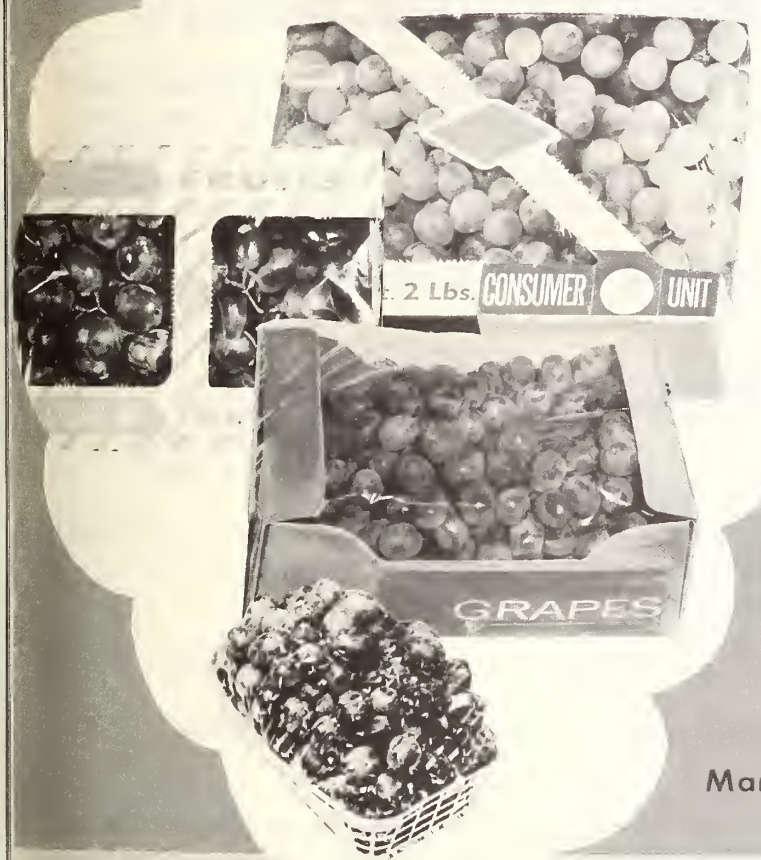
PREPACKAGING CALIFORNIA GRAPES

at shipping point



Marketing Research Report No. 410

United States Department of Agriculture
Agricultural Marketing Service
Transportation and Facilities Research Division

PREFACE

This report is one of a number evaluating new packages and shipping containers and new methods of packing fruits and vegetables in them. The study on which the report is based is part of a broad program of research aimed at improving marketing efficiency and expanding markets for farm products.

Retailers say they want to buy prepackaged California table grapes. Growers have hesitated to prepackage because of many unanswered questions, especially those concerning costs and the ability of consumer packages to protect highly perishable grapes in shipment to distant markets. This study was undertaken to find answers to these questions.

Many grower-shippers, manufacturers and suppliers of package material, wholesalers, and supermarket organizations cooperated in this project. In particular, credit is due The California Grape and Tree Fruit League and the following California grape shippers: B.H.&O. Cold Storage Co.; Ballantine Produce Co., Inc.; Barr Packing Co.; Bianco Packing Co., Inc.; D. Papagni Fruit Co.; Hall Packing Co.; L. R. Hamilton, Inc.; Kilburn Packing Corp.; Pacific Fruit Exchange; Red Banks Fruit Co.; Sadoian Brothers; Sierra Packing Co.

James B. Fountain and John L. Ginn, Agricultural Marketing Service, assisted with the evaluation of the consumer packages at the terminal markets.

Related publications previously issued by the U. S. Department of Agriculture include:

Fresh Produce Prepackaging Practices, MRR 341, July 1959

Evaluation of Shipping Containers for Western Lettuce, MRR 248, July 1958

Evaluation of Shipping Containers for Florida Avocados, MRR 228, May 1958

Packing California Potatoes in Fiberboard Boxes, MRR 214, February 1958

Development of Carrot Prepackaging, MRR 185, June 1957

New Shipping Containers for Plums, MRR 128, June 1956

A free copy of these reports may be obtained on request to the Office of Information, U. S. Department of Agriculture, Washington 25, D. C.

July 1960

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C. Price 25 cents

CONTENTS

SUMMARY

Fresh table grapes can be prepackaged successfully in California for shipment to eastern markets. Grape growers and packers received premium prices for prepackaged grapes in recent trial shipments, although packaging costs were greater. Moreover, grapes prepackaged in California arrived in eastern markets in better condition than comparable grapes packed and shipped in bulk boxes.

The usual premium charged was 50 cents per shipping container of prepackaged grapes because it cost about that much more to prepackage them than to bulk-pack them in a conventional wood box--from 94 cents to $1.08 as compared to 47 cents.

The prepackaged grapes arrived in eastern terminal markets with less than 1½ percent damage as compared to 2.3 percent for conventional bulk-packed grapes. Also, the consumer packages adequately protected the grapes in retail stores from further damage by consumer handling.

These studies were made over a 4-year period--1956-60. Researchers of the Agricultural Marketing Service evaluated grapes prepackaged in 8 different types of consumer packages in a total of 54 commercial trial shipments and 8 controlled test shipments. Several consumer packages were eliminated because of unfavorable characteristics. Four consumer packages proved to have considerable merit. Of these four packages, a folding tray overwrapped with film and a film window carton with a stapled recessed bottom met with the most favorable acceptance.

In 1960, one corporate grocery chain reported buying 58 carloads of grapes prepackaged in California--about 90 percent packaged in acetate film window cartons with stapled recessed bottoms. The price of this package was reduced in 1960, which coupled with the use of a cheaper master container and increased efficiency of operation permitted a premium differential of only 40 cents. Also, in 1960 a plastic basket in which the grapes were prepackaged after first being overwrapped with film was well accepted by receivers.

PREPACKAGING CALIFORNIA GRAPES AT SHIPPING POINT

By Philip W. Hale and Donald R. Stokes,
agricultural economists,
Transportation and Facilities Research Division,
Agricultural Marketing Service

INTRODUCTION

The packaging of Thompson seedless grapes in cellophane bags in self-service food stores was tested in August 1952. Results of these experiments indicated that losses due to shattering were considerably reduced when grapes were packaged in cellophane bags, principally because of less handling by customers. 1/ In retail stores, prepackaged grapes increase the efficiency and speed of checkout operations, make neat displays, and reduce unsightly and dangerous floor litter.

Attention is now shifting to the prepackaging of grapes at shipping points. Since 1954, shippers have been experimenting with the packaging of grapes in 2-pound consumer packages. Many types of consumer cartons and master shipping containers have been introduced to the packers but experimentation has been confined for the most part to various designs of two basic types of grape packages. These are folding paperboard cartons with cellulose acetate film windows, and folding paperboard trays overwrapped with either cellulose acetate or semimoistureproof cellophane films. Each type of package has advantages and disadvantages with respect to costs of material and labor, protection and ventilation afforded, handling and stacking ability, and attractiveness when displayed. The objectives of this study were to evaluate consumer packages for prepackaging grapes at point of production in California and to compare the costs of packing and shipping grapes in these consumer packages with costs of marketing grapes packed in bulk in standard wood boxes.

How Study Was Conducted

Beginning in 1956 preliminary investigations were made of many different packages that were tried by shippers. These included several types of window cartons, folding trays that were overwrapped with film, and a basket-type carton. These preliminary experiments by the shippers, manufacturers, and research workers were invaluable in the development of package specification and standards of performance.

Between 1956 and 1959 a total of 54 commercial trial shipments of 8 different types of consumer packages were inspected by packaging specialists of

1/ Hawes, R. L., McGaha, M. E., and Stokes, D. R. Prepackaging Thompson Seedless Grapes in Cellophane Bags in Retail Stores. U. S. Dept. Agr., Prod. & Mktg. Admin., January 1953. (Mimeo.)

the Agricultural Marketing Service upon arrival at terminal markets. Whenever possible they were also inspected in the retail stores after they had been on display 1 to 3 days. The followup inspections permitted determination of the condition of the packages and the grapes after additional handling by truckers, store clerks, and customers.

Research workers examined the grapes to determine the amount of bruising, crushing, decay, stem punctures, cuts, or skin breaks. The inspections were more critical than those normally conducted by the trade. The condition of the packages and their master containers on arrival at the market and the condition of the packages at retail stores also were recorded.

Commercial Trial Shipments

Table 1 shows the condition of grapes in eight different consumer packages upon arrival at terminal markets. The level of product damage found was usually low. All the packages protected the grapes during shipment.

All but one of the packages also protected the grapes adequately in the movement to the store, within the store, and on display. However, not all the packages were entirely satisfactory in other respects, particularly in ease of packing, in appearance, and for display purposes.

