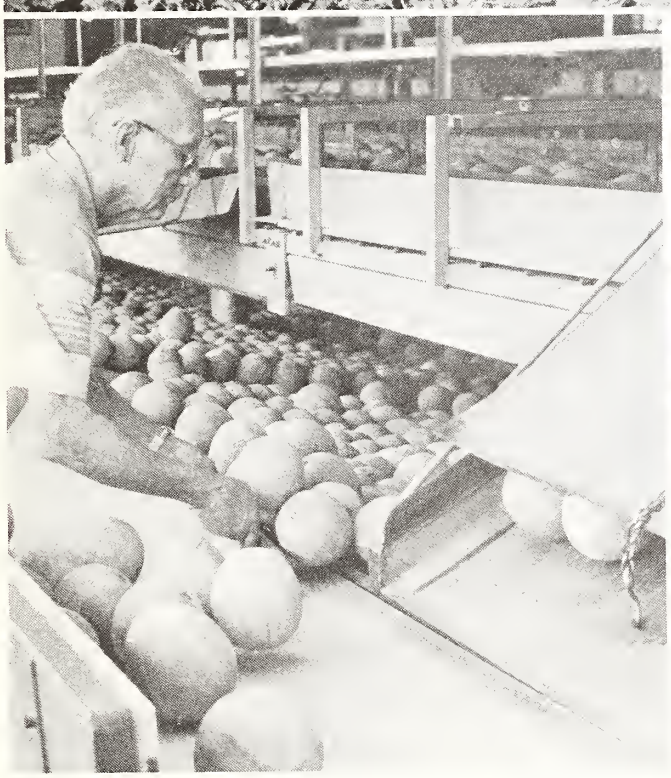
United States
Department of
Agriculture

Agricultural
Marketing
Service

Marketing
Research Report
Number 1148

Systems and Costs for Marketing Cantaloupes



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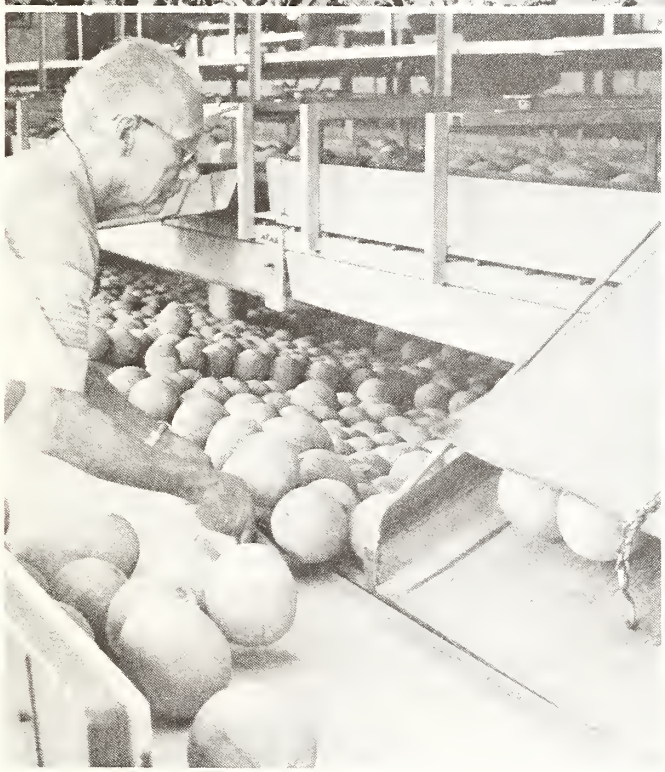

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Preface

This study is part of a continuing research program of the Agricultural Marketing Service to find agricultural marketing systems that are more efficient and less costly and that best maintain the quality of the food product from the producer to the consumer.

The authors acknowledge the help of growers, shippers, carriers, wholesalers, and receivers of cantaloupes who made their facilities available and who gave their time and cooperation to this study.

March 1987

Summary

Methods for harvesting, transporting, and delivering cantaloupes from growing area to retail store were studied to provide an overview of the total marketing system and to determine the costs of different methods within the marketing system.

Six harvesting methods were studied. Four were used by large national growers/shippers (more than 1,500 trailer loads per season) and two by small growers/shippers (20-40 trailer loads per season). Harvesting costs per ton for the six methods ranged between $10.18 and $23.41. A large grower/shipper used the least costly method, an 18,000-pound-capacity bin on a field truck with steps in the rear. The highest cost method was that of a small grower/shipper who used an 850-pound-capacity field bin on a wagon.

Packing plant costs, including both direct and indirect costs, ranged between $1.50 and $2.50 per 42- pound container. Packing plant costs can vary based on efficiency of plant layout, employee skill, and volume of melons handled.

Of the four methods used during transportation, the palletized method was the lowest in labor and equipment cost per container ($0.019) from packing plant to wholesale warehouse. The bin method was next lowest, with a cost equivalent per container of $0.027 for disposable bins and $0.026 for permanent bins. Slipsheet and handstacked methods were next, at $0.031 and $0.041 per container, respectively.

