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**EVALUATION OF  
SELECTED CONSUMER PACKAGES  
AND  
SHIPPING CONTAINERS  
FOR**

U. S. DEPT. OF AGRICULTURE  
JUN 25 1962  
CURRENT SERIAL RECORDS

# PEACHES



7a Marketing Research Report No. 533

5b  
**U. S. DEPARTMENT OF AGRICULTURE,  
Agricultural Marketing Service,  
Transportation and Facilities Research Division**

## PREFACE

This report describes the development and evaluation of improved packages, packing materials, and master containers for fresh peaches. The study on which this report is based is part of a broad program of marketing research to hold down marketing costs and to deliver better farm products to the consumers. The work was planned and supervised by Donald R. Stokes of the Agricultural Marketing Service. Thomas D. Reinbold, Freeman K. Buxton, and Joseph T. Clarke conducted the research in terminal markets and retail stores, and determined reaction in the industry.

Related reports include:

Prepackaging Medium-Size Apples in Shrinkable Films at Shipping Point, MRR 534, April 1962

Evaluation of Shipping Trays and Pads for Pears and Apples, MRR 530, April 1962

Evaluation of Shipping Containers for Washington Cherries, MRR 426, September 1960

Packaging California Cauliflower, MRR 414, July 1960

Prepackaging California Grapes at Shipping Point, MRR 410, July 1960

Prepackaging Early California Potatoes at Point of Production, MRR 401, June 1960

Prepackaging Firm Ripe Peaches, AMS 312, June 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

Fresh Fruit and Vegetable Prepackaging, Northeastern Region, MRR 154, February 1957

New Shipping Containers for Plums, MRR 128, June 1956

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## SUMMARY

Fresh peaches can be prepackaged at the place where they are grown, and shipped successfully to distant markets. In 1961, approximately 10,000 master containers of 4-pound pulpboard till baskets of peaches overwrapped with shrinkable film were hauled by truck from South Carolina to northeastern and midwestern cities. The arrival condition of the peaches in the new package was satisfactory in all markets, even at distant points.

The 4-pound pulpboard till was selected for evaluation after preliminary shipments in 1960 of various sizes of tills and trays. The 1961 research evaluated this consumer package in comparison with a flat fiberboard box holding two cell-trays and 20.5 pounds of peaches, and with a conventional 3/4-bushel bulk-pack holding 38.5 pounds of peaches; determined terminal and retail trade reactions; and worked out methods of merchandising all sizes of peaches in the various packs.

Packaging material charges per 100 pounds of peaches packed were highest for the prepackaged tills--\$2--as compared with \$1.81 for peaches tray-packed in fiberboard boxes, and \$1.38 for the 3/4-bushel bulk basket.

Direct labor costs also were higher for the consumer package--36 cents per 100 pounds of peaches--as compared with 30 cents for the fiberboard flat with tray-pack, and 27 cents for the 3/4-bushel basket.

Combined material, direct labor, and transportation charges per 100 pounds of peaches in the prepackaged tills were \$4.45 compared with \$3.86 in the fiberboard box tray-pack, and \$3.49 in the 3/4-bushel bulk-pack.

The 4-pound consumer packages of small peaches sold at retail for an average of 55 cents, or approximately 14 cents a pound; larger peaches in the fiberboard flat tray-pack averaged 17 cents a pound; and bulk peaches of mixed sizes in the 3/4-bushel basket sold for an average of 10 cents per pound.

Data on 23 shipments, obtained from terminal and retail sources, showed that peaches packed in the consumer tills and in the fiberboard boxes with tray-pack suffered considerably less bruising in all classifications than those in the 3/4-bushel bulk container. Total bruising in the consumer packages was 3.3 percent as compared to 7.2 percent in the tray-pack box and 13.5 percent in the 3/4-bushel basket. With few exceptions, all three types of containers arrived at terminal and retail levels in good condition.

Wholesalers and retailers showed keen interest in the new 4-pound units. They liked the ease of display, eye-appeal, salability, protection, and convenience. Retailers also commented favorably on the appeal, protection, and display advantages of the tray-pack box for peaches. However, comments at both terminal and retail levels on the 3/4-bushel bulk-pack pertained mostly to excessive bruising.

After the shipping season was over in South Carolina, limited research was done in Maryland to evaluate a 38-pound-capacity full-telescope fiberboard box for a semiautomatic bulk pack of peaches. This box appeared to have promise, but the marketing season ended before adequate data could be obtained.

The various packs evaluated may be considered as a family of containers for peaches: The wrapped till made a protective, attractive package which stimulated sales of small peaches; the fiberboard tray with shipping trays reduced transit bruising of larger peaches; the 3/4-bushel basket and, possibly, the new fiberboard box were useful, low-cost containers for mixed sizes of peaches in a bulk pack.

The purpose of this study was to maximize the sale of peaches and returns to the grower by shipping the fruit in a "family" of different containers. Package differentiation permits the marketing of peaches in containers most suitable for particular sizes or qualities, and most profitable in particular segments of the consuming market. The prices received for any one type of package are not as important as getting the highest average price for the whole crop of peaches.

# EVALUATION OF SELECTED CONSUMER PACKAGES AND SHIPPING CONTAINERS FOR PEACHES

By John L. Ginn, agricultural economist  
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## BACKGROUND

Research has been conducted since 1952 to increase sales of peaches and to satisfy consumer demands through the development and trial of new and improved containers. "Prepackaging Firm-Ripe Peaches"<sup>1/</sup> summarizes the evaluation of a variety of consumer packages and the conventional 3/4-bushel basket and the 1 1/9-bushel wirebound crate. Of the five consumer packages evaluated in this 1959 report, retailers considered a 2-pound acetate window carton the best; however, it has not been used commercially to any extent.