In the four packages which were later selected for a series of controlled tests, the condition of the grapes in most instances was within 1 percentage point as good after 1 to 3 days on display as it had been upon arrival in the terminal. Average percentages of injuries noted in the dual inspections were as follows:

Type of injury	At terminal	At retail store
Crushed or bruised	0.8	1.4
Shattered	.5	.7
Skin punctures, breaks, or cuts	.6	1.7

Stapled-bottom cartons.--Grapes packed in these cartons usually arrived in good condition. Bruised or crushed berries ranged between 0.1 and 1.9 percent; shattered berries, 0.5 to 1.5 percent; berries with stem punctures, cuts, and skin breaks, 0 to 0.5 percent; and decay, 0 to 0.5 percent.

One shipment of Thompson Seedless grapes in fiberboard shipping containers had an unusually high percentage of bruised, decayed, and shattered berries. It was thought that this was primarily caused by the application of too much pressure to the grapes when the recessed bottoms were stapled in place.

This package was sturdy. The recessed bottoms protected the face of the packages beneath. The bottom was also a half inch shorter in length and width than the top of the package. The effect of this design was to draw in the sides of the package, thus taking up slack within the package. When the recessed bottom was forced into the carton and stapled too deeply in the carton, berries in the bottom of the package were flattened and crushed. Also, inspectors occasionally found packages in which stems had been stapled to the carton.

Table 1.--Percentage of prepackaged grapes showing 4 types of damage on arrival at terminal markets, by kind of packaging and variety of grapes, 54 commercial shipments, California, 1956-59

Consumer packages, master shipping containers, and variety of grapes	Number of shipments	Percentage of grapes having specified kinds of damage			
		Crushed or bruised	Decayed	Shattered	Skin breaks or punctures
		Percent	Percent	Percent	Percent
Stapled-bottom cartons:					
Wood masters:					
Emperor	9	1.0	1/	0.6	0.5
Thompson Seedless	2	.3	1/	.8	0
Fiberboard masters:					
Emperor	1	.1	0	.5	2/N.A.
Thompson Seedless	1	1.9	.5	1.5	N.A.
Self-locking-bottom cartons:					
Wood masters:					
Emperor	6	1.2	1/	.5	1.0
Thompson Seedless	5	1.3	0	1.5	.7
Folding trays, overwrapped:					
Wood masters:					
Emperor	2	.1	.2	.5	.4
Thompson Seedless	6	.8	0	1.2	1.0
Fiberboard masters:					
Emperor	5	1.0	0	.4	1.0
Thompson Seedless	6	1.0	1/	1.4	.4
Self-locking-end cartons:					
Wood masters:					
Emperor	2	.5	.1	.6	.3
Self-locking-top cartons:					
Wood masters:					
Thompson Seedless	1	.8	0	.8	N.A.
Tokay	1	2.2	.1	1.1	4.7
Emperor	1	N.A.	N.A.	N.A.	N.A.
Cardinal	1	.3	.3	.3	N.A.
Self-locking-side carton, polyester film windows:					
Fiberboard masters:					
Emperor	1	.4	0	N.A.	N.A.
Open, paperboard trays, not overwrapped:					
Fiberboard masters:					
Emperor	1	4.3	0	1.6	1.8
Plastic baskets:					
Fiberboard masters:					
Emperor	1	.8	0	.4	.7
Thompson Seedless	2	.8	0	1.4	.6

1/ Less than one-tenth of 1 percent.
2/ N.A. - Data not available.

The wood crates most often used as shipping containers were constructed of very light shook. The side and cover slats were weak and subject to breakage. The cover slats provided little protection from overhead weight. The fiberboard master containers used in two shipments were satisfactory.

Self-locking-bottom cartons.--The defects found in grapes packaged in these cartons were slight. The proportion of bruised berries ranged between 1.2 and 1.3 percent; shattered berries, 0.5 to 1.5 percent; skin punctures, cuts, and skin breaks, 0.7 to 1.0 percent; and decay, 0 to less than 0.1 percent.

These packages were satisfactory. The interlocking tabs held the recessed bottoms in place fairly well. The original design of the package did not provide a good lock for the bottom piece, and the packages had to be shipped upside down in the shipping containers. Chaff from the grapes sifted down and stuck to the film window, giving the package an unsightly appearance. In addition, there was no protection for the face of the package so that berries were flattened and split at the top of the package where they were visible. The interlocking tabs were redesigned for the 1958 season and these tabs locked the bottom satisfactorily so that the packages were shipped right side up. Packages and grapes arrived in good condition.

The wood shipping containers used for these packages were satisfactory. No breakage was recorded.

Folding trays, overwrapped.--Few defects were found in grapes packaged in these cartons. Bruised berries ranged between 0.1 and 1.0 percent; shattered berries, 0.4 to 1.4 percent; stem punctures, cuts, and skin breaks, 0.4 to 1.0 percent; and decay, 0 to 0.2 percent.

The trays were overwrapped with either cellophane or cellulose acetate. When cellulose acetate was used, moisture condensation was not much of a problem and the film retained its bright, clear appearance. A major disadvantage of cellulose acetate is that it tears easily. Torn acetate film wraps were often found in as many as 5 percent of the packages inspected.

Cellophane, although much stronger than cellulose acetate, absorbed moisture and became dull and cloudy looking. Also, cellophane is not as permeable to water vapor as cellulose acetate; therefore, more moisture usually condensed on the surface of the cellophane film. This moisture condensation was serious in hot weather but not too great a problem in the winter when the packages were not subjected to sudden changes in temperature. The combination of a high relative humidity in the package and high temperatures is conducive to mold growth and should be avoided.

Occasionally, and particularly when cellophane was used as an overwrap, the folding trays absorbed moisture and became slightly limp. Although the percentage of flattened and crushed berries was no greater than in the other packages, the damaged berries were a problem because they were on top where customers could see them. The crushed berries in the other packages were usually in the bottom of the packages where they were not visible. Housewives don't like damaged grapes on the top or the bottom, visible or invisible.

However, only 1 or 2 split or bruised berries showing among the 200 grapes in a 2-pound package actually are an indication of better than average condition. Nevertheless, the package with extremely minor defects showing probably will be passed over by the customer in an unsuccessful gamble for perfection.

Wood boxes and one-piece fiberboard boxes were used as shipping containers for the folding trays. The wood shipping containers protected the packages very well. The fiberboard boxes were considerably cheaper and were fairly satisfactory. Aside from minor creasing, usually found in the bottom layer of the load, there was no damage.

A tear-tab arrangement was used to open the fiberboard master and it could not be closed after opening for inspection.

Self-locking-end cartons.--These packages protected the grapes very well during the two trial shipments. The carton was so designed that pressure was not applied to the grapes at the time the carton was closed.

Defects recorded on arrival averaged 0.5 percent crushed and bruised berries, 0.6 percent shattered, 0.3 percent stem punctures, cuts, and skin breaks, and 0.1 percent decay.

The wood boxes used as shipping containers were satisfactory. No breakage was recorded.

Self-locking-top carton.--Four trial shipments with four different varieties of grapes were conducted. The grapes were in good condition on arrival, but the packages absorbed moisture and were very weak. They would not retain their shape and consequently made a poor display in the retail stores.

Self-locking-side carton.--Only one trial shipment was made with these packages. The packages were satisfactory in all respects, except that they were difficult to fill. Researchers suggested to the manufacturer that the package be redesigned with a larger opening to facilitate filling.

Open paperboard tray, not overwrapped.--One trial shipment was made with these packages. They were weak and did not protect the grapes as well as the other packages did.

Plastic baskets.--Three trial shipments were made with plastic baskets, which were not overwrapped. Injuries to the berries were slight and did not affect sales acceptance. However, because the baskets were not covered, customers were able to handle the grapes.

Generally, the fiberboard tray-type master shipping containers in which the baskets were placed arrived in the terminal markets in good order. However, in all shipments there were a few master containers with creasing damage, believed the result of a shift in the load.

Application of Preliminary Evaluation

The information obtained at the terminal markets was passed on to the grape packers and the package manufacturers. When a particular design proved unsatisfactory, the manufacturer either improved it or discarded it. For example, one manufacturer designed a window carton so that its cover was self-locking on one side. This container was manually set up and was easy to fill. However, after a few trial shipments several defects became apparent. The carton proved to be weak--particularly in hot weather when it absorbed considerable moisture. It would not retain its shape and consequently made a poor display in retail stores. Retail store produce managers objected to the self-locking feature because it was easy for customers to open the cartons and handle the grapes.

Another package tried was a paperboard basket. Although this package was relatively inexpensive and easy to pack, it was not sturdy enough to protect the grapes during marketing. A third package tested was also a window carton but polyester film was used for the window instead of cellulose acetate. This package was satisfactory during trial shipments and maintained its appearance in the retail store. However, the package was difficult to fill and it was suggested to the manufacturers that the carton be redesigned with a larger opening.

