomer, Harold, and Wright, T. R. Sealed Film Lug Liners for Packing Bing Cherries. U. S. Agr. Mktg. Serv. AMS-121, 8pp., illus. Sept. 1956.

Table 11.--Arrival condition of cherries in 27 test shipments from Yakima, Wash. at eastern terminal markets, by kind of container, 1958-59

Arrival condition	Average 23 shipments containing both 1/--		Average 8 shipments containing both 1/--		Average 6 shipments containing both 1/--	
	15-pound face pack	20-pound loose pack	15-pound face pack	14-pound loose pack	15-pound face pack	28-pound plastic basket pack
	Percent	Percent	Percent	Percent	Percent	Percent
Sound.....	93.2	94.0	93.4	93.0	91.6	92.7
Bruising:						
Slight.....	4.0	3.9	4.1	5.3	5.7	4.4
Damage.....	.7	.5	.7	.6	.7	.5
Serious.....	.3	.4	.2	.1	.1	.1
Total.....	5.0	4.8	5.0	6.0	6.5	5.0
Stem punctures, cuts, and skin breaks:						
Slight.....	.9	.8	.5	.5	1.1	1.9
Damage.....	.3	<u>.2</u>	.4	.2	.5	.2
Serious.....	.2	<u>.2</u>	.2	.1	.2	0
Total.....	1.4	1.0	1.1	.8	1.8	2.1
Decay.....	.4	.2	.5	.2	.1	.2

1/ Differences not statistically significant.

2/ Less than 0.1 percent.

All the wood boxes examined at terminal markets arrived in excellent condition. Some creasing of the fiberboard trays used for the plastic basket consumer packs was noted.

Sizes of Cherries in Faced and Loose Packs

A problem confronting the Washington cherry industry in its attempts to increase the use of the 20-pound loose pack is that some buyers think that less care goes into sizing cherries for the loose pack than in the faced unit.

When research workers inspected cherries upon arrival at terminal markets they also measured the diameter of samples of the cherries they inspected. The cherries were measured with the aid of a plastic card which had holes in it graduating 1/16-inch in diameter. The 15-pound faced units and some 20-pound loose units were marked either 10-, 11-, or 12-row size. Most 20-pound loose packs, however, were marked "5 1/4/6 1/4-inch diameter or larger" and all the smaller loose packs were marked "4 8/6 1/4-inch diameter or larger."

The measurement of almost 9,000 cherries at the terminal markets indicated that the shippers were almost equally exact in sizing the 15-pound face packs and the 20-pound loose packs.

Table 12 lists the sizes marked on the various boxes and the actual sizes of the cherries they contained, as measured to the nearest 16th of an inch by researchers in the terminal markets. The findings were a tribute to the skill of the packers who, for the most part, selected cherries of a wanted size by eye and sense of touch alone. (Since this study was made, a number of plants have installed mechanical sizing equipment.)

When appropriate figures in the first two percentage columns of table 12 are added together (34.0 percent 17/16 inches or larger, plus 41.4 percent 16/16 inch), it may be seen that 75.4 percent of the cherries in the 15-pound 10-row face pack and 80 percent (31.0 plus 49.0) of the cherries in the 20-pound 10-row loose pack were a full 16/16 inch or more in diameter. Although the face pack contained a slightly lower proportion of all cherries an inch or more in diameter than the loose pack, the face pack had more of the larger cherries, 34 percent as compared to 31 percent.

Addition of pertinent entries in the first three percentage columns shows that 83.3 percent of the cherries in the 11-row face pack and 79.8 percent in the 20-pound 11-row loose pack measured 15/16 inch or more. However, the loose pack had a higher percentage in the largest size, 7.3 percent as compared to 3.8 percent for the 11-row face pack.

Combining the first four percentage columns reveals that the 12-row face pack and the 12-row loose pack in the 20-pound box held approximately the same quantity of cherries 14/16 inch or larger, 88.7 and 87.7 percent.