Four methods of delivery from the wholesale warehouse to the retail store were studied: palletized, mobile cart, handstacked, and bin. The palletized delivery method had the lowest labor, equipment, and transportation cost per container, $0.258. The costs per container for mobile cart delivery and handstacked delivery were $0.269 and $0.298, respectively. Cost for the bin method was $0.694 per equivalent container. Retail store handling was $0.26 per container and $0.42 per bin, or $0.02 per equivalent container.

Cantaloupe damage ranged between 1 and 1-1/2 percent upon arrival at the packing plant. Increased selectivity by the pickers at harvesting could reduce this damage rate. At the retail store, the damage rate for locally grown melons was 15 percent and for nationally marketed melons, 7 percent. Quality control for locally grown melons is usually not as good as that for nationally marketed melons.

Systems and Costs for Marketing Cantaloupes

By Robert C. Mongelli and Joseph P. Anthony, Jr.[1]

Commercial cantaloupe production in the United States in 1983 totaled 1.4 billion pounds (*13*).[2] The value of the crop was more than $180 million. Cantaloupes for the commercial market are grown in 24 States. California is the leading producer with 68 percent of total production; Texas follows with 18 percent; and Arizona is third with 8 percent. Supplies from these three States, combined with the production from 21 other States and Mexico, provide a year-round supply, at least in major cities (*15*). The supply of cantaloupes is small from October through April. The main production season is May through September, and the peak period is June through August (*8*)

During early stages of growth, cantaloupe plants need warm weather, ample soil moisture, and a dry atmosphere. Excessive moisture while the melons are ripening is likely to lower their quality. The principal commercial varieties of cantaloupe grown in the United States require about 80 to 115 days from the time the seeds are planted until the first melons are ripe. For maximum yields a growing season of from l30 to l40 days and a high mean temperature are desirable. The poor quality of many commercial cantaloupes, particularly among those produced in humid parts of the country, is due mainly to disease or to harvesting too early, or both.

Climatic conditions highly favorable to the cantaloupe plant are found in the Imperial Valley of California and in the Rocky Ford district of Colorado and other irrigated districts. Important areas in California also include the Palo Verde Valley, the Kern district, and the Westside district. Chief producing districts in Arizona are Yuma and Parker (*18*).

In Texas the most important growing areas are the lower Rio Grande Valley, Pecos, Laredo, and Wintergarden (*6*).

Because cantaloupes are highly perishable, the shortest possible storage time is recommended. A temperature of 40 to 50 degrees Fahrenheit and a relative humidity between 85 and 90 percent provide the best environment. Even under these conditions, cantaloupes deteriorate from field-fresh to fair condition in l2 to l6 days.

Cooling immediately after harvest is essential to reduce self-heating during transit and marketing and loss of quality and shelf-life. Cantaloupes should be handled carefully to avoid damage. Bruising, scruffing of the netting, puncturing, or cracking can cause rapid deterioration through moisture loss or decay.

[1]Aricultural economists, Market Research and Development Division, Agricultural Marketing Service, U. S. Department of Agriculture, Washington, D.C. 20250

[2]Italicized numbers in parentheses refer to sources in the References.

Objective and Methodology

Only a mature melon provides the sweetness, texture, flavor, and juiciness that characterize cantaloupes at their finest. Melons must mature on the vine before they are harvested. Their sugar content does not increase after they are picked, although their sugar type changes and they soften.

A cantaloupe that is mature is well netted or webbed and has a smoothly rounded, depressed scar at its tip. If this tip is rough, with portions of the stem remaining, the melon was not ready for harvest.

Because cantaloupes are shipped when they are firm to avoid damage, they usually need a few days to soften and become juicy. A day or two at room temperature in the home is adequate. When ready to eat they take on a yellow background appearance, acquire an aroma, and soften.

Cantaloupes should be about 5 inches in diameter. Those that are small, runty, or misshapen should be avoided. Also to be avoided are shriveled, flabby, or badly bruised melons or any with growth cracks, mottling, or decay (mold or soft sunken spots on the surface) (*14*).

The purpose of this report is to describe the systems for marketing cantaloupes from grower to retail store and to determine the costs for the major methods used at harvest, transport, and delivery. Caution should be used in applying these costs to obtain a total cost figure for the movement of cantaloupes from grower to retailer. Because the data were gathered in different parts of the country and at different times of the year, use of the same methods at different locations may give slightly different results. Cost data for methods within a phase of the marketing system, where these methods are interchangeable, could be used to compare the cost of one method with another. Primary data were gathered by time studies, direct observations, and personal interviews with industry, State, and county officials in California, Arizona, Texas, South Carolina, Virginia, Maryland, Washington, D.C., and New Jersey. Secondary data were taken from USDA, State, and trade association publications.

Six harvesting, methods were evaluated:

- Bulk truck with rear ramps
- Bulk truck with loader
- Low-back bulk truck with rear steps
- Flatbed wagon and baskets
- Flatbed wagon and bins
- Self-propelled moving conveyor

Costs were measured for labor, equipment, and materials in worker-hours, equipment-hours, and dollars per function performed. The equipment-hour requirements were converted to costs by the use of hourly ownership and operating costs.

For consistency in the measurements for harvesting, it was necessary to develop a breakpoint between harvesting and packing plant operations. For this study, harvesting included picking the melons through the unloading of field trucks or wagons at the packing plant. For each harvesting method, a model was constructed that included a typical load size, labor, equipment and material requirements, and costs. Data were collected in California, Arizona, Texas, Maryland, Delaware, Virginia, and New Jersey.