From then on the study was concentrated on the four most promising consumer cartons. These were:

(1) Carton with cellulose acetate film window and stapled, recessed bottom
(2) Carton with cellulose acetate film window and self-locking bottom
(3) Folding tray, overwrapped with cellulose acetate film
(4) Carton with cellulose acetate film window and self-locking end

Costs of materials were determined and time studies were conducted in four packing plants that were using these packages. So that comparisons could be made, the costs of bulk-packing grapes in standard wood boxes were also recorded. 2/

DESCRIPTION OF PACKAGES AND MASTER CONTAINERS

Following are descriptions of the four consumer packages which survived commercial trials and were evaluated in a series of controlled tests. Master containers in which the packages were shipped also are described. (See also table 2 and illustrations which follow.)

2/ For a comprehensive study of the relative salability and costs of retailing prepackaged and bulk grapes see reference in footnote 1.

Table 2.--Consumer packages and their master containers used in shipping tests with California table grapes, 1958-59

Type of carton	Consumer package		Material	Master shipping container	
	Inside dimensions	Capacity		Inside dimensions	Consumer units per master
	Inches	Cu. in.		Inches	Packages
Window carton, stapled recessed bottom 1/	7-3/8x6-11/16x2-7/8	2/110	Wood	22-3/8x13-1/2x6-7/16	12
Do. 1/	do.	do.	Fiberboard	20x15x6-1/2	12
Window carton, self-locking bottom	7-5/8x5-1/4x3-3/16	109	Wood	16-5/16x15-5/8x6-5/8	12
Window carton, self-locking end	6-5/8x5-1/4x3-1/8	109	Wood	16-1/8x13-1/2x6-7/16	12
Folding tray 3/	7-7/8x5-1/4x2-7/8	119	Wood	16-1/8x16x6-1/2	12
Do. 3/	do.	119	Fiberboard	24-3/8x10-7/8x6	12

1/ In the fall of 1959, the dimensions of this package were changed to 7-3/16x6-5/8x3 inches.

2/ This is an approximate measurement. The carton is closed with a recessed corrugated bottom piece measuring 1/2 inch shorter in length and width than the top of the carton. After the carton is filled this recessed bottom is inserted into the carton up to 9/16 inches and then stapled to the sides and ends of the carton. With sides and ends drawn in and the bottom piece inserted, the capacity varies from 105 to 110 cubic inches.

3/ Overwrapped with cellulose acetate film or partially moisture-protective cellophane.

Window Carton with Stapled, Recessed Bottom

This was a 2-piece waxed paperboard carton with a cellulose acetate top window extending down 1-5/8 inches on each end. The window was protected by two removable paperboard flaps. The carton was closed by stapling in place a corrugated fiberboard recessed bottom (fig. 1). The corrugated bottom piece was ½-inch shorter in length and width than the top of the carton. Stapling the bottom in place drew in the carton sidewalls around the grapes. Twelve consumer cartons were packed and shipped in each master shipping container which was either wood or fiberboard.

BN-10368

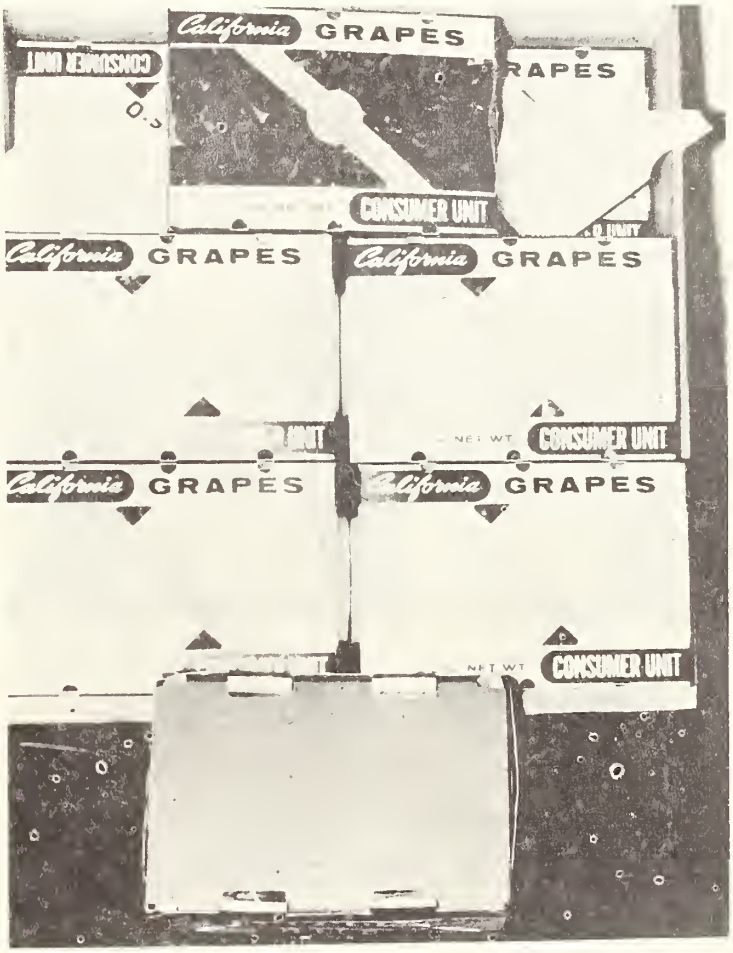
Figure 1.--This is the window carton with recessed bottom. The flat (upper left) is folded to form body of carton (upper right). After filling, the bottom (upper middle) is stapled in. The film window is covered with protective paperboard (lower right) which is removed when the carton is put on display (lower left).

The wood master container was a 10-piece flat with slatted sides and bottom and solid ends. The ends were 11/16 inch thick and the slats were ½-inch thick.

The fiberboard master was a 1-piece regular slotted box with a 2-inch gap between flaps at top and bottom. The box was closed by stapling the top flaps and gluing the bottom flaps together. This container had single ends and single sides.

Window Carton with Self-Locking Bottom

This was a two-piece paperboard carton with a cellulose acetate top window extending down 1½ inches on each end. As in the stapled-bottom package described above, the window area was protected by removable paperboard flaps. It was closed by bending four interlocking tabs on the sides of the carton into a corrugated recessed bottom. The self-locking-bottom carton was shipped in wood crates (fig. 2).



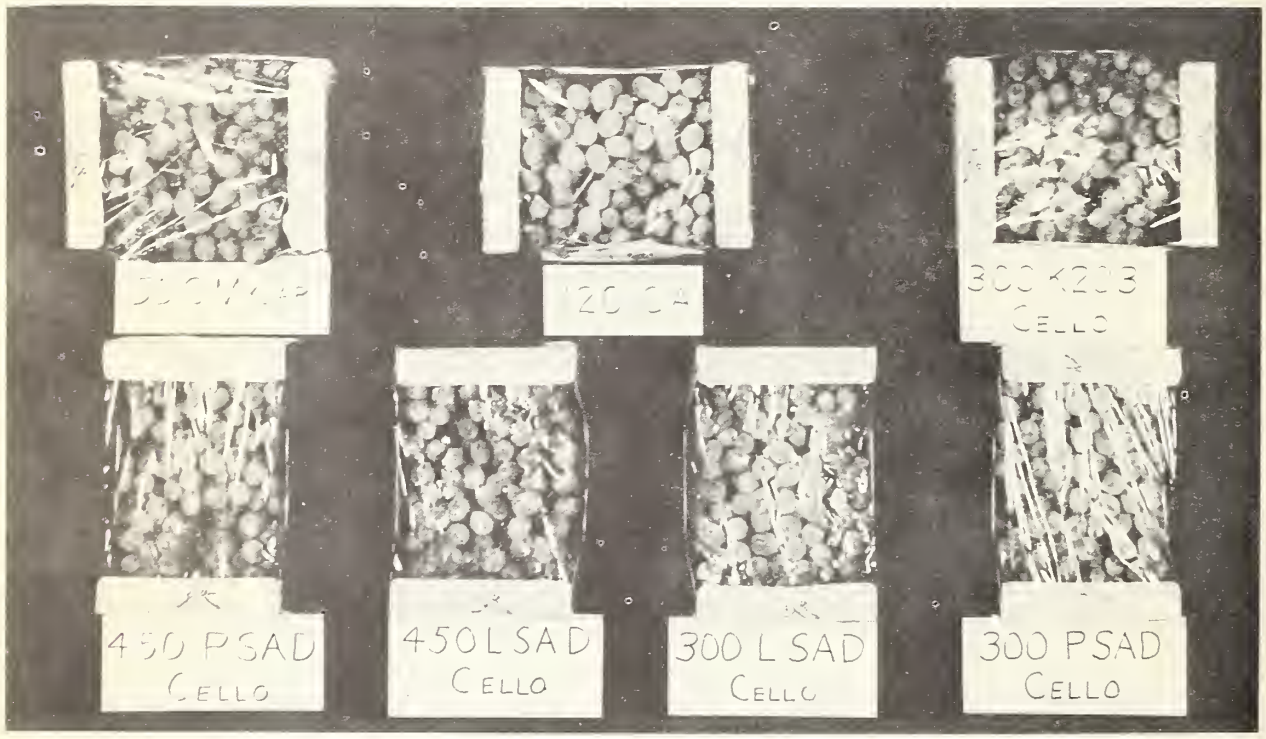
BN-10573

Figure 2.--The window carton with self-locking bottom is shown at top with film window open to display grapes. Protective paperboard covers the windows in the four center cartons. Carton at bottom is upside down.