There have been many reasons for the failure of experimental packages for peaches:

1. Additional labor and time are usually required to pack them.
2. Costs of the new packaging materials and equipment are higher than conventional packs.
3. Expensive changes in packing processes are often required when a change is made in the type of package.
4. The differential between the cost of packing and the price received for prepackaged peaches in most cases, is insufficient to encourage packers to adopt the new packages.
5. Trade and consumer reaction may be unfavorable.
6. Excessive spoilage may occur in some moisture-retentive packages when the fruit is not from clean, disease-free orchards.

Since prepackaging peaches had failed to make much progress, further research was needed to develop a consumer package that would be economical, protect the peaches better, and satisfy trade and consumer demands.

Cost per pound is lower in a larger container than in a small one. Therefore, plans were made to pack a unit of 4 pounds instead of 2. To keep material charges at a minimum, a pulpboard till basket was used. The till was overwrapped with shrinkable film, which immobilized the peaches, thereby preventing their rolling and bumping during transit, and consequently eliminating considerable bruising damage. This film also made a very tight, eye-appealing package, with fairly good visibility of the peaches.

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<sup>1/</sup> John L. Ginn. Prepackaging Firm-Ripe Peaches. U. S. Dept. Agr. AMS-312, 48 pp., illus. 1959.



The conventional tub-type 3/4-bushel baskets are packed with 2-inch and larger fruit, all jumbled together when displayed in bulk at the retail store. The appearance of these peaches is often unattractive, because of repeated rough handling by the consumer, who is searching for mature, bruise-free peaches. The lack of uniformity of size and maturity among the peaches also tends to discourage sales in the bulk basket pack. The small peaches appear at a disadvantage when displayed in the same container with the larger peaches. The 4-pound overwrapped till provided the consumer with a package of uniformly-sized peaches, 2 to 2¼ inches in diameter.

Larger peaches were sized and tray-packed two layers deep in full-telescope fiberboard flat boxes.

#### HOW THE STUDY WAS CONDUCTED

During the 1960 peach marketing season, preliminary investigations were made of various sizes of the pulpboard trays and till baskets. It was necessary to determine beforehand the best pattern in which peaches should be placed, and the number of peaches required to guarantee that the consumer received a 4-pound net-weight unit. One important objective was to obtain terminal trade reaction, and to compare the arrival condition of peaches in these packages with that of those in bulk containers.

In two truck shipments from South Carolina to New York in 1960, researchers placed two master containers of the pulpboard packages in each shipment. The first shipment contained a variety of tray and till sizes. Following suggestions and recommendations made by terminal receivers and researchers, two master containers with only 4-pound pulpboard till baskets were shipped on the second test.

On arrival at the terminal there was a noticeable difference in the condition of the peaches. Even though peaches in the packages had been handled considerably more than those in bulk containers, there was less bruising. This extra handling at production level was necessary because of researchers' selecting, sizing, and manually overwrapping and shrinking the film. The most encouraging result from these small preliminary shipments was the extremely favorable reception of the prepackaged peaches.

Information obtained on the arrival condition of the prepackaged peaches and their reception by the trade was relayed to the cooperating shipper. Plans were made for larger shipments from a commercial-size packaging line to be set up by the beginning of the 1961 season. Representatives of container, film, and machinery firms were brought together to provide the necessary packing materials and equipment to ship a volume of packages large enough for researchers to evaluate on a commercial scale.

The research was designed to evaluate the pulpboard till basket in comparison with new and conventional bulk containers as to costs of material, labor to pack, refrigeration, and transportation; and to determine trade reactions. It was decided to ship partial or full truckloads to as many buyers

as possible. Emphasis was placed on working out methods to merchandise all sizes of fruit within the most profitable price structure--that is, merchandising the relatively small peaches in the consumer package and the larger ones in the tray packs.

Researchers cooperated with shippers and the manufacturers of the containers and packaging materials by immediately passing on to them information obtained at terminal markets and retail stores. For example, when an early shipment of packaged peaches arrived in a northern market with fogged film wraps that reduced the visibility of the fruit, the film manufacturer was notified that more ventilation was required. Within days, the perforations in the film were increased from 1/32 inch to 1/16 inch in diameter, and the fogging was eliminated. Other changes resulting from suggestions of researchers in the terminal markets included redesign of the container separator pads, to contribute to the strength of the master containers, and the development of an improved method of closing the master containers to avoid damaging the tills and tearing the film wraps.

During the 1961 peach season, 59 test shipments containing about 10,000 boxes of prepackaged peaches were made by truck from South Carolina to northern markets. Peaches in 23 shipments with approximately 5,500 boxes were inspected at the terminal cities, in order to determine the comparative condition upon arrival of fruit in experimental packages and in conventional containers.

Clemson College and Cornell University evaluated the comparative salability of prepackaged and bulk peaches in retail stores. The prepackaged peaches, when displayed alone, outsold bulk peaches displayed alone by from 55 to 66 percent, the study indicated 2/. Combination package and bulk displays sold from 30 to 62 percent more peaches than bulk displays alone. Spoilage losses in the bulk baskets were almost 50 percent higher than in the packages.

After the peach season was over in South Carolina, limited tests of a new bulk container were made in Maryland. A summary of this work follows the evaluation of packages and containers for Carolina peaches.