The packing plant operation began when the cantaloupes entered the packing plant after they were unloaded and ended when they were placed in temporary holding areas after they were packed and before they were moved to the over-the-road transport vehicle for loading. For purposes of the study, fiberboard containers held 42 pounds of melons; fiberboard bins 600 pounds; and wooden bins 850 bounds.

Transportation methods from packing plant to wholesale warehouse consisted of loading, transporting, and unloading. Loading started when the cantaloupes were taken from the end of the packing line or storage and moved into the transport vehicle. Because more than 81 percent

of the cantaloupes are shipped by highway trailer, only truck movement was considered in this report. Loading was completed when the last container or bin was securely in place in the transport vehicle, the dock plate was removed, and the trailer doors were closed.

Four transporting methods were evaluated: handstacked, palletized, slipsheeted, and bin loaded. A refrigerated highway trailer, 40 feet long, was the transport vehicle. Costs were based on containers per trailer load. Over-the-road transportation started when the transport vehicle left the loading area at origin and ended at the wholesale warehouse.

Unloading at the wholesale warehouse started when the trailer doors were opened and the dock plate was positioned. It was completed when the last container was in place in the warehouse storage area.

The delivery methods from wholesale warehouse to retail store consisted of order assembly, stock replenishment, loading, transporting, and unloading at the retail store. The beginning and ending of loading, transporting, and unloading activities were the same as those for the over-the-road transportation. Three delivery methods were studied: handstacked, palletized, and mobile cart.

When fiberboard containers were used, retail store operations consisted of moving of cantaloupes from storage to display case, loading the display case, and removing the empty containers. When bins were used, the operation consisted of moving the bins from storage to display area, removing the empty bins and returning them to the wholesale warehouse, and ultimately returning the bins to the grower/shipper.

The worker-hour labor requirements were converted to costs based on the prevailing usage rates for the job categories as reported by the cooperating packing plants, wholesale warehouses, and retail stores. A 15-percent personal fatigue allowance was added to all labor requirements to provide a standard time for performing the various operations. The equipment-hour requirements were converted to costs by the use of hourly ownership and operating costs.

To determine the least costly methods for marketing cantaloupes, seven packing plants, two wholesale warehouses, and three retail stores were selected for analysis.

In some areas of the United States (including parts of California and Arizona) cantaloupes are usually harvested and transported to a packing plant under a contract agreement. Pickers and field truck drivers are paid an agreed upon amount of money to deliver cantaloupes to the packing plant. Equipment needs such as harvesting bags are usually provided by the packing plant. The packing plant also provides employees to unload the field trucks at the plant and to size, cull, and package the cantaloupes. Field trucks are either owned by the packing plant or by private individuals who have a delivery contract with the plant.

In other areas of the country (including parts of the east coast and Texas) pickers and drivers are hired by the packing plant and paid an hourly wage to harvest and deliver cantaloupes to the packing plant. This phase of the study was designed to determine the requirements and costs of harvesting cantaloupes and delivering them to the packing plant when the packing plant supplies all the equipment and materials and the laborers work for the plant and are paid an hourly wage.

The efficiency of the harvesting crew is vital to the profitability of the operation. If little of the load from the field is culled at the packing plant, the harvesting and hauling cost per packed container is relatively low. With increased culling, the cost per packed container rises accordingly.

In most harvesting methods, pickers carry the cantaloupes in their field bags to the field truck and dump them. In a few instances a belt conveyor is used to assist in the dumping of the cantaloupes. When a belt conveyor is used, the pickers must work together as a unit, moving behind the belt conveyor and placing harvested melons on the conveyor, which carries them up into the field truck.

Some major growers in California, Arizona, and Texas consider this system too slow.[3] In one alternative, pickers use field bags and dump their contents onto the belt conveyor. Pickers thus work independently of each other and almost entirely independent of the conveyor. In another alternative, pickers working ahead of the conveyor pick the cantaloupes and place them into alternate furrows. Another crew follows the conveyor belt and loads the cantaloupes onto the belt (*19*). The self-propelled belt conveyor moves along with a field truck and conveys the harvested melons along the belt into the truck.

The method used most often for harvesting cantaloupes is one in which harvesting crews use field bags (fig. 1) during field picking. Each picker pulls cantaloupes from a single row and places them in the bag carried on the side or

[3]Personal and telephone interviews with six growers/shippers.

Figure 1.—Pickers harvesting cantaloupes using field bags.

Figure 2.—Pickers harvesting cantaloupes using baskets.

back. When the bag, usually holding 60-70 pounds, is filled, the picker walks to the field truck and up the rear ramp and dumps the melons or hands the bag to someone on the truck who does the dumping.

Beside harvesting into bags, crews fill field baskets (fig. 2) and boxes, which are later placed on flatbed trucks or wagons for delivery to the packing plant.

Other harvesting methods and techniques have been tested to make harvesting more efficient. Among the methods being examined is the use of side-steps on field trucks to make dumping easier for the pickers (*4*). Another is night harvesting with artificial lighting so that the melons will be cooler when harvested and thus require less precooling (*5*). Methods studied are described below.