The wood crate was a 10-piece container with slatted sides and bottom. It held 12 cartons. The lid was nailed on by a semiautomatic machine. The ends were 5/8 inch thick and the sides were ¼ inch thick.

Folding Tray

This was a waxed paperboard tray carton overwrapped with either semi-moistureproof cellophane or cellulose acetate film (fig. 3). The sides were cut down 3/4 inch from the top to provide maximum visibility of the grapes. This package was shipped in either fiberboard or wood master containers.

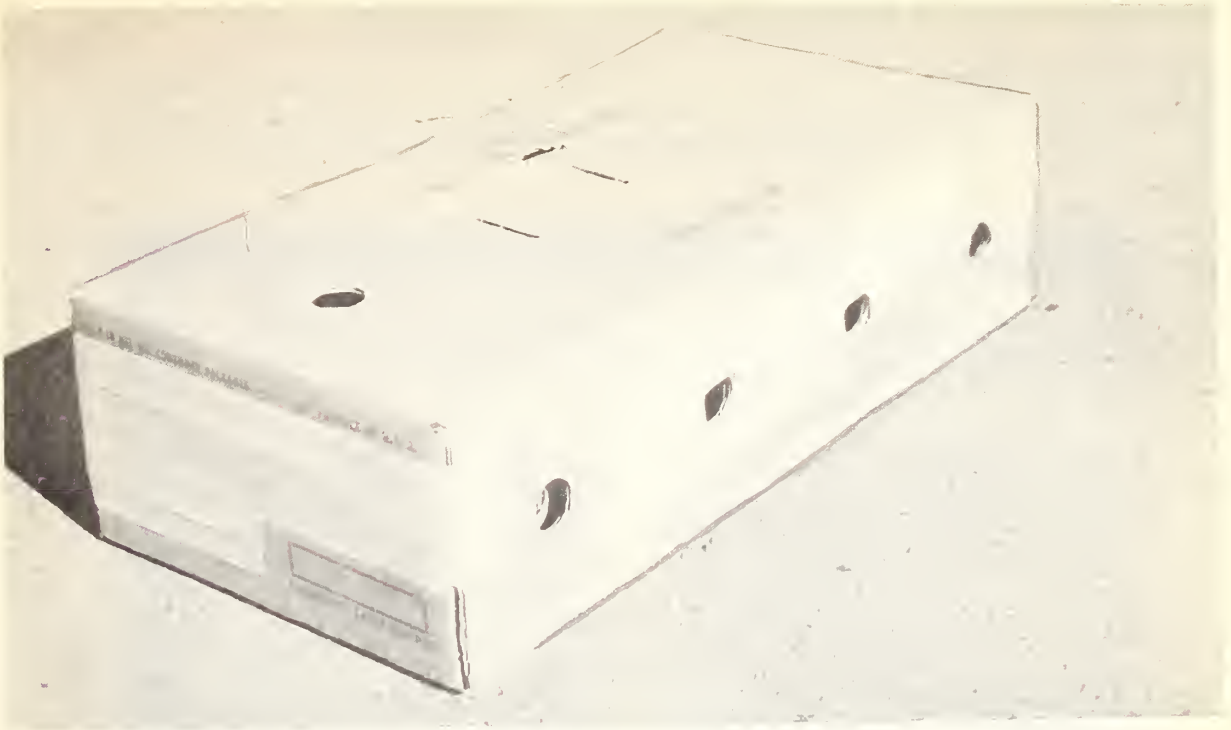


BN-10572

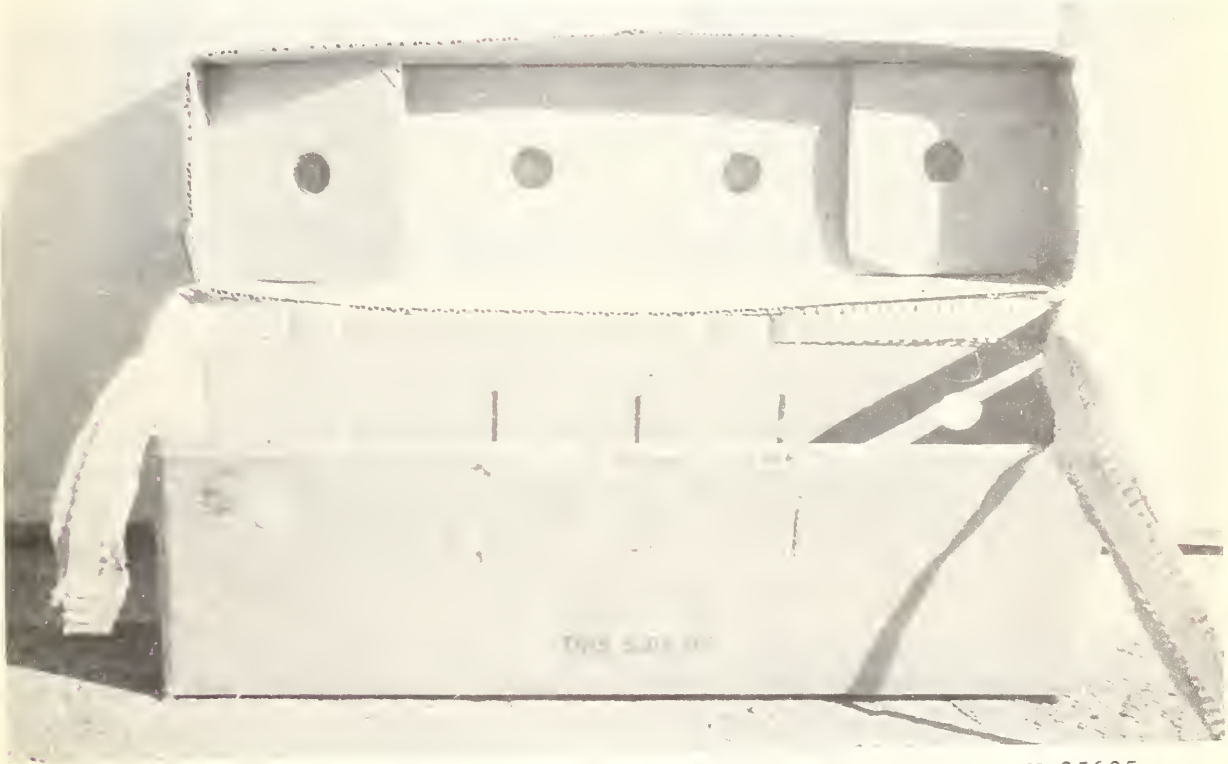
Figure 3.--The folding tray is shown here wrapped in seven different types of film. The cellulose acetate film, top center, proved to be the most satisfactory wrap.

The fiberboard master container was a one-piece slotted box with full overlap flaps. The ventilation apertures consisted of three ¼- by 2-inch slots and ¼-inch-diameter hole in the top and bottom and four 1¼-inch-diameter holes in each side. A tear tab across the top, ends, and part of the bottom of the box provided a method of easily opening the packed box (fig. 4).

The wood crate was an 11-piece flat with slotted sides and bottom and solid ends. It held 12 cartons. The lid was nailed on by a semiautomatic machine. The ends were 11/16 inch thick and the slats were ¼ inch thick.



BN-10571



N-35605

Figure 4.--Dotted line on box at top shows where tear tape was inserted. A pull on tape opened the box as shown in lower photo.

Window Carton with Self-Locking End

This was a waxed paperboard carton with a cellulose acetate window. The window extended down 1-3/4 inches on each side. It was closed by bending an interlocking tab on one side-flap into the other side-flap. The cartons were shipped in wood master crates (fig. 5).

BN-3564

Figure 5.--This carton locks on the end and has windows of cellulose acetate film.

The crate was a 10-piece flat with slatted sides and bottom and solid ends, and with a capacity of 12 cartons. The lid was nailed on by a semi-automatic machine. The ends were 5/8 inch thick; the sides were ¼ inch thick.

Conventional Wood Box

This was a seven-piece lug with slatted sides and bottoms and solid ends. The ends were 5/8 inch thick and the sides were ¼ inch thick. The inside dimensions were 16-1/8 by 13½ by 5-3/4 inches; 28½ pounds of grapes were usually packed in it.

COST OF MATERIALS

The cost of materials for the experimental consumer packages, their master containers, and the conventional wood box are shown in table 3. These figures are based on quotations received from packers and manufacturers.