Comparison of Prices Received

Cherry prices are so volatile that they are difficult to compare for cherries packed in two types of containers unless exactly the same quality and condition are offered in both containers and sold at approximately the same time under similar conditions. In the auction markets the buyers are critical of the slightest variation in quality or condition. Also, in addition to the normal influences of supply and demand for cherries, the number of either 15-pound or 20-pound boxes being offered for sale on a particular day will affect the price relationship. Such factors as the position of a lot in the sale and the position of the lot in the display area may also affect the prices received for the cherries. For these reasons the trade has not established a consistent price relationship between the 15- and 20-pound packs and the difference in prices must be interpreted with caution.

The cherries packed loose in the 14-pound boxes are smaller sizes and are discounted 30 percent or more by the buyers.

Recognizing the limitations outlined above, the research workers recorded the prices paid for 18 rail shipments in 1958 that contained cherries in the 15-pound face and 20-pound loose packs (table 13). Each shipment contained at least three different sizes of cherries and many different lots, but the

Table 12.--Diameters of Washington Bing cherries in various containers of specified sizes of fruit, as measured upon arrival in eastern markets, 27 test shipments, 1958-59

Type of container and size of cherries marked on box	Cherries sampled	17/16 inches or larger	16/16 inch	15/16 inch	14/16 inch	13/16 inch	12/16 inch or less
	Number	Percent	Percent	Percent	Percent	Percent	Percent
15-pound face pack:							
10-row.....	1,100	34.0	41.4	18.0	5.6	1.0	0
11-row.....	1,300	3.8	39.3	40.2	12.7	3.9	.1
12-row.....	900	.3	5.9	41.2	41.3	11.3	.0
20-pound loose pack:							
10-row.....	700	31.0	49.0	15.7	3.6	.7	.0
11-row.....	1,050	7.3	33.0	39.5	16.1	4.1	.0
12-row.....	600	.8	9.2	43.3	34.4	12.0	.3
5 1/4/6 1/4 inches and larger.....	1,200	.8	20.0	44.7	25.7	7.7	1.1
14-pound loose pack:							
4 1/8/6 1/4 inches and larger.....	800	.0	.0	2.2	28.5	46.4	22.9
28-pound plastic basket pack:							
10-row.....	200	25.5	49.5	22.0	1.0	2.0	.0
11-row.....	650	14.2	47.6	26.5	9.7	2.0	.0
12-row.....	50	.0	12.0	44.0	40.0	4.0	.0
5 1/4/6 1/4 inches and larger.....	200	1.5	34.5	42.5	17.0	4.5	.0

1/ Approximate equivalent of 10-row size which is between 16/16 and 17/16 inches.

2/ Approximate equivalent of 11-row size.

3/ Exact equivalent of 12-row size.

4/ Equivalent of 12- to 13-row size.

5/ Equivalent of 13- to 14-row size.

Table 13.--Prices of Washington cherries in faced and loose packs in 18 test shipments at eastern auction markets, June-July 1958 ^{1/}

Variety, auction market, and test shipment number	15-pound face pack		20-pound loose pack		Premium paid for face pack per pound
	Per box	Per pound	Per box	Per pound	
	<u>Dollars</u>	<u>Dollars</u>	<u>Dollars</u>	<u>Dollars</u>	<u>Dollars</u>
Bing cherries:					
Philadelphia:					
No. 1.....	6.10	0.41	7.12	0.36	0.05
No. 3.....	5.79	.39	7.01	.35	.04
No. 11.....	5.73	.38	5.95	.30	.08
No. 12.....	5.19	.35	5.63	.28	.07
New York:					
No. 2.....	5.62	.38	6.35	.32	.06
No. 4.....	5.96	.40	7.53	.38	.02
No. 5.....	6.87	.46	8.73	.44	.02
No. 7.....	5.58	.37	7.07	.35	.02
No. 8.....	4.82	.32	4.83	.24	.08
No. 9.....	5.79	.39	5.22	.26	.13
No. 10.....	5.81	.39	7.05	.35	.04
No. 13.....	6.00	.40	6.72	.34	.06
No. 14.....	5.61	.37	6.14	.31	.06
Milwaukee: ^{2/}					
No. 6.....	7.04	.47	7.00	.35	.12
Boston:					
No. 20.....	3.65	.24	4.12	.21	.03
Average - Bings.....	5.70	.38	6.43	.32	.06
Lambert cherries:					
Philadelphia:					
No. 12.....	4.40	.29	4.19	.21	.08
New York:					
No. 16.....	6.04	.40	5.18	.26	.14
No. 17.....	4.37	.29	5.89	.29	.00
Boston: ^{2/}					
No. 20.....	3.65	.24	4.12	.21	.03
Average - Lamberts.....	4.91	.33	4.84	.24	.09

^{1/} Average for all sizes of cherries.