Method 1 utilized a 16,000-pound-capacity field truck with sides, rear ramps and a movable bulkhead, and 12 picking bags. Pickers walking through the field picking melons required 2.70 minutes to fill a bag (65 lb), walk to the rear of the field truck and up the ramp (fig. 3), dump the cantaloupes, and return to picking. It took 246.15 full bags to fill the truck. Because of the physical demands of the work, a 20-percent fatigue allowance was used.

The crew consisted of 12 pickers, plus one worker on the truck and the driver, and it took 55.38 minutes (0.92 hour) to fill the truck or 0.11 hour per ton.

The loaded truck was driven from the field to the packing plant, a distance usually ranging from 3 to 20 miles. At the packing plant the truck was driven up a sloping incline, a side door of the truck was opened, and the cantaloupes rolled out (fig. 4) onto an area from where they were conveyed into the plant. Three plant employees assisted in unloading the truck, which required 0.25 worker-hour and 0.25 equipment-hour. Elapsed travel time from the field to the plant totaled 0.36 hour based on 5 to 6 miles of travel; elapsed unloading time was 0.08 hour; and elapsed travel time to return to the field was 0.36 hours, for a total of 0.804 hour.

With this method the total time required for travel and for loading and unloading the truck was 1.72 hours.

Figure 3.—Pickers carrying their loads into the field truck for dumping.

Figure 4.—Unloading field truck at packing plant.

Figure 5.—Picker at rear of low-body field truck.

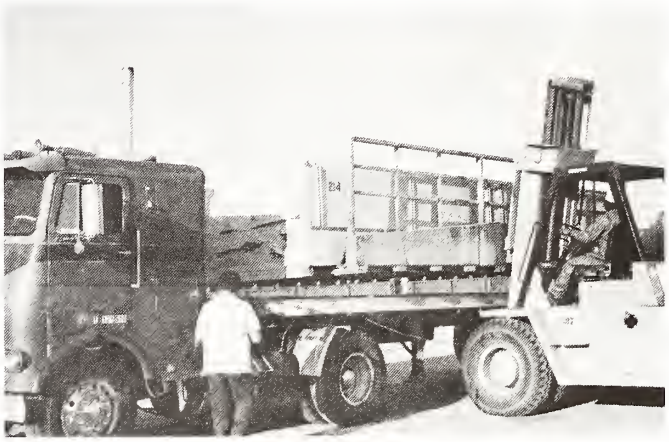

Figure 6. Full bin of cantaloupes being placed on plant truck at staging area.

Method 2 also used a 16,000-pound-capacity flatbed truck with sides, but it had no rear ramps or movable bulkhead. The picking method and number of bags used were the same as in method 1, but—because the truck had no rear ramps—when pickers walked to the truck they had to remove their full bags and wait until they could hand them to a worker on the truck, who dumped the cantaloupes and returned the empty bags to the pickers. Then the pickers returned to picking. Total time for these operations was 2.82 minutes per picker. Because of the physical demands of the work, a 20-percent fatigue allowance was used. With this method, it took 246.15 full bags to fill the truck.

As in method 1, the crew consisted of 12 pickers, one worker on the truck, and the truck driver, but it took 57.84 minutes (0.96 hour) to fill the truck, or 0.12 hour per ton.

With method 2, all of the procedures, travel distance and time, number of plant employee assistants, and unloading time when the loaded truck was driven to the packing plant were the same as for method 1.

With method 2, the total time required for travel and for loading and unloading the truck was 1.77 hours.

Method 3 used equipment that consisted of a flatbed, low-body field truck with steps and an 18,000 pound-capacity bin (approximately 22 feet by 7.5 feet), 12 picking bags, a forklift truck, a plant wagon, and a flatbed plant truck. In this method a picker required 2.40 minutes to pick cantaloupes and fill a bag (65 lb). When the pickers reached the field truck, instead of walking up ramps or handing over their bags for dumping, they walked up steps (fig. 5) at the rear of the field truck and dumped their melons into the bin. Then they returned to picking. Because of the physical demands of the work, a 20-percent fatigue allowance was used. With this method it took 276.92 full bags to fill the bin.

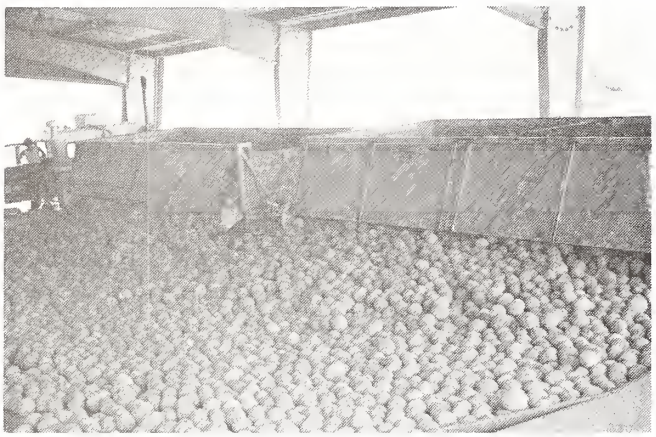

Figure 7.—Unloading plant truck and wagon at packing plant.