Table 3.--Costs of packaging materials for shipping prepackaged grapes and grapes packed in conventional wood boxes, California shipping points, 1958-59

Type of pack	Packing material cost			
	12 consumer packages	1 master container	Total per unit 1/	Total per pound
	Cents	Cents	Cents	Cents
Consumer packages and master containers:				
Stapled-bottom carton and wood master	59.94	22.85	82.79	3.18
Stapled-bottom carton and fiberboard master 2/	59.94	21.39	81.33	3.13
Self-locking-bottom carton and wood master	58.44	26.88	85.32	3.28
Folding tray, overwrapped, and wood master	3/59.68	26.86	86.54	3.33
Folding tray, overwrapped, and fiberboard master	3/59.68	16.80	76.48	2.94
Self-locking-end carton and wood master	50.10	26.53	76.63	2.95
Conventional container:				
Standard wood box	---	4/38.71	38.71	1.36

1/ Twelve consumer packages per master container with an average net weight of 26 pounds. Conventional wood boxes contained an average net weight of 28½ pounds of grapes.

2/ The cost of this pack was lower in the 1959-60 season. The price of the carton was reduced and one shipper packed it in a less expensive open-top fiberboard master container.

3/ Cost based on tray overwrapped with cellulose acetate film. When cellophane was used the cost was 4.91 cents less.

4/ Average of 4 plants whose costs ranged from 37.8 to 40.2 cents. The cost variations depended to a great extent on type of accessory packing materials used, such as side guards, end guards, curtains, pads, and cellophane dressing.

The average net weight of grapes packed in 12 consumer packages was 26 pounds. The conventional wood box was packed with 28½ pounds of grapes.

The cost of 12 experimental consumer cartons and their master container ranged between 76.48 and 86.54 cents. The cost of the conventional wood box averaged 38.71 cents. Per pound of grapes, the cost of materials for the experimental packages ranged between 2.94 and 3.33 cents as compared to 1.36 cents for grapes packed in the conventional wood box.

COST AND AMOUNT OF DIRECT LABOR FOR PACKING GRAPES

Time studies conducted in four packing sheds measured the amount of direct labor required for packing grapes in stapled-bottom cartons, self-locking-bottom cartons, folding trays, and self-locking-end cartons. Approximately 2 pounds of grapes were packed in each consumer package. Twelve consumer packages were packed in each master container. For comparison, studies of the labor requirements for packing 28½ pounds of grapes in a conventional wood box were made in each of the same four plants.

Only plant operations directly connected with packaging and packing were studied. Plant labor used for handling the field lugs, gassing, cull handling, and supervision was not measured since it was identical for all the containers packed in one plant. The labor requirement figures used in this report contain an allowance of 15 percent for fatigue and personal time.

Description of Packing Operations

Consumer Packages

The self-locking-bottom and self-locking-end packages were packed on conventional wood box lines. Over-and-under scales with metal package holders attached on top of each scale were the only additional equipment needed in converting wood box lines to prepackaging lines.

For packing stapled-bottom packages the plants added carton assembling and closing machines, conveyor belts for transporting the packages to and from the filling stations, and scales with package holders.

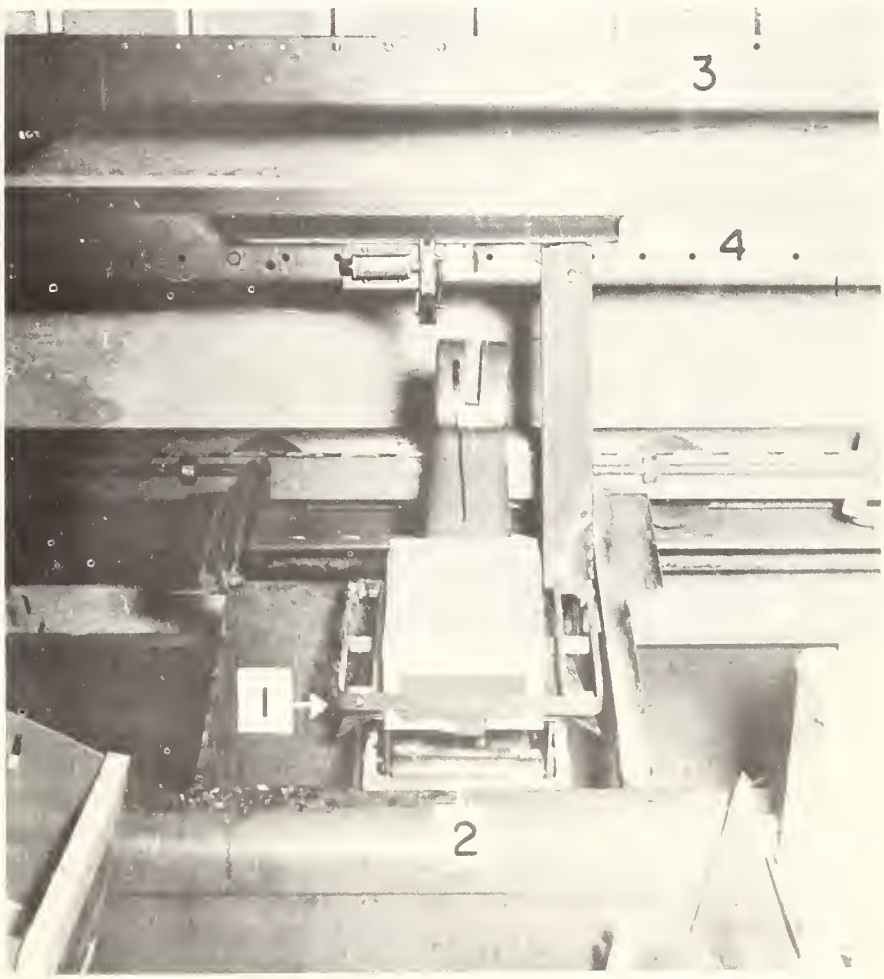
A still different line was designed for packing the folding-tray cartons. It required automatic tray setup machines, conveyor belts for carrying the trays to and from the packers, scales with package holders, automatic film overwrapping machines, an automatic master box filler, and an automatic master box sealer.

Assembling the cartons.--The stapled-bottom cartons were assembled on a semiautomatic folding machine by one full-time worker.

The self-locking-bottom and self-locking-end cartons were received from the manufacturers preassembled and folded flat. Prior to filling with grapes, each packer formed the cartons manually.

The folding-tray cartons were set up on an automatic machine attended by a part-time worker.

Filling the cartons.--Basically, the method of filling was the same for all the consumer units. The empty cartons were placed on over-and-under filling scales. Metal holders or jigs held the cartons in place (fig. 6). The scales were preset at 2 pounds and 4 ounces to allow for carton tare weight, and a 2- to 3- ounce overage. The grapes were supplied to the packers in field boxes that were placed adjacent to the packing stands. A packer removed a grape bunch from the field box, held it in one hand, and with clippers in the other hand, trimmed off the discolored, split, and bruised berries. The trimmed bunches were placed in the consumer cartons. The stapled-bottom and self-locking-bottom cartons were filled through bottom openings. The folding trays were filled through the open tops and self-locking-end cartons were filled through an open end.



BN-10574

Figure 6.--Packing stand: Metal form (1) holds carton in place on scale (2). The top belt (3) supplies empty cartons; the lower belt (4) carries full cartons away.

Checking quality and weight.--In all of the plants studied one worker moved from station to station checking the quality of the grapes being packed. The cartons were checkweighed manually by another worker on a scale usually located beside the conveyor belt that carried the cartons to the closing area (fig. 7).

N-35607

Figure 7.--One worker continuously checked the weight of the filled packages.

Closing the carton.--The recessed stapled-bottom cartons were closed by an automatic stapling machine. One worker fed the cartons into the machine and another supplied the machine with the recessed corrugated fiberboard bottom. The bottoms were fastened to the carton with eight staples.

The self-locking-bottom cartons were closed manually by the carton filler who bent four interlocking tabs attached to the sides of the carton into a recessed corrugated bottom.

The self-locking-end cartons also were closed manually by bending interlocking tabs located on one end of the carton.

The folding trays were closed by passing them through an automatic machine which overwrapped them with semimoistureproof cellophane or cellulose acetate film. One worker fed the filled trays into the machine and another attended the machine.

Master Containers for Consumer Packages

The wood master containers held 12 consumer units. The crates were assembled by a semiautomatic nailing machine, packed manually, and closed by semiautomatic nailing machines. One worker supplied the shook and a second operated the machine.

Both types of fiberboard masters also held 12 consumer units. The top flaps of the fiberboard box for the stapled-bottom cartons were stapled together by a semiautomatic stitching machine. The box was filled manually, and closed manually by gluing the bottom flaps. The fiberboard master containers for the tray cartons were assembled manually, filled by an automatic case filler, and closed by an automatic case sealer.

Conventional Wood Boxes

Conventional containers for bulk grapes in California were the standard wood lugs. In all of the plants visited, the methods of assembling, filling, and closing were the same.