## DESCRIPTION OF CONSUMER PACKAGES AND SHIPPING CONTAINERS

### Consumer Tills and Film Wrap

The till was of green molded pulpboard and was approximately 10 by 5 3/4 by 3 inches with perforations 1/4-inch wide by 1-inch long, three on the bottom edge of each side, and one on the bottom edge of each end.

The till, sometimes referred to as a 2-quart till, held from 4 to 4 1/2 pounds of peaches in two layers, depending on the size of peaches and the pattern in which they were packed (fig. 1).

2/ Thomas, Wendell H. Consumer Acceptance of Packaged South Carolina Peaches in Selected Supermarkets. S.C. Agr. Exp. Sta. Cir. 132, 8 pp., illus. 1962.



BN-15656X

Figure 1.--Looking down on upper layer of peaches packed in new 4-pound consumer till overwrapped with clear polyvinyl chloride film.

The shrinkable film used for overwrapping the pulpboard tills was 1/2-mil biaxially oriented (it can shrink both in length and width) cast polyvinyl chloride, and came in rolls 13 inches wide. The amount of film used to overwrap a till averaged 13 by 20-1/4 inches. There were eight perforations per square inch, each 1/16 inch in diameter.

#### Fiberboard Master Container

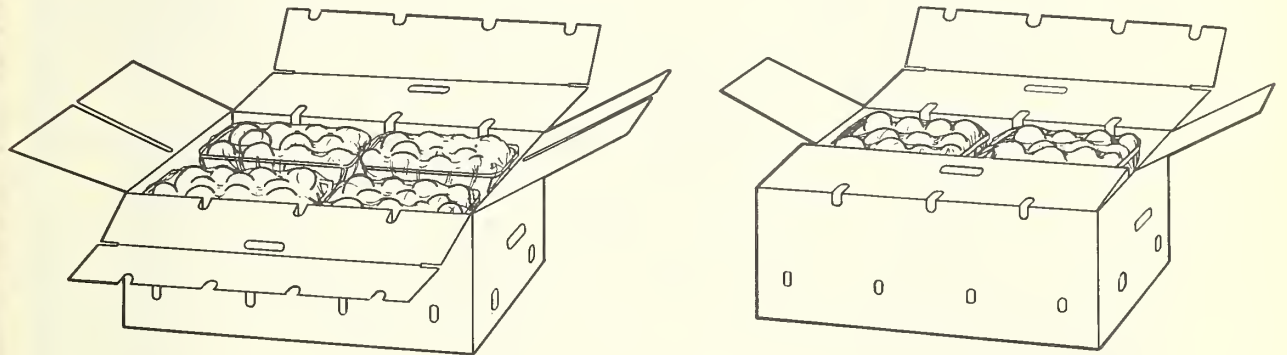
The master container was a one-piece die-cut box of kraft-lined corrugated fiberboard with a designed minimum bursting strength of 200 pounds per square inch. The inside dimensions of the box were 20-7/8 by 13-1/16 by 9-7/8 inches. A pad separator (fig.2) was 52-1/4 by 12-5/8 inches. This strip of corrugated fiberboard served three functions: As a liner for the ends of the box, as a pad between layers, and as a separator between wrapped trays in the bottom layer. The flaps of the box folded down and separated trays in the top layer (fig.3). The box had perforations 1-1/2 by 3/4 inches, seven on each side and two on each end, plus a handhold on each end, and one in each of the two side-flaps which form the cover.





BN-15923X

Figure 2.--One side of this master container has been cut off to reveal four of the eight film-wrapped tills of peaches packed in it. The upper packages are supported by a pad separator which also serves to isolate the peaches on the left from the peaches on the right in the bottom layer. (S. C. Agricultural Experiment Station photo.)



BN-16024

Figure 3.--Four consumer tills of peaches are visible in upper layer in fiberboard master container in drawing at left. Slitted end flaps (right and left) will be laid flat over peaches. Then scored side flaps will be folded down through slits and between tills to form snug separators. Drawing at right shows box with closure half completed.



This box, when fully packed, contained eight 4-pound tills in two layers and weighed from 35 to 40 pounds to allow for shrinkage. The usual net weight observed was 34 pounds. The tare of box and 8 tills was approximately 2 pounds.

#### Bulk Two-Layer Tray Pack in Fiberboard Box

This was a shallow full-telescope box of corrugated fiberboard with a test bursting strength of 200 pounds per square inch. The corrugation was the "C" flute type which combines good cushioning characteristics and crush resistance. Inside dimensions of the body of the box were 16 1/8 by 13 1/2 by 5 3/4 inches.

The box was well ventilated by 1 1/2- by 3 1/4-inch oval perforations in top, sides, and ends. The perforations on both the inner and the outer case followed an exact pattern so that the openings matched when the telescope cover was fitted down over the body of the box (fig. 4).



BN-15651X

Figure 4.--A shipping tray in inner case of shallow fiberboard box is filled with sized peaches from tub. Note perforations in box, which will be matched by those in telescope cover to provide ventilation.

Each box carried two cell-trays of peaches, packed one on top of the other. The dimensions of the trays were slightly less than the dimensions of the inside of the box. They were made of semirigid polyvinyl chloride with molded cups to hold the peaches in place. The number of cups per tray (18 to 35) varied with the size of the peaches packed. The peaches in this box usually ranged from 2-9/16 to 3-1/4 inches in diameter. Tare weight of box and trays was 1 pound and the average net weight was 20.5 pounds.

#### Bulk Pack in 3/4-Bushel Basket

The 3/4-bushel basket (fig. 5) is the conventional container in the Carolinas for shipping bulk-packed peaches. Therefore, it was selected for comparison with the new and experimental containers.