Figure 8.—Loading baskets on wagon pulled by tractor.

The crew size and truck loading time were the same for this method as for method 1.

The flat bed field truck with loaded bin was driven to a staging area, a distance usually ranging from 3 to 20 miles. There, the full bin was uncabled from the field truck body, lifted off with a forklift truck, placed on either a flat bed truck (fig.6) or wagon, hooked to the vehicle with cables, and driven to the packing plant. The staging area was usually I to 2 miles from the packing plant. At the packing plant the truck and wagon were driven up a sloping incline, the side doors of the bins were opened, and the cantaloupes rolled out (fig. 7) onto an area from where they were conveyed into the plant. Plant employees assisted in the unloading. At the staging area a forklift truck driver and helper moved the full bin from the field truck bed to the packing plant truck and wagon requiring 0.13 work-hour and 0.07 equipment-hour to transfer two full bins. The transfer of an empty bin from the plant truck to the field truck at the staging area required 0.08 work-hour and 0.04 equipment-hour.

Elapsed time from field to staging area totaled 0.24 hour, based on 3 to 4 miles of travel; 0.07 hour to transfer bin at the staging area, 0.12 hour to travel from staging area to packing plant, based on I to 2 miles of travel; 0.09 hour to unload with three workers per bin; 0.12 hour to return to the staging area; 0.04 hour to transfer the bin from the plant truck to the field truck; and 0.24 hour to travel from the staging area back to the field.

With this method the total time required for travel and for loading and unloading the truck was 1.84 hours.

Methods 1, 2, and 3 were used by growers/shippers who produced approximately 1,500 trailer loads per season.

Method 4 used equipment that consisted of a tractor, wagon, and 122 baskets. The pickers walked through the field to pick melons but collected them in baskets instead of bags. The time required to fill a basket (24.6 lb) was 1.63 minutes. When a basket was full, the pickers walked to the edge of the field, set down the filled basket, walked back into the field, secured another basket, and began picking again. Because of the physical demands of the work a 20-percent fatigue allowance was used. In this method a load of approximately 3,000 pounds was collected and placed on a wagon pulled by a tractor (fig. 8). It took 121.95 full baskets to total 3,000 pounds. The eight-picker crew took 24.84 minutes (0.41 hour) to collect 3,000 pounds, or 0.27 hour per ton.

During collection of the full baskets, a tractor and wagon were driven along the edge of the field or between two fields. Two loaders, one working on each side of the wagon, collected the baskets and placed them on the wagon bed, which held 78 baskets. When the bed was filled, the loaders dumped melons from other baskets until no more melons could be loaded. Total time to load the wagon was 0.55 hour, or 1.10 worker-hours. The loaded wagon was driven by tractor from the field to the packing area, a distance usually ranging from less than 1 mile to 3 miles. Unloading the wagon and packing the cantaloupes into containers was performed as one operation by three workers. Therefore, the time and cost were divided between the harvesting operation and packing area operation.

Elapsed travel time from the field to the packing area totaled 0.15 hour, based on 1.5 miles of travel; elapsed time at the packing area while the wagon was unloaded and containers were packed was 0.45 hour; and elapsed time to return to the field was 0.15 hour, for a total of 0.75 hour.

With this method (4) the total time required for travel and unloading the wagon was 1.71 hours (including time to pack the melons in containers).

This method was used by a small grower/shipper who usually produced 20-40 trailer loads of cantaloupes per season.

Method 5 had the same picking technique as in method 4 and the time required to fill a basket was the same. But in this method the loaders dumped the filled baskets into empty wooden bins (48 inches by 40 inches each) on pallets that were set on a wagon similar to the one used in method 4. In method 5 each bin held 850 pounds, and there were 10 bins per wagon. The total load was 8,500 pounds, representing 345.53 full baskets. The crew consisted of eight pickers, and it took 70.6l minutes (l.l7 hours) to collect 8,500 pounds, or 0.27 hour per ton.

The collecting time required for two loaders to dump enough baskets to fill the 10 wooden bins (8,500 pounds) was l.55 hours, or 3.l0 worker-hours. The loaded wagon was driven by tractor from the field to the packing and trailer loading area, a distance usually ranging from less than 1 mile to 3 miles.

At the packing and loading area, the bins were unloaded from the wagon and placed in a holding area (fig. 9) before they were loaded onto a highway trailer. The grower/shipper surveyed used this method for customers who agreed to return the empty bins or for customers who supplied their own bins. The grower sells these melons for less than those packed in containers (method 4) because the buyer cannot as easily inspect the load at destination.

Elapsed travel time from field to unloading area totaled 0.15 hour, based on 1.5 miles of travel; elapsed time to unload was 0.09 hour; elapsed time to load empty bins on the wagon was 0.08 hour; and elapsed time to return to the field was 0.15 hour, for a total of 0.47 hour.

With this method (5), the total time required for travel and for loading and unloading the wagon was 3.20 hours.

As with method 4, method 5 was used by a grower/shjpper who usually produced 20-40 trailer loads per season.

On some occasions the melons were removed from the bins at the packing area and packed in containers for container shipments.