The standard box was assembled on a semiautomatic nailing machine. One worker attended the machine, and another supplied the shook. Conveyor belts carried assembled boxes to the packing stations. A packer positioned a box on a scale and packed it. Scales were usually preset to allow each box to be packed with 28½ net pounds of grapes. When filled, the box was taken by the set-off worker and placed on a conveyor belt leading to the closing area. As the boxes moved along the belt a worker checked the quality of each pack. The boxes were closed on a semiautomatic nailing machine operated by one worker. After closing they moved on to a scale, usually built into the conveyor belt line, for a final weight check.

Labor Requirements

Consumer Cartons

Table 4 shows the average amount of direct labor used to pack grapes in four types of consumer units (in five types of master containers) and in conventional wooden boxes. Labor required for packing the stapled-bottom cartons in the fiberboard master containers was not determined because only a few of these were packed for experimental tests.

The differences in total direct labor were due to the distinctive features of assembling, filling, and closing the cartons and master containers.

Table 4.--Direct labor requirements for packing 26 pounds of average-quality grapes in 12 consumer packages and 1 master shipping container, and for bulk-packing 28½ pounds of grapes in 1 conventional wood box, four plants, 1958-59 1/

Operation	Wood shipping container				Fiberboard shipping container, overwrapped folding trays	Conventional wood box
	Stapled-bottom cartons	Self-locking-bottom cartons	Self-locking-end cartons	Overwrapped folding trays		
	Man-minutes	Man-minutes	Man-minutes	Man-minutes	Man-minutes	Man-minutes
12 consumer units:						
Assembling	0.24	1.44	1.40	0.24	0.24	---
Filling	8.52	8.52	8.88	8.64	8.64	---
Checking quality and weight	.48	.48	.48	.48	.48	---
Closing	.72	1.96	1.60	.60	.60	---
1 shipping container:						
Assembling	.30	.30	.30	.26	.14	0.25
Filling	.63	.72	.72	.58	.36	4.63
Setoff	---	.06	.06	---	---	.05
Checking quality and weight	---	---	---	---	---	.20
Closing	.13	.10	.10	.12	.04	.09
Total:						
Per large container	11.02	13.58	13.54	10.92	10.50	5.22
Per pound of grapes	.42	.52	.52	.42	.40	.18

1/ Includes 15 percent adjustment for personal and fatigue allowance.

Carton assembly.--The overwrapped trays and the stapled-bottom cartons were machine assembled and required less direct labor to set up for filling than the self-locking-bottom and self-locking-end cartons which were manually assembled. Direct labor required to assemble 12 cartons ranged from 0.24 to 1.40 man-minutes (table 4).

Filling cartons.--Time studies indicated that the amount of direct labor required to fill the cartons varied with the quality and condition of the grapes being packed. Small bunches of high-quality grapes required less trimming than large bunches with tight clusters and many damaged or discolored berries.

In three of the plants where a series of daily studies were made there was a wide variation in time required to fill the cartons because the quality of the grapes was mixed. In one plant where studies were made on only 3 consecutive days, the times to fill the self-locking-bottom cartons were consistently low because the quality of the grapes was much above average. Therefore, the average time to fill this carton was adjusted to reflect times for packaging grapes of average quality (tables 4 and 5).

Table 5.--Direct labor required for filling four types of consumer packages with grapes of average quality, California, four plants, 1958-59

Type of consumer package	Direct labor required to fill one consumer package	
	Range	Average
	Man-minutes	Man-minutes
Stapled-bottom carton 1/	0.56-0.94	0.71
Self-locking-bottom carton 2/	.55- .58	3/.71
Folding tray 1/	.43-1.04	.72
Self-locking-end carton 1/	.53- .95	.74

1/ Based on time studies conducted during August, September, and October; includes a 15 percent allowance for personal time and fatigue.

2/ Time studies were made on 3 different days only and the fruit was of high quality each day.

3/ Adjusted to reflect requirements for packing grapes of average quality.

The type of carton also influenced the filling time slightly. The unattractive stem ends of the bunches were hidden on the bottom to give the cartons more eye appeal when placed on display. It was easier to conceal the stems in the stapled-bottom and self-locking-bottom cartons. These cartons were packed upside down with stems on top. When the cartons were turned right side up the stems could not be seen. The folding trays and the self-locking-end cartons were packed right side up and it was more difficult to insert the stems and broad shoulders of the bunches first.

Checkweighing cartons.--In the plants studied the methods of checking the quality and weight of the consumer units were the same. The average amount of direct labor used for these operations was 0.48 man-minute per 12 consumer units (table 4).

Closing cartons.--The stapled-bottom cartons and the overwrapped folding trays were closed by automatic machines, and required 0.72 and 0.60 man-minute for 12 packages. The self-locking-bottom and self-locking-end cartons, which were closed manually, required 1.96 and 1.60 man-minutes for 12 consumer units (table 4).

Master Containers for Consumer Packages

The fiberboard master shipping containers for the folding trays were manually assembled, automatically filled, and automatically closed; the master containers for the other packages were manually assembled, filled, and closed. Thus, the fiberboard master box for the folding trays required the least amount of labor to assemble, fill, and close, 0.54 man-minute.

The direct labor for assembling, filling, and closing the wood master shipping containers ranged from 0.96 to 1.18 man-minutes. This range was primarily due to the methods used in filling. The stapled-bottom and folding tray cartons were packed in their master shipping containers at a central point in the packing line. The self-locking-bottom and self-locking-end cartons were packed in their master containers by the individual packers. It required less labor to fill the masters at a central point in the line than at the individual packing stations. Also, when the master containers were filled at the individual stations, additional labor was required to move the filled master containers from the packing stands to conveyor belts leading to the closing area.

Conventional Wood Boxes

The four plants studied used similar methods of packing the conventional wood boxes. The average amount of direct labor required in four plants was 5.22 man-minutes (table 4). Only 4.90 man-minutes were needed at the most efficient plant, 6.39 man-minutes at the least efficient.

Direct Labor Costs

Because workers on packing lines were paid both piece and hourly rates, for comparative purposes direct labor costs of packing are all based on an assumed wage of $1.00 per hour.

At this assumed wage rate, direct labor costs for prepackaging grapes in consumer packages ranged between 18.2 and 22.6 cents per 26-pound master container compared with 8.7 cents for the conventional 28½-pound bulk pack in the standard wood box (table 6).

Table 6.--Costs of direct labor and packaging materials for grapes packed in consumer packages and master shipping containers, and for grapes bulk-packed in conventional wood boxes, four plants, California, 1958-59 1/

Type of container and quantity of grapes packed	Direct labor 2/		Packaging material (complete pack)	Total, direct labor and packaging materials
	Per pound of grapes packed	Per complete pack		
	Cents	Cents	Cents	Cents
12 consumer packages and 1 master container (26 lbs. of grapes):				
Stapled-bottom cartons, wood master	0.71	18.4	82.8	101.2
Self-locking-bottom carton and wood master	.87	22.6	85.3	107.9
Folding tray, overwrapped, and wood master	.70	18.2	86.5	104.7
Folding tray, overwrapped, and fiberboard master	.67	17.5	76.5	94.0
Self-locking-end carton and wood master	.87	22.6	76.6	99.2
Conventional wood box, 28.5 pounds	.30	8.7	38.7	47.4

1/ Does not include equipment costs, depreciation, taxes, interest, insurance, or other overhead and fixed costs.

2/ Based on assumed wage of $1.00 per hour. Does not include labor to truck or load containers into rail cars.

COMPARATIVE COSTS OF PREPACKAGING AND CONVENTIONAL PACKING

Comparative costs of materials and direct labor used in packing the experimental consumer packages and the conventional wood box are shown in table 6. The combined costs of 12 cartons or trays filled and packed in wood shipping containers ranged from $0.99 to $1.08. The same costs for packing the conventional wood box were 47 cents.

When a one-piece fiberboard box was used as a shipping container for the overwrapped folding trays the packing costs were reduced from $1.05 to 94 cents. In addition to a 10-cent saving in materials, a labor saving of 7 cents resulted from the use of a mechanical case filler and case sealer.

COMPARATIVE TRANSPORTATION COSTS

With the exception of the crates used for the stapled-bottom cartons, the wood shipping containers for the experimental consumer packages were loaded in cars in the same manner as the conventional wood boxes. The master crates containing the stapled-bottom cartons were 3-5/8 inches longer and were loaded 4 wide instead of 5 wide. The cost of materials (lumber and nails used for stack braces and the centergate) used to brace the loads of prepackaged grapes in the railroad cars averaged $8.77 per carload.

The fiberboard master containers used for the stapled-bottom cartons and the overwrapped folding trays did not require bracing materials since they were loaded solid in the railroad cars.

Freight and refrigeration charges for shipping grapes in the experimental and the conventional containers by rail, from Fresno, Calif., to New York, N. Y., are shown in table 7.