The tub basket had a stitched-in bottom. The sides were constructed of a minimum of 11 short veneer staves held in place by four hoops--one inside and one outside at the top, one at the center and one at the bottom; both of the latter were outside. The bottom was either solid or built up of 7/16-inch veneer. This basket is identified as No. 8055 in the container and loading rules tariff No. 823-c of the Southern Freight Tariff Bureau. The tariff gives the minimum inside diameter at the top as 15-3/8 inches, the maximum outside diameter at the top as 16-7/8 inches, and the capacity as 1,612 cubic inches.



PMA-19780



PMA-17863

Figure 5.--At left is face (top layer) covering bulk fill of peaches in tub basket. At right cover has been secured.

The basket had a separate cover, which was secured by a cross-slat extending across the top and forced through two opposite wire handles looping up from the rim of the basket. The closure was further secured by two wire loop fasteners on the rim and spaced midway between the handles.

The 3/4-bushel basket had a gross weight of 41.5 pounds and a tare of 3 pounds. Accessory packing materials included a paper liner and a paper-covered cushion.

### COST OF PACKAGES AND CONTAINERS

Table 1 shows the cost of all packing materials per unit when purchasing 10,000 units or more, and on the basis of 100 pounds of packed peaches.

Table 1.--Cost of containers and materials per unit and per 100 pounds of peaches packed, South Carolina, 1961 1/

Type of pack	: Cost per unit : <u>2/</u>	: Cost per 100 pounds : packed peaches <u>3/</u>
	: <u>Dollars</u>	: <u>Dollars</u>
Eight film-wrapped tills in master container .....	.68	2.00
Two shipping trays in fiberboard box ..	.37	1.81
Three-fourth-bushel bulk basket .....	.53	1.38

1/ Charges include containers, consumer packages, film, labels, cushions, liners, and plastic trays, depending on type of container.

2/ Where more than one manufacturer supplied containers, costs were averaged. All charges are commercially quoted, and do not include grower discounts or bonuses.

3/ Based on net weight of 34 pounds of peaches in master containers with eight film-wrapped tills, 20.5 pounds net in the fiberboard flat, and 38.5 pounds net in the 3/4-bushel basket.

The 3/4-bushel bulk basket was the least expensive container used for packing peaches when compared with the tray-packed or prepackaged units.

### METHODS OF PACKING

Only direct packing operations are described. Regardless of the type of container packed, all peaches are first unloaded, dumped onto a conveyor, washed or brushed, graded, sized, and conveyed to the various packing lines; these operations were not included in the study.



## Consumer Tills in Fiberboard Master Containers

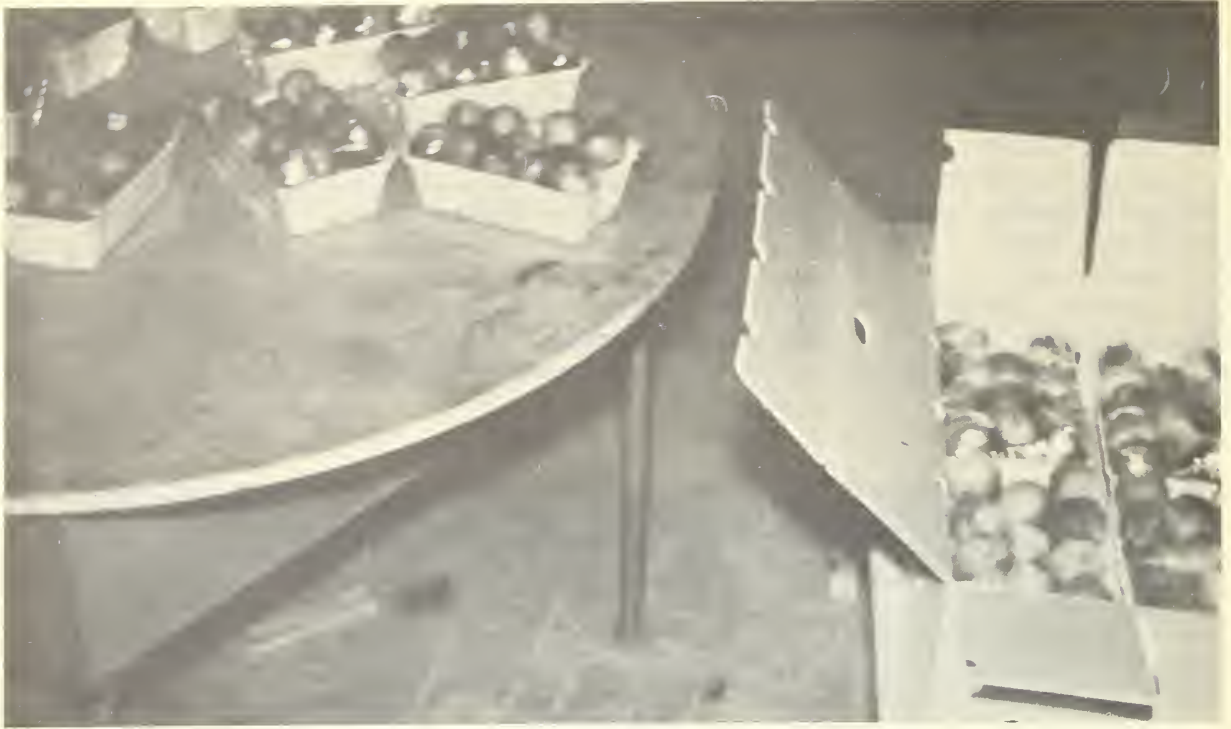
Stacks of the tills were placed close to the first packing station at the beginning of the packing operation. Here eight peaches, already hydrocooled, were jumble-filled in the bottom of the till. A conveyor then took the tills to a second group of workers who place-packed 10 to 12 peaches, depending on size, in a second layer. The tills were then conveyed to a machine which overwrapped them in shrinkable film (fig. 6). After being conveyed through a heat tunnel where the film was shrunk, the tills emerged onto a turntable from which workers packed them eight to a master container (fig. 7), closed it, and stamped it with grade and variety of peaches. Master shipping containers were manually assembled upstairs, and were delivered to packers below through a gravity chute.