Method 6 utilized a self-propelled moving conveyor (fig. 10), a tractor, and two 18,000-pound-capacity wagons. The conveyors used for harvesting can cover 10 to 20 rows of melons. Those used in this study covered 16 rows. Pickers

Figure 9.—Filled bins being placed in holding area.

Figure 10.—A self-propelled moving conveyor, wagon, and tractor being used to harvest cantaloupes.

walking behind the conveyor picked melons and placed them on the conveyor, which transported them to a wagon pulled by a tractor. The harvesting crew consisted of 19 workers: 16 pickers, one conveyor driver, one tractor driver, and a worker in the wagon, who spread out the load as the melons entered the wagon. It took 0.93 hour to fill each wagon, or 0.10 hour per ton.

When one wagon was filled, it was driven to the side of the field and unhooked from the tractor. A second wagon was hooked to the tractor and transported to the field for loading. Time for this operation was 0.18 hour. When the second wagon was filled, the tractor transported it to the first wagon and hooked the first wagon to the rear of the second wagon. Time for this operation was 0.12 hour.

The tractor transported the two wagons to the packing plant, usually 3 to 20 miles distant. At the packing plant the tractor and wagons were driven up a sloping incline, the side doors of the wagons were opened, and the cantaloupes rolled out onto an area from where they were conveyed into the plant. Three plant employees assisted in the unloading.

Table 1.—Hourly ownership and operating costs for equipment required for six methods of harvesting cantaloupes

Method and equipment	Initial cost (1)	Total fixed cost (1)	Variable costs		Total variable costs	Total costs	Costs per hour of operation (2)
			Power	Maintenance			
	Dollars	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
Method 1:							
Field truck with ramps	15,000.00 (10)	3,750.00	3 1,200.00	4 750.00	1,950.00	5,700.00	1.781
Harvesting bags	10.50 (3)	5.07	—	—	—	5.07	.006
Method 2:							
Field truck, no ramps	14,800.00 (10)	3,700.00	3 1,200.00	4 740.00	1,940.00	5,640.00	1.762
Harvesting bags	10.50 (3)	5.07	—	—	—	5.07	.006
Method 3:							
Field truck	5 30,000.00 (10)	7,500.00	3 1,200.00	4 1,500.00	2,700.00	10,200.00	3.187
Harvesting bags	10.50 (3)	5.07	—	—	—	5.07	.006
Forklift truck	20,000.00 (10)	5,000.00	600.00	4 300.00	900.00	5,900.00	1.844
Plant truck	5 30,000.00 (10)	7,500.00	3 1,200.00	4 1,500.00	2,700.00	10,200.00	3.187
Plant wagon	8,000.00 (10)	2,000.00	—	4 240.00	240.00	2,240.00	.700
Bin	1,000.00 (10)	250.00	—	4 30.00	30.00	280.00	.087
Method 4:							
Tractor	10,000.00 (10)	2,500.00	3 400.00	4 400.00	900.00	3,400.00	.531
Wagon	500.00 (8)	137.50	—	4 15.00	15.00	152.50	.024
Harvesting baskets	.75 (2)	.49	—	—	—	.49	.001
Method 5:							
Tractor	10,000.00 (10)	2,500.00	3 400.00	4 500.00	900.00	3,400.00	.531
Wagon	500.00	137.50	—	4 15.00	15.00	152.50	.024
Harvesting baskets	.75 (2)	.49	—	—	—	.49	.001
Bins	37.00 (8)	10.17	—	4 1.11	1.11	11.28	.002
Forklift truck	11,000.00 (10)	2,750.00	300.00	4 165.00	465.00	3,215.00	.502
Method 6:							
Conveyor	50,000.00 (10)	12,500.00	3 800.00	4 2,500.00	3,300.00	15,800.00	4.937
Wagon	9,000.00 (10)	2,250.00	—	4 270.00	270.00	2,520.00	.787
Tractor	10,000.00 (10)	2,500.00	3 800.00	4 500.00	1,300.00	3,800.00	1.187

— = Not applicable.

1 Total fixed cost includes straightline depreciation (estimated life in years in parentheses after initial cost), interest at 10 percent of initial cost of 20 percent of depreciated balance, and insurance and taxes at 5 percent of initial cost.

2 Based on total of 1,600 hours of annual operation for all equipment multiplied by 0.5 or 800 hours (4 months) equipment used for cantaloupe operation and 200 hours per month for harvesting bags for methods 1, 2, 3, and 6. Based on total of 1,600 hours of annual operation for all equipment multiplied by 0.25 or 400 hours (2 months) equipment used for cantaloupe operation and 200 hours per month for harvesting baskets for methods 4 and 5.

3 Fuel costs calculated at $300 per month for trucks, $200 per month for tractor and conveyor, and $150 per month for forklift trucks.

4 Maintenance costs at 5 percent of initial cost for trucks, tractor, and conveyor; 3 percent for wagons and bins; and 1.5 percent for forklift trucks.