Freight and refrigeration charges for shipping a standard load of 1,040 conventional wood boxes from Fresno, Calif., to New York City based on actual weights were $922.00. Shipping the same number of boxes with prepackaged grapes cost between $870.20 and $882.52. Transportation costs were lower for fiberboard master boxes than for wood master crates. Tare weight of the fiberboard boxes was less; also, the fiberboard containers used for the overwrapped folding trays were loaded 1,088 per car as compared to 1,040 for the other master containers and the conventional wood boxes.

Transportation charges for consumer packages packed in fiberboard shipping containers were 4 to 6 cents per container less than the cost of shipping the same packages in wood master containers. Although transportation charges for the standard wood box were the highest, this box carried more grapes and the charge per pound actually was fractionally lower.

Table 7.--Transportation charges for shipping prepackaged grapes in fiberboard and wood shipping containers and bulk grapes in conventional wood boxes from Fresno, Calif., to New York City, 1958

Item	Per carload				Freight and standard refrigeration charges 2/	
	Number of shipping containers	Gross weight	Net weight 1/	Tare weight	Per carload	Per shipping container
	Number	Pounds	Pounds	Pounds	Dollars	Dollars
Stapled-bottom cartons and wood masters	1,040	32,115	27,040	5,075	870.20	0.84
Stapled-bottom cartons and fiberboard masters	1,040	30,236	27,040	3,196	829.86	.80
Self-locking-bottom carton and wood masters	1,040	32,656	27,040	5,616	882.52	.85
Folding trays, overwrapped, and wood masters	1,040	32,271	27,040	5,231	873.81	.84
Folding trays, overwrapped, and fiberboard masters	1,088	31,345	28,288	3,057	852.89	.78
Self-locking-end cartons and wood masters	1,040	32,302	27,040	5,262	874.51	.84
Conventional wood boxes	1,040	34,403	29,640	4,763	922.00	.89

1/ Net weight of 26 pounds of grapes per shipping container (12 consumer packages). Net weight of conventional box based on 28½ pounds of grapes.

2/ Southern Pacific Railway Co., Fresno, Calif., 1958.

PREMIUM PRICES FOR PREPACKAGED GRAPES

During the period that this study was made, the shippers charged a premium of 50 cents per box of 26 pounds of prepackaged grapes. The premium was added to the market price of 28½ pounds of their first-quality grapes packed in a conventional wood box. The shippers said that they needed this premium price to cover the cost of the extra materials and labor used in their prepacking operations.

One grape prepackager charged only a 40-cent premium during the 1959-60 season because (1) the price of stapled, recessed-bottom, window cartons, which he used, was reduced; (2) he used a less costly open-top fiberboard master container; and (3) he speeded up his packing operations and saved on labor costs.

EVALUATION OF GRAPES AND CONTAINERS AT TERMINAL MARKETS

In order to control variables, the window cartons and folding trays that received favorable market reaction in the commercial trials were all packed the same day in the same plant with Emperor grapes of comparable quality under the supervision of research technicians.

The master shipping containers for the test packages were wood cartons.

Conventional wood boxes were bulk-packed at the same time with grapes from the same lots. These conventional packs were used as a basis for comparison.

Each of eight test shipments contained one stack of each type of consumer package, and one stack of the conventional wood boxes. The test containers were loaded adjacent to one bunker wall, nine high, crosswise, on bottoms. Special wood space frames were used to hold the test stacks in place.

The test cars were shipped within a 3-week period to the following terminal markets:

Date shipped	Terminal
October 25, 1958	Philadelphia, Pa.
October 27, 1958	Philadelphia, Pa.
October 30, 1958	Flint, Mich.
October 31, 1958	No. Hawthorne, N. J.
October 31, 1958	New York, N. Y.
November 6, 1958	Chicago, Ill.
November 11, 1958	Buffalo, N. Y.
November 13, 1958	Lakeland, Fla.

At the terminal markets, test containers were removed from layers 1 (floor), 3, 5, 7, and 9 (top), and were examined for four types of product damage. Three packages of each type were also reexamined in the retail stores after a shelf life of 2 or more days.

Inspection by Agricultural Marketing Service packaging specialists at the terminal markets and in the retail stores showed that the grapes, the experimental consumer packages, and the conventional bulk pack in standard wood boxes arrived in excellent condition (table 8). Very few grapes showed bruising, shattering, stem punctures, cuts, or skin breaks, and only a trace of decay was found. There was no significant difference in the condition of the grapes packed in the four types of consumer packages.

Bruising.--There was no significant difference in the amount of bruising found in the grapes packed in any of the four types of consumer packages or in the conventional wood boxes. The average bruising in the four consumer packages was 0.6 percent as compared to 1.3 percent in the conventional bulk pack in the wood boxes.

Examinations in the retail stores also showed little difference in the amount of bruising in the different types of packages. Bruising in the packages upon arrival at terminal markets, and in the retail stores, was minor and did not affect the salability of the grapes.

Stem punctures, cuts, and skin breaks.--At terminal market, the incidence of stem punctures, cuts, and skin breaks in the four experimental consumer packages and in the conventional wood boxes ranged between 0.8 and 1.0 percent. In the retail stores this type of injury ranged between 1.1 and 1.6 percent, a low level that did not affect the salability of the grapes.

Decay.--Only a trace (0.01 percent) of decay was found in the overwrapped folding trays, and no decay was found in any of the other packs at terminal market. Examinations at the retail stores showed no decay in the stapled-bottom and self-locking-side cartons, and only a trace of decay (.01 to .04 percent) was found in the self-locking bottom cartons and the folding trays.

Shattering.--Upon arrival in terminal markets, shattered berries in the four types of consumer packages averaged 0.3 to 0.4 percent; 0.5 percent of the grapes packed in bulk in the conventional wood boxes were shattered. Examinations in the retail stores showed an average of 0.4 to 0.5 percent of the grapes in the four consumer packages shattered.

TRADE ACCEPTANCE

Of the eight consumer packages tried in the early commercial shipments, the window carton with self-locking top and the open paperboard tray were not strong enough to maintain a good appearance and they did not protect the grapes adequately.

The carton with self-locking side and polyester film window received favorable trade reaction, but because the packages were hard to fill, only one trial shipment was made.

Table 8.--Percentage of grapes having specified kinds of damage after shipment in four kinds of consumer packages and wood master containers, and after bulk shipment in conventional wood boxes, test shipments of Emperor grapes, California, October-November, 1958 1/

Type of damage to grapes 2/	Consumer packages				Average, all packages	Conventional wood boxes
	Stapled-bottom cartons	Self-locking bottom cartons	Over-wrapped folding trays	Self-locking-side cartons		
	Percent	Percent	Percent	Percent	Percent	Percent
At terminal markets:						
Bruising:						
Slight	0.3	0.5	0.4	0.3	0.4	0.6
Damage	.1	.1	.1	.1	.1	.3
Serious	.1	.1	.1	.1	.1	.4
Total	.5	.7	.6	.5	.6	1.3
Stem punctures, cuts, and skin breaks:						
Slight	.7	.6	.6	.6	.6	.6
Damage	.2	.2	.2	.1	.2	.3
Serious	.1	.2	.1	.1	.1	.1
Total	1.0	1.0	.9	.8	.9	1.0
Decay	0	0	3/	0	0	0
Shattering	.4	.4	.3	.3	.3	.5
At retail stores						
Bruising:						
Slight	.6	.8	.8	.6	.7	---
Damage	.2	.3	.3	.3	.3	---
Serious	.1	.2	.2	.1	.2	---
Total	.9	1.3	1.3	1.0	1.2	---
Stem punctures, cuts, and skin breaks:						
Slight	.7	1.0	1.0	.7	.9	---
Damage	.2	.3	.4	.3	.3	---
Serious	.2	.3	.2	.2	.2	---
Total	1.1	1.6	1.6	1.2	1.4	---
Decay	0	3/	3/	0	3/	---
Shattering	.5	.5	.4	.4	.4	---

1/ All containers were packed at the same time with the same lot of grapes and shipped between October 25 and November 13.

2/ 8 test shipments were examined on arrival at terminal markets; 5 of these were examined again in retail stores.

3/ Less than one-tenth of 1 percent.

The unwrapped plastic baskets received unfavorable trade comments. A typical comment by a retailer was, "These trays need an overwrap or something to hold the grapes in. We have been selling them in bulk." The manufacturers of these plastic baskets have now developed methods of overwrapping them with polyethylene or cellophane. These baskets show considerable promise because they provide good visibility and excellent ventilation.

All of the four packages in the controlled test shipments were sent to the same retail stores and displayed side by side. This provided an excellent opportunity for the retailers and produce merchandisers cooperating in the controlled test shipments to evaluate their relative merits.