BN-15734X

Figure 6.--Worker removes tills of peaches from conveyor and feeds them into machine which applies sleeve wrap of transparent film. (S.C. Agricultural Experiment Station photo.)





BN-15654X

Figure 7.--Film-wrapped tills of peaches on accumulator table (left) are ready to be packed into master container as soon as full box (right) is removed and replaced by empty.

#### Bulk Two-Layer Tray Pack in Fiberboard Box

The packer removed a box from an overhead chute, placed it on a slanted wooden stand, inserted a plastic tray and filled it from a tub of sized peaches, inserted a corrugated pad over the peaches, placed another plastic tray on the pad, filled the tray, and moved the box onto a conveyor. The box was taken to a station where it was closed, and the count and size stamped on the cover. Both tops and bottoms of these boxes were assembled by semiautomatic stapling machines overhead and supplied to workers by gravity-fed chutes. Before loading, the boxes were tallied and their markings checked.

#### Bulk Pack in 3/4-Bushel Baskets

A packer prepared the top, or face, layer of the basket by arranging peaches in a round metal plate called a "ring." The rim around the edge of the ring held the outer line of peaches in a circle. The "facer" usually placed one peach in position at a time with the right hand while holding the previous peach in place with the left hand. The facer built from the outer circle toward the center until the center hole was reached and then filled the center hole with a few peaches selected for an exact fit.

A paper basket liner was inserted into a metal mold, called a "tub." The mold was the shape of a basket, was slightly larger at the top than at the bottom, and was open at both top and bottom. The larger opening of the mold was placed down over the ring, which held a completed face layer of peaches.

The mold, liner, face, and ring, as one unit, were placed under a chute and filled with peaches through the smaller mold opening. After being filled, the entire unit was moved to the main conveyor line and the mold slipped off; the paper liner held the peaches in a mound on top of the face and ring.

A basket was then placed down over the liner, which was holding the peaches mounded over the face. A device on the conveyor belt automatically turned the basket, ring, and face right side up simultaneously. The ring, now inverted on the top of the basket, was removed and returned to the facers by a chain conveyor. Workers at this point adjusted or replaced green and blemished fruit which appeared in the inverted basket face.

The filled basket was conveyed to the hydrocooler where it remained about 15 minutes.

A pad was placed over the top of the peaches to protect the face of the fruit, and the lid on top of that. The wire handles of the basket were bent over the center stave of the lid, and the two wire ties on the top sides of the basket were pulled through wire loops on the lid and bent down tight with a handtool. A paper brand label was pasted on the side of the basket, and the fruit size, variety, and grade were stamped in ink on the lid.

#### LABOR REQUIREMENTS AND COST

Table 2 shows the number of workers directly engaged in packing the various containers and the cost of the labor at an average wage of \$1.30 per hour.

Table 2.--Number of workers in direct packing operation, hourly production and direct labor cost, South Carolina, 1961

Type of pack	Workers engaged in direct packing operation	Average packout of containers per hour	Cost per master container	Cost per 100 pounds of peaches
	<u>Number</u>	<u>Number</u>	<u>Cents</u>	<u>Cents</u>
Wrapped tills ..	13	136	12.4	36
Tray pack .....	21	444	6.1	30
Bulk 3/4-bushel: basket .....	22	275	10.4	27

#### Consumer Tills in Fiberboard Master Containers

The 13 workers directly assembling and packing the 4-pound tills, overwrapping, supplying boxes, packing tills in master shipping containers, stamping, and stacking, packed a maximum of 202 shipping containers per hour. The average packout for the shipping season was 136 per hour. The direct labor cost of packing the tills was 9 cents more per 100 pounds than bulk-packing the same quantity of peaches in 3/4-bushel baskets.

### Bulk Two-Layer Tray Pack in Fiberboard Boxes

Twenty-one workers were engaged in the direct packing operations. These operations were: Assembling and supplying boxes, packing, placing tubs of peaches for packers, closing, stamping, and stacking boxes for loaders. The maximum hourly packout was 525 boxes, but averaged 444 with a direct labor cost of 30 cents per 100 pounds, 3 cents more than for the bulk basket method.

### Bulk Pack in 3/4-Bushel Basket

There were 22 workers facing, packing, basketing, removing metal rings, straightening faces, lidding and closing, labeling, stamping, and stacking. These workers packed a maximum of 390 baskets per hour, but averaged over the shipping season 275 per hour at a direct labor cost of 27 cents per 100 pounds of peaches.

### TRANSPORTATION COSTS

Table 3 shows that on an equal weight basis it cost more to transport pre-packaged peaches by truck than tray-packed peaches or bulk peaches in baskets.