5 Cost estimated by truck manufacturer's dealer.

Tabel 2.—Labor and equipment costs for harvesting and transporting cantaloupes from field to packing plant or packing area with six methods

Item	Method 1 Field truck with ramps (16,000 pounds per truckload)	Method 2 Field truck, no ramps (16,000 pounds per truckload)	Method 3 Large bin on field truck (18,000 pounds per truckload)	Method 4 Baskets on wagon (3,000 pounds per load)	Method 5 Bins on wagon (8,500 pounds per load)	Method 6 Conveyor (36,000 pounds per load—two wagons)
	Dollars	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
Labor cost[1]:						
Harvesting	71.96	75.18	72.06	19.93	56.49	220.64
Load wagon	—	—	—	6.58	18.65	—
Transportation	[2]10.36	[3]10.61	[4 5]10.39	[6]5.89	[7]12.19	[8].86
Staging area	—	—	[9]1.30	—	—	—
Packing plant/area	1.51	1.51	1.66	[10].67	1.07	1.66
Harvesting and plant equipment cost:						
Field truck	3.07	3.11	[11]4.71	—	—	
Harvesting bags	.12	.13	.13	—	—	—
Forklift truck	—	—	[12].20	—	—	—
Plant truck	—	—	[13].70	—	—	—
Bin	—	—	[14].19	—	—	—
Plant wagon	—	—	[15].26	—	—	—
Tractor	—	—	—	[16].45	[17].98	—
Baskets	—	—	—	.15	.94	—
Wagon	—	—	—	[18].03	[19].05	—
Forklift truck	—	—	—	—	.09	—
Bins	—	—	—	—	[20].04	—
Conveyor	—	—	—	—	—	[21]10.09
Tractor	—	—	—	—	—	3.53
Wagons	—	—	—	—	—	4.68
Total labor and equipment cost:						
per load	87.02	90.54	91.60	33.70	99.50	258.46
Per ton	10.88	11.32	10.18	22.47	23.41	14.36

—Not applicable

[1]At $6 per hour. [2]Includes field truck driver's harvest, to and from packing plant, and unloading times. Total time of 1.7266 hours. [3]Same as footnote [2]for a total time of 1.7679 hours. [4]Includes field truck driver's harvest time, to and from staging area and at staging area times. Total time of 1.512 hours. [5]Includes plant truck driver's staging area time, to and from packing plant, and unloading times for 36,000 pounds payload (truck and wagon). Total time 0.4402 hour. Cost figured on one-half of this time to reflect driver's double load. [6]Includes tractor driver's time to and from field and basket loading on wagon. Total time 0.8487 hour. [7]Includes tractor driver's time to and from field, bin loading in the field, bin unloading and reloading empty bins at packing area. Total time 2.0318 hours. [8]Includes tractor driver's total harvest, to and from packing plant, and unloading times. Total time of 2.977 hours. [9]Includes time to transfer two full bins to plant truck and wagon and empty bin to field truck at staging area. Total time 0.1082 hour. [10]Unloading of the wagon and packing the containers was performed as one operation. Unloading and packing time and cost are divided between the harvesting and packing area operations (1/2 of 0.4494 hour by 3 workers). [11]Total time of 1.4785 hours. [12]Total time of 0.1082 hour. [13]Total time of 0.4402 hour ÷ 2 to reflect double load. [14]Total time of 2.176 hours (1.8105 for first bin and 0.3655 hour for second bin). [15]Total time of 0.3655 hour. [16]Total time of 0.8487 hour. [17]Total time of 1.8538 hours. [18]Total time of 1.2981 hours. [19]Total time of 2.0318 hours. [20]Total time of 2.0318 hours for 10 bins. [21]Total time of 2.043 hours.

Packing Plant Operations

Elapsed time from the field to the packing plant totaled 0.36 hour based on 5 to 6 miles of travel, elapsed time to unload was 0.09 hour, and elapsed time to return to the field was 0.36 hour, for a total time of 0.81 hour.

With this method, the total time required for travel and for loading and unloading two wagon loads (36,000 pounds) was 2.97 hours.

This method of harvesting was used by growers/shippers who usually produced 120-150 trailer loads per season. It also was used occasionally by growers/shippers who produce more than 1,000 trailer loads per season. Their usual harvesting method was method 1, but they also used method 6.

In the desert area of California and Arizona, where temperatures can rise above 110 °F, the self-propelled moving conveyor is sometimes fitted with large lamps for night harvesting (*15*). During the night, pulp temperature of the melons may drop to 80° to 90 °F, compared to more than 110 °F during the hot part of the day. Harvesting at night is easier for the crew, and precooling is faster, because the pulp temperatures of the melons are lower.

Table 1 shows the ownership and operating costs for the equipment used in the six harvesting methods; table 2 shows the costs per load and per ton for the six method. Caution should be used in comparing these costs. They were gathered in different parts of the country, at different times of the year, and represent different operation sizes. Therefore, use of the same methods at different fields and facilities may not be applicable or may give slightly different results.

Melons can be packed in a relatively small open area of a few hundred square feet or in a large packing plant of thousands of square feet, depending on the volume being handled. No matter the size of the operation, a few basic steps generally take place.

Melons are sorted after they are received at the packing plant (fig. 11). Additional sorting may take place to separate melons by maturity and grade. Grades for U.S. cantaloupes are U.S. Fancy, U.S. No. 1, U.S. Commercial, and U.S. No. 2. A grade of U.S. No. 1, the grade given to most U.S. cantaloupes, requires that the melons be mature, have good internal quality, and be free from damage. Also, the melons must not be overripe, soft, or wilted. (*9*).