^{2/} Commission merchants.

cherries packed in both containers were of similar quality. For these shipments, the buyers paid an average premium of 6 cents per pound for the Bing cherries in 15-pound face packs and 9 cents per pound premium for the 15-pound faced Lamberts. The premium paid for the 15-pound packs of Bing cherries ranged between 2 cents and 13 cents per pound. There is no explanation for this wide variation.

Eight of the 18 test shipments in 1958 contained 15-pound face packs and 20-pound loose packs of Bing cherries in matched sizes. The buyers paid an average premium of 9 cents per pound for the 10-row size, 4 cents for the 11-row size, and 5 cents for the 12-row size in 15-pound faced packs (table 14).

Table 14.--Average price of Washington Bing cherries in faced and loose packs, in eight test shipments by size of cherries, New York and Philadelphia auctions, 1958

Type of pack	10-row size		11-row size		12-row size	
	Per box	Per pound	Per box	Per pound	Per box	Per pound
15-pound face pack.....	Dol. 6.53	Dol. 0.435	Dol. 5.36	Dol. 0.357	Dol. 4.75	Dol. 0.317
20-pound loose pack.....	6.90	.345	6.35	.318	5.40	.270
Premium for face pack..	---	.090	---	.039	---	.047

In 1959, three similar test shipments of 15- and 20-pound packs were made (table 15). In these three shipments the buyers paid a premium of 8 cents per pound for the Bing cherries in the 15-pound face pack.

Table 15.--Price of Washington Bing cherries in three test shipments, weighted average all sizes, in faced and loose packs at New York auction market, 1959

Test shipment	15-pound face pack		20-pound loose pack		Premium for face packs, per pound
	Per box	Per pound	Per box	Per pound	
No. 1.....	Dol. 9.14	Dol. 0.609	Dol. 9.92	Dol. 0.496	Dol. 0.113
No. 6.....	6.55	.437	7.71	.386	.051
No. 7.....	4.81	.321	4.94	.247	.074
Average.....	6.83	.455	7.52	.376	.079

The weighted average weekly prices received in 1958 on the New York, Philadelphia, and Chicago auctions showed a widely fluctuating differential in the prices of cherries packed in the 15-pound and 20-pound packs. The average weekly premiums paid for the cherries packed in the 15-pound faced box were:

	Range	Average
	<u>Cents</u>	<u>Cents</u>
New York.....	3.5-10	5.6
Philadelphia.....	1.5-10	7.4
Chicago.....	1.0-15	6.4

Washington Bing cherries were in comparatively short supply in 1959 and prices were substantially higher than in the previous year. The weighted season average prices in nine auction markets were: 3/

	<u>1958</u>	<u>1959</u>
15-pound face pack.....	\$5.70	\$6.61
20-pound loose pack.....	5.09	7.04

These box prices reflected a premium for the row face pack of 12.6 cents per pound in 1958 and 8.9 cents in 1959.

During the first four weeks of the 1960 season, the premium paid on the New York auction for Bing cherries in the 15-pound face pack decreased to 6.12 cents a pound. In the equivalent weeks of 1959 the premium was 7.95 cents. Cherries marketed in the 20-pound loose pack increased from 13.4 percent of the total volume in the two packs in 1959 to 19.4 percent in 1960.

The relatively greater price rise of the loose pack and the reduction in the premium paid for the face pack seem to indicate improved acceptance of the loose pack.

It is apparent from the foregoing series of price comparisons that the premium paid for cherries in the face pack varied considerably but generally averaged somewhere between 5 and 10 cents a pound. If the average premium amounted to, say, $7\frac{1}{2}$ cents a pound, the net return to the grower-shipper would be about 4 cents per pound greater in the face pack in view of the fact that it costs about $3\frac{1}{2}$ cents more to pack and ship than the loose pack.