Table 3.--Cost to transport peaches in various containers by truck from South Carolina to New York City, 1961

Item	Unit	8 tills in fiberboard box	2 trays in fiberboard box	3/4-bushel basket
Net weight of peaches	Pounds	34	20.5	38.5
Tare weight	Do..	2	1	3
Gross weight	Do..	36	21.5	41.5
Billing weight	Do..	41.5	21.5	41.5
Charge per container	Dollars	.71	.36	.71
Cost per 100 pounds of peaches	Do..	2.09	1.76	1.84

The master container with 8 tills held an average of 34 pounds of peaches and had a gross weight of 36 pounds. The 3/4-bushel basket held 38.5 pounds of peaches and its gross weight was 41.5 pounds. However, the billing weight assigned to both by the truckers was 41.5 pounds because the protectively compartmented master container for the tills required as much space as the basket.

### COMBINED COSTS OF PACKING AND TRANSPORTATION

Costs to buy packing materials, to pay for direct packing labor, and to transport peaches by truck from South Carolina to New York City are listed in table 4.



Table 4.--Combined cost of materials, direct packing labor, and transportation per 100 pounds of peaches in alternative containers, 1961

Item	8 tills in fiberboard box	Tray pack in fiberboard flat	3/4-bushel basket
	<u>Dollars</u>	<u>Dollars</u>	<u>Dollars</u>
Materials .....	2.00	1.81	1.38
Direct labor .....	.36	.30	.27
Transportation <sup>1/</sup> .....	2.09	1.76	1.84
<b>Total .....</b>	<b>4.45</b>	<b>3.87</b>	<b>3.49</b>

<sup>1/</sup> Based on truck charges from North Carolina to New York City.

As the table shows, the cost to deliver prepackaged South Carolina peaches in New York City was slightly less than a cent a pound higher than the cost to deliver bulk peaches. This difference in cost may be expected to decline as less expensive materials are developed, packing methods are improved, and transportation billing weights are brought more in line with actual weights.

#### TERMINAL AND RETAIL EVALUATION OF PEACHES AND CONTAINERS

During the 1961 South Carolina peach marketing season, 59 shipments were made that included the experimental consumer packages. These shipments ranged from 2 to 100 percent of a truckload of the new packages. Where less than a truckload shipment was made, the balance of the load was either in fiberboard flats for the tray pack or the 3/4-bushel bulk pack. Of the 59 shipments made, researchers inspected 23 at terminal cities. All contained wrapped tills, 14 had tray packs, and 8 had bulk baskets.

#### Method of Evaluation

Packaging specialists inspected the peaches after arrival in market cities to determine the amount and severity of bruising, skin discoloration, stem punctures, cuts and skin breaks, and decay, mainly brown rot. Designation of bruising as slight, damage by bruising, or serious bruising depended upon the area and depth of the bruise. In general, the following guide was used: Slight bruising, bruised area less than 3/4-inch on diameter, damage by bruising, 3/4- to 1-inch, serious bruising, over 1 inch.

Because the overwrapped 4-pound tills were not usually opened, inspections were made with limited visibility. Therefore, some defects were probably overlooked.



However, nearly 100 experimental tills, shipped in preliminary tests to determine the incidence of bruising and decay before making commercial shipments, were opened and examined in terminal markets. Bruising in both bottom and top layers was negligible, although some decay had developed. Thus, it was not considered practical to damage the packages by opening them when they were in commercial channels.

The various containers were evaluated upon arrival at terminal markets and later at retail stores to observe their overall appearance, and their resistance to crushing, tearing, scuffing, and absorption of moisture. At both terminal and retail levels researchers recorded trade reaction to the condition of the peaches and to the types of containers.

All shipments that included the experimental consumer packages were subject to the usual commercial practices. The peaches were packed, handled, and loaded in the same manner as peaches shipped in the other containers. In many cases, the same workers who packed the fiberboard flat boxes also packed the 4-pound consumer units.

### Condition of Peaches in Terminal Markets

Peaches in the 4-pound consumer packages arrived at terminal markets with considerably less bruising in all degrees than peaches in the other containers (table 6). Total bruising in the consumer packages amounted to 3.3 percent compared to 7.2 percent in the fiberboard flat tray pack, and 13.5 percent bruising in the 3/4-bushel bulk pack.

Table 6.--Bruising and decay of peaches at terminal markets by type of container, 1961

Container	Bruising <sup>1/</sup>				Decay <sup>2/</sup>
	Slight bruising	Damage by bruising	Serious damage	Total	
	Percent	Percent	Percent	Percent	Percent
Wrapped tills .....	.2	1.0	2.1	3.3	.9
Fiberboard flat .....	.5	3.1	3.6	7.2	1.7
3/4-bushel basket .....	3.0	3.9	6.5	13.5	1.8

<sup>1/</sup> Statistical differences exist at the 5-percent level among all containers.

<sup>2/</sup> Statistical differences exist at the 5-percent level except between the fiberboard flat and the 3/4-bushel basket.

Slightly more decay was recorded on peaches in the 3/4-bushel bulk pack and in the fiberboard flat than in the 4-pound package.

Stem punctures, cuts, and skin breaks totaled less than 0.5 percent in all containers, and the amount of discoloration was negligible. Hence, neither of these defect categories is included in table 6.

### Condition of Peaches in Retail Stores

In retail stores, researchers made 25 inspections of packaged peaches the first day on display, 17 inspections the second day, and 6 inspections the third day. Peaches in the fiberboard flats and in the baskets only occasionally were put on sale in the same stores with the packaged peaches. In consequence, observations were limited, and no third day inspection of bulk peaches in baskets was made.

Efforts were made to record the condition of the peaches on the first 3 consecutive days after they went on display. In many instances, peaches in any given lot were all sold by the third day. Furthermore, in some stores the bulk peaches were culled and discarded because of bruising caused by consumer handling.