Cantaloupes are sized either by mechanical means or by workers who manually select melons of comparable size for individual shipping containers. Conveyors carry the sized melons to the packing area. At the packing area the melons are handpacked into shipping containers. Packers usually stand beside or in front of bins containing melons of comparable size, maturity, and quality. Packs are denoted by number of melons per container (*19*).

After the containers are packed, they are generally closed by automatic case sealers or staplers. In some operations, separate tops are placed over the packed bottoms of the containers (full telescope).

Cooling melons is a major function of packing plant operations. Cooling methods include hydrocooling, forced-air cooling, and package-ice cooling. Hydrocooling (fig. 12) involves using water to remove field heat from the fruit. Forced-air cooling permits closer adjustment of cooling cycle time to initial fruit temperatures by moving cold air through packed containers of cantaloupes in cold rooms (fig. I3). Vents in the bottom of the bin (fig. 14) allow for air circulation throughout the load. In package-ice cooling, predetermined amounts of finely crushed ice are used in each water-tolerant container of cantaloupes. After the containers are iced, they must be moved rapidly into cold rooms or loaded into precooled trailers (*19*).

Most cantaloupes are packed in fiberboard containers holding 40 to 42 pounds of product. During the early I980's packers shifted from the use of wooden crates to fiberboard containers (half-cartons). Two half-cartons have approximately the same capacity as one wirebound crate; and the half-carton costs substantially less (75 to 80 cents, compared with $2.50 for the wooden crate). Also, the inherent precision of the fiberboard container has made mechanization of packing plant operations much easier (*10*).

Figure 11.—Inspecting melons along the line at packing plant.

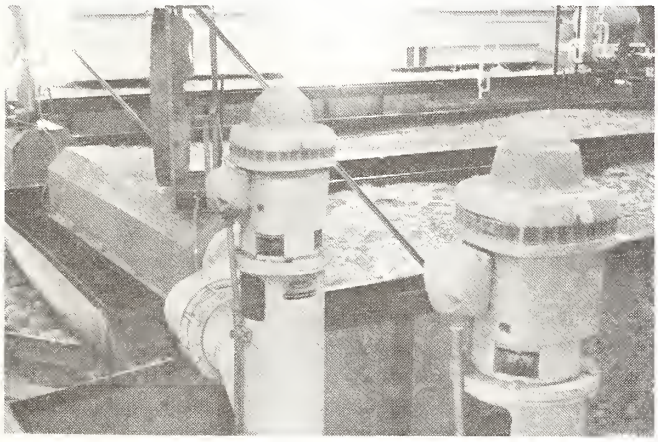

Figure 12.—Hyrocooling melons at packing plant. Note melons entering at left.

Figure 13.—Melons in fiberboard containers being forced-air cooled prior to loading on a highway trailer.

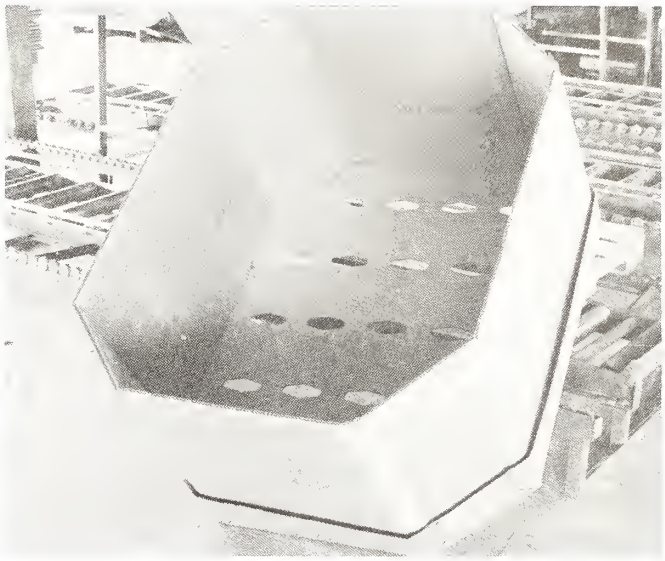

Figure 14.—Fiberboard bin showing air vents in the bottom cap.

Some shippers transport melons in pallet bins. The bin, which is most often fiberboard but may be wood, sits on a standard 48- by 40-inch pallet and is approximately 24-36 inches deep. Depending on the size of the fruit, fiberboard bins usually have a holding capacity of approximately 15 to 17 fiberboard containers of cantaloupes, or about 600 pounds; wooden bins hold about 850 pounds. Forced-air cooling of the fruit in bins does not seem to present any problems if the bins are properly vented (*11*). Cost of a fiberboard bin varies, but usually ranges from $7-$8. This cost includes the sleeve ($5) and cap for bottom and/or top ($1.50 each). The pallet cost ranges from $7-$9. Wooden bins vary in cost from $25-$30.

Total packing plant costs vary from one plant to another, depending on the volume handled, operating expenses, layout, modernization, and labor efficiency. Therefore, specific packing plant costs are not given here. Costs generally range from $1.50 to $2.50 per container (carton). These packing plant costs include labor, container, selling, and overhead.[4]

[4]Information supplied by growers/packers and