Whether or not this premium will be paid in the future, of course, is a matter of conjecture. However, if the premium continues to decline as it did in nine auction markets between 1958 and 1959, the use of the more expensive face pack will become less advantageous for the grower-shippers; and the time may come when the less expensive loose pack will yield a larger net return.

3/ U. S. Agricultural Marketing Service, Fruit and Vegetable Div., Market News Branch. Yakima Weekly Fruit Report, 10 (33) Tuesday, Aug. 18, 1959. Wash. Dept. Agr., Div. Mkts., cooperating.

In the meantime it would seem wise for the industry to market cherries in both packs in order to appeal to all types of demand and to stimulate maximum sales.

Wholesale Trade Reaction

For the most part the trade prefers the 15-pound face pack. The best measure of this preference is the premium price that they have paid for it. However, it was the opinion of several receivers in the eastern terminal markets that confidence in the 20-pound loose cherry pack increased in 1959. The smaller premium paid for the faced units in 1959 tends to bear this out. Receivers feel that the sizing of cherries was greatly improved during 1958 and 1959. Moreover, there was considerable movement of loose-packed cherries to the large supermarkets and chains. These organizations, which are noted for being both price conscious and quality conscious, evidently have recognized that important savings can be made by buying cherries of equal quality in the less expensive loose packs.

The row face used in the 15-pound packs is very attractive and probably stimulates point-of-sale impulse buying. In the large cities where a discriminating demand exists there will continue to be a good market for the eye-catching face packs.

Reaction to the plastic basket consumer packs was that the size of the experimental unit, 1-3/4 pounds, was too large. Some of the plastic baskets were shipped without polyethylene liners, and unfavorable comment on the drying out and browning of the cherry stems was received.

Reaction to the use of a full telescope fiberboard lid on the 20-pound loose cherry pack was favorable. "It is easy to inspect, saves time." There may be potential savings in using such a lid by making the wood sides and ends thinner and less expensive.

Discussion

In 1959 Washington cherries were packed and shipped under a Federal marketing agreement and order for the third consecutive season. During these 3 years of self-regulation of size and quality, researchers noted an increasing buyer confidence in the 20-pound loose packs.

In 1956 Washington cherries were not sold at auction in 20-pound boxes; in 1957 8 percent were packed in 20-pound boxes; in 1958 the use of the 20-pound boxes increased to 22 percent; and in 1959 it declined slightly to 20 percent. The 1959 crop was about 35 percent smaller than the 1958 crop, which probably caused the leveling off of the trend toward increased use of the 20-pound box. In larger crop years, the packers are likely to pack more of the larger boxes.

Considerable savings in the total marketing costs for fresh cherries can be effected by increased use of the 20-pound loose pack. Materials and direct labor for packing and carloading the 15-pound box cost 3.4 cents a pound more than for the 20-pound box. A carload of 27,720 pounds of cherries would cost

\$942.48 more to pack and load in 15-pound faced boxes than in 20-pound loose packs. In 1959 about 350,000 boxes and in 1958 about 500,000 15-pound faced boxes were shipped. If these cherries had been packed loose in 20-pound boxes there could have been a savings of about \$180,000 in 1959 and \$255,000 in 1958. Also, because of less proportionate tare weight in the 20-pound packs, there could have been minor savings in freight charges.

The savings in packing and carloading materials, direct labor, and freight charges indicated by this study are not the only savings which may result from the increased use of the 20-pound box. In the packing plant, loose packing would require fewer workers and consequently would reduce costs of supervision, training, recruiting, and administration. The loose-fill packs lend themselves to straight-line or assembly-line methods of packing which require much less packinghouse space than the conventional method of packing from individual bins.

Also to be considered are the savings in handling at the terminal market and at wholesale and retailing levels. The larger 20-pound box requires fewer packages than the 15-pound pack for a given quantity of cherries.

Trade interest in the development of point-of-production prepackaging of cherries is growing. Shipment of the plastic baskets was another effort of packer-shippers to develop an economically suitable consumer package. This particular plastic basket shows promise, but additional development is necessary to determine the proper size of the unit, to develop an overwrap or a method of placing a polyethylene liner in the master container, and to develop better methods of packing these units.