Peaches inspected in the tills and in the tray-packs in the fiberboard flats averaged more overall bruising on the second day than on the first, and more on the third day than on the second (table 7).

Table 7.--Bruising and decay of peaches in retail stores, by type of container, market cities, 1961

Container	Days: in store	Bruising			Total	Decay
		Slight bruising	Damage by bruising	Serious damage		
		Percent	Percent	Percent	Percent	Percent
Wrapped tills .....	1	2.5	.6	.5	3.6	.6
Do. ....	2	3.4	1.0	1.4	5.8	2.5
Do. ....	3	3.8	2.6	2.0	8.4	3.6
Fiberboard flat .....	1	3.5	1.0	2.0	6.5	1.0
Do. ....	2	6.0	2.5	3.5	12.0	4.5
Do. ....	3	8.5	6.0	1.0	15.5	6.0

Peaches inspected upon arrival at terminal markets by AMS specialists, frequently were reinspected by wholesale warehouse personnel before delivery to retail stores. At this time peaches showing damage by bruising, serious bruising, or decay were replaced by sound peaches. Produce clerks in the stores also often removed defective peaches before building their displays. Hence, test inspections made on the first day the peaches were in the stores indicated less damage by bruising, serious bruising, and decay than had been found earlier at the terminal.

Peaches in the baskets showed substantial bruising; however, the number of observations was insufficient to permit valid comparisons, and therefore, percentages for baskets in retail stores are not listed in table 7.

Decay among peaches in 1961 was fairly extensive, because of excessive rainfall.

### Condition of Containers

The master shipping containers with the prepackaged peaches in four shipments showed slight to serious crushing and buckling from overhead weight. Some rubbing and skinning also was observed. This affected the general appearance of the containers, but it did not affect the condition of the peaches.

Loaders and truckers did not agree as to how this new and untried container should be stacked. A stacking pattern for both trucks and rail cars needs to be developed.

Occasionally the 4-pound tills were crushed, and the film torn. These packages, usually in the top layer, were damaged by careless closing of the shipping container at the packing plant. Workers were trained in the techniques of closing the master container, but during rush peaks or a change in work assignments, this type of damage often recurred. Improvements are needed in the closing features of the shipping container.

The fiberboard flat for tray-pack peaches and the 3/4-bushel bulk basket arrived at destinations in good condition with very few exceptions. In two shipments the fiberboard flat showed slight to serious crushing, denting, skinning, and rubbing. Slight to serious damage of the 3/4-bushel basket was observed in only one shipment. The damage to both the fiberboard flat and the basket was caused by rough handling and/or a shifting of the load. Fiberboard containers often buckle or are crushed by overhead weight while in transit, when they absorb moisture and weaken. The longer the time in transit, the more pronounced is this type of damage.

### Weight Loss of Peaches in Consumer Packages

In four shipments the consumer packages were weighed in the packing plant, and again at terminal markets and retail stores.

From the packing line to the terminal level the 4-pound wrapped tills lost an average of 0.9 ounce. From terminal to retail display the packages lost an additional 0.3 ounce. In an effort to guarantee the consumer receiving at least 4 pounds of peaches in the wrapped till, packers should pack an average of 4 pounds and 3 to 4 ounces per unit. Because the packages averaged a loss of only 1.2 ounces, the recommended packing weight will more than offset shrinkage.



## Comparative Retail Prices Received

Comparative prices received at retail per pound of peaches in the different containers were:

	<u>Size of peaches</u>	<u>Cents</u>
Film-wrapped tills ..	2 to 2½ inches	14
Tray pack .....	2 9/16 to 3½ inches	17
Bulk basket .....	2 to 3½ inches	10

The small peaches prepackaged in the tills sold at lower prices than the larger peaches in the tray packs but at higher prices than the mixture of sizes in the bulk baskets.

## Reaction of Trade

Reaction of the trade to the prepackaged peaches was almost entirely favorable. Both wholesalers and retailers commented on the ability of the overwrapped tills to reduce bruising, to protect the peaches from handling by customers, to make an attractive display, and to increase sales; and action paralleled words.

Eight receivers interviewed in terminal markets made initial purchases of from 10 to 45 boxes of peaches in the experimental consumer packages early in the season. They liked the packages and increased their orders. By season's end, deliveries to these same receivers ranged from 125 to 700 boxes per shipment.

Most of the trucks making the deliveries carried mixed loads of prepackaged peaches and fiberboard flats with peaches in trays, or prepackaged peaches and bulk peaches in baskets. In the first 13 trucks hauling the peaches which were inspected at terminal markets, the average volume of prepackaged peaches per load was 125 boxes. In the last 10 trucks the average per load was 385 boxes. Two trucks contained only prepackaged peaches, one 700 boxes, and one 800.

As the season progressed, the increase in the volume of orders for prepackaged peaches from all buyers was so great that the shipper could not fill them.

Some typical comments on the consumer packages were:

"A fine package for small peaches."

"With the film overwrap, customers can't handle the peaches. This makes for better sanitation and reduces damage to the peaches."

"They make an attractive display, and one easy to set up and maintain" (fig. 8).

"The customers like them. Sales of peaches went up."





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Figure 8.--These prepackaged peaches were quickly built into a colorful sidewalk display on top of two empty master containers.

"They save us the time and labor to rehandle the peaches and package them here in the store."

"The 4-pound package is the best size." (A minority said it was "too big.")

"I wish we could get more of them."

Infrequent adverse criticism of the package centered around the occasional appearance of a defective peach. "To remove the peach we must tear off the film wrap. Then we must re-wrap the till or try to sell a less attractive, unwrapped package."