Attractiveness and appearance of display.--Most of the merchandisers thought the stapled-bottom cartons and the folding trays made a more attractive display than the other two kinds of cartons. The folding trays were particularly effective in presenting an attractive display because most of the grapes were visible when one looked directly at the display. However, some of the produce merchandisers did not like the appearance of the stems that were exposed in the overwrapped trays. The window cartons, which were filled bottom side up with the stems at the bottom, made a neat appearance. The stapled, recessed-bottom cartons were packed with a slight bulge and because they were shallower but larger in area, they gave the impression of being slightly bigger or better value to the consumer than the other two window cartons.

Ease and adaptability for display.--The self-locking-end carton was the most versatile package for display. It could be stacked on bottom, sides, or ends. Some of the other packages, such as the overwrapped folding tray, could not be displayed well on the sides or on the ends as is sometimes necessary in certain retail display cases.

Ease of price marking.--Price marking was easier on the cardboard areas of the window cartons than on the film used for overwrapping the folding trays.

Protection to the grapes against damage.--Retailers and produce merchandisers generally considered the stapled, recessed-bottom carton the most sturdy and protective package. They particularly liked it because the recessed bottom helps protect the face of the package beneath it. It also was durable and better withstood consumer handling than the other packages. Also, it could not be easily opened either deliberately or accidentally by the shoppers.

Freedom from condensation.--All of the three acetate-film-window cartons showed less moisture condensation than the film-overwrapped trays. This was mainly because the window cartons had ventilation holes in the cardboard which provided more ventilation than the perforations in the films used to overwrap the folding trays.

Fastest selling and best overall package at retail.--The overwrapped tray and the recessed-bottom stapled window carton received the most favorable comments from the produce merchandisers as selling faster than the other packages, and having other advantages as well. Some retailers preferred the window cartons because of their sturdiness; others preferred the overwrapped trays because of better visibility of the grapes.

Table 9 summarizes the rankings that the retail merchandisers gave the four packages for superiority in various respects.

Table 9.--Preferences for type of consumer package for grapes, as indicated by representatives of six retail organizations, 1958

Quality judged	Number of first-choice ratings for each package			
	Stapled-bottom carton	Self-locking-bottom carton	Over-wrapped tray	Self-locking-end carton
Displayed most attractively	7	4	8	4
Was easiest to display (in various positions or locations, on sides, ends, etc.)	3	4	6	9
Was easiest to pricemark	12	14	2	10
Afforded best protection to grapes under all conditions	9	6	5	6
Had least amount of water condensation	12	18	2	11
Had best overall appearance	8	5	10	5
Sold fastest	7	2	9	4
Is preferred--everything considered	10	6	10	7

ADVANTAGES AND DISADVANTAGES OF PREPACKAGING GRAPES AT SHIPPING POINT

The advent of self-service produce departments in supermarkets has resulted in an increase in consumer packaging of table grapes at the retail and wholesale terminal levels. This increase in grape packaging stems from the retailer's desire to (1) reduce losses from waste and spoilage resulting from excessive handling of bulk displays by consumers; (2) increase the speed and efficiency of check-out operations by the use of preweighed and prepriced packages; (3) maintain neater and more sanitary displays; (4) reduce the possibility of accidents caused by floor litter; and (5) provide customers with packages that are clean, attractive, and conveniently handled.

A major disadvantage of consumer packaging at the retail or terminal wholesale level has been the cost of labor and materials for taking grapes out of conventional wood boxes and repacking them in consumer packages. Another disadvantage is that the additional handling of the grapes during repacking reduces quality. Because of these factors some retailers are very much interested in obtaining grapes that have been prepackaged at shipping point.

Advantages

By prepackaging at shipping point the total cost of marketing grapes may be reduced. Labor, space, and other overhead costs are usually lower in growing areas than in terminal markets or in retail stores. Also, assembly-line packaging of large volumes of grapes would be more efficient than the small-volume packaging done at the retail store level.

Packaging materials costs--consumer packages and master shipping containers--are likely to be lower if prepackaged at shipping point than the total costs of shipping containers for bulk grapes plus the cost of consumer packages and master containers if repacked in the terminal markets. Also, grapes prepackaged at shipping point are in better condition when delivered to the consumer because they have not been rehandled.

By buying prepackaged grapes the retailer reduces his waste and spoilage losses and saves the cost of labor, materials, equipment, and floor space needed to prepackage the produce in the store. Prepackaged grapes require much less labor for removal from the master container and for stocking on the display shelves than bulk-packed grapes. By obtaining grapes and other produce prepackaged, the produce managers and clerks have more time to attend to the important part of their jobs--that of merchandising produce--instead of the comparatively nonproductive work of attempting to manufacture packages with inadequate facilities and filling up garbage cans with produce waste and discarded packaging materials which cost 2 to 3 cents a pound for transportation charges alone.

Disadvantages

The primary disadvantage most shippers cite is the extra labor and materials that must be used for prepacking. Shippers who cooperated in these tests received for twelve 2-pound packages of consumer-packaged grapes a 50-cent premium above the market price of 28½ pounds of similar quality grapes packed in a conventional wood box. Since only 26 pounds of grapes were packed in the consumer packages the shippers also received (in effect) a premium of 2½ pounds of grapes. At $2.50 per box f.o.b. California, these grapes would be worth approximately 15 cents in the packing shed.

Costs of packing materials and direct labor were 46.6 to 57.5 cents more than for packing the conventional box. The premium shippers received might appear to be adequate reimbursement for consumer packaging, but this is doubtful. The costs mentioned above do not include costs of equipment and of inventory maintenance, or the cost of additional necessary floor space in the packing plant. Since more workers are needed there are also additional administrative, training, and supervisory costs.

During the period that this study was made the packaging lines were largely makeshift. New machinery was being used and packaging was done intermittently for short periods of time. Under these conditions it was difficult to manage the packing crews efficiently and considerable time was lost because

of machinery failure. However, it could be reasonably assumed that if a substantial percentage of the grapes were consumer packaged, a packing plant would be able to reduce unit costs of labor and fixed overhead considerably.

Many retailers prefer to handle and display grapes in bulk because some store patrons prefer selecting individual bunches of grapes. Also, some retailers and terminal market prepackagers feel they have an advantage over the grape shippers by being able to cull out any poor-quality grapes by packaging shortly before they are offered for sale to the consumer. The general feeling of the trade is that shipping-point prepackaging of table grapes will eventually be done by many shippers, but it is impossible to forecast at this time how fast its use will increase. The premium price required for packaged grapes has been a deterrent to any sudden great demand, but if more retailers decide that there are economic advantages in purchasing grapes packaged at shipping point, or if cheaper methods of packaging are developed, then a large demand can be expected.

TRENDS

The development of new packaging materials and more efficient packing methods continues at a rapid pace. For example, toward the end of the 1958-59 season, a new package was introduced to the industry. This was a basket constructed of rigid plastic material. A sheet of polyethylene with many diagonal slits was used as a wrap. The slits allowed the sheet to stretch in one direction, thus forming a pocket for the grapes placed in it. This covering formed an attractive basket-like weave. A printed cellophane sheet also has been used in the same manner. Six of the baskets are packed in a single-layer fiberboard flat; two flats are tied together with rigid wire loops forming a two-layer, 24-pound pack (fig. 8).

The costs of materials for this pack are as follows:

	Cents
Two fiberboard flats at 13.2 cents each	26.4
Twelve plastic baskets at 1.4 cents each	16.8
Two wire loops at 1.5 cents each	3.0
Twelve polyethylene film wraps at 1.2 cents each	14.4
Total	60.6

The cost of materials for this plastic basket pack is 2.52 cents per pound of grapes. Costs of materials for the four consumer packages analyzed in this report ranged from 2.94 to 3.33 cents per pound.

A more recent development has been the introduction of a smaller plastic basket with a capacity of 1½ pounds of grapes. Eight of the baskets are packed in a fiberboard flat. The most important problem to be solved is the need for a method of mechanically wrapping the packages. The package is attractive and has received favorable reaction from the trade. It is hoped that extensive trials of this basket pack will be made in the 1959-60 season.

BN 10027

Figure 8.--Plastic basket consumer packages. Two wire loops passed through the ends of two flats form 24-pound units. The polyethylene film wrap forms an attractive design when stretched over the grapes in the plastic baskets.

Another newly developed item is a low-cost fiberboard master container for the stapled-bottom window cartons. This container enabled the packer who used it to reduce the 50-cent premium charge to 40 cents. As a result of the lower premium this packer had a definite increase in sales of prepackaged grapes in the early part of the 1959-60 marketing season.

This study indicated that shipping-point prepackaging of table grapes for shipment from California to distant markets is commercially feasible. However, high costs of packaging materials and low rates of production in packing plants during the short harvest season, when packers must process a large volume of grapes in a short time, have held back the development of a large volume movement of prepackaged grapes. Additional research may be needed to develop less costly consumer packages and master containers, and more efficient and faster methods of packing and handling the consumer packages and master containers.

* U.S. GOVERNMENT PRINTING OFFICE : 1960 O—554998