One produce handler commented that peaches in the bottom layer of the till should have better visibility.

The fiberboard flat with two layers of peaches was liked for the most part because it "protected the fruit better than the basket" and because it made a "better display."

The basket was usually criticized because of the higher incidence of bruising among the peaches packed in it. "However," one retailer remarked, "you can always remove a defective peach from a basket without running into complications."

## PRELIMINARY STUDY OF FIBERBOARD BOX FOR SEMIAUTOMATIC BULK PACK 2/

Following the research in South Carolina, some preliminary work was initiated in Maryland to evaluate a fiberboard box, which was semiautomatically bulk-packed with 38 pounds of peaches. This is the weight usually delivered in the 3/4-bushel basket.

### Description of Container

The shipping container was a full-telescope fiberboard box. The body was double-walled with test bursting strength of 350 pounds. The cover was single-walled with test bursting strength of 200 pounds. Both body and cover had stapled joints. Inside dimensions were 16 $\frac{1}{4}$  by 11 by 11  $\frac{3}{4}$  inches.

### Cost of Container and Packing Materials

The fiberboard box, paper pads for the top and the bottom of the pack, and a cellulose cushion pad for the top cost 37 cents.

### Labor Requirements to Pack

The peaches were hydrocooled, brushed, sorted and sized, then conveyed to an automatic filler head. One worker lined the bottoms of empty boxes with a thin paper pad and fed the boxes to the filler head. Peaches flowed in. When the weight reached 38 pounds, the flow was automatically halted, and the box removed. A second worker check-weighed the box, laid a paper pad, and then a cellulose pad on top of the peaches. A third worker fitted on the cover, stamped it with size and grade, and stacked the box on a pallet.

A complete time study of the packing operation was not made. However, it was apparent that direct labor requirements to bulk-pack the fiberboard box were substantially less than those for the 3/4-bushel basket, the container for the bulk-pack studied in South Carolina. On the other hand, it was evident that the investment in machinery and equipment to pack the box was greater than that required for the basket. A more complete study is needed to analyze the various factors involved.

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2/ Thomas D. Reinbold, industrial engineer, and Joseph T. Clarke, agricultural economist, Transportation and Facilities Research Division, Agricultural Marketing Service, conducted this phase of the study.

## Trade Reaction

All the peaches marketed by the cooperating Maryland plant in 1961 were bulk-packed in fiberboard boxes; comparable peaches in conventional containers were not available for use as a control. Because of the limited availability of research personnel, peaches from only three shipments were observed after arrival in retail stores in the New York City area and in Hartford, Conn.

However, trade reaction to the boxed peaches was almost uniformly favorable. Store produce managers who had received a number of shipments said that the arrival condition of the peaches was good and that the boxes were easier to handle, stack, and store than baskets.

## DISCUSSION AND CONCLUSIONS

Packaging specialists at terminal markets and retail stores found less bruising among peaches in film-wrapped tills than in tray-packed fiberboard flats or 3/4-bushel baskets, and less in the flats than in the baskets.

Comments of wholesalers and retailers predominantly favored the tills. A number of storekeepers reported that the attractively wrapped tills increased their sales of peaches.

Receivers, who purchased small sample lots of prepackaged peaches early in the season, increased the size of their orders until the shipper could no longer meet the demand.

The various types of packs evaluated constituted a family of containers, each of which contributed a share to improved overall marketing of peaches.

The wrapped tills provided a consumer package with eye-appeal which increased the salability of uniformly-sized small peaches.

The fiberboard flats with two trays reduced bruising in transit and facilitated the display of larger peaches.

The 3/4-bushel basket was a low-cost container with adequate protection for a bulk pack of peaches in a mixture of sizes.

The 9/10-bushel fiberboard box (38 pounds) also showed promise as a container for a bulk pack.

The purpose of this study was to maximize the sale of peaches and returns to the grower by shipping the fruit in a "family" of different containers. Package differentiation permits the marketing of peaches in containers most suitable for particular sizes or qualities, and most profitable in particular segments of the consuming market. The prices received for any one type of



package are not as important as getting the highest average price for the whole crop of peaches.

Although prices received for peaches shipped in 4-pound till baskets and the 2-layer cell boxes were not made available by the shipper it was known that the prepackaged peaches sold for a price equivalent to or above those sold in the 3/4-bushel basket; and prices received for peaches packed in the 2-layer boxes were substantially higher than the equivalent 3/4-bushel basket price. The 4-pound till basket, as well as some of the film and master containers, was given early in the season to the shipper by the manufacturers, for his willingness to participate in the experiment. These prepackaged peaches initially were priced attractively low to develop a market and demand for them.

It was expected that during the 1962 season, the till-packaged peaches would be priced, as a general rule, at the rate of 1 cent per pound above the price of the 3/4-bushel basket.

Research is needed to improve packaging materials, handling and transportation practices, and efficiency of the packing line, to cut costs. Other improvements can be realized through more efficient and improved machinery for processing and packing peaches.

When fresh produce is packaged, complete quality control is mandatory. A consumer will help pay for the cost of packaging, if she knows that the produce being purchased is of better quality than that generally offered in bulk displays. The only way to make packaging succeed is to consistently package quality produce in a quality pack. For successful prepackaging of highly perishable peaches, fruit must come from clean orchards, with little history of brown rot spoilage. Packaging not only offers the consumer convenience, more protection and sanitation, but also a wider selection.

If the terminal and retail trade and consumers make their wants known to the peach industry, it is anticipated that a much higher percent of fresh peaches will be packaged in some type of container in the near future.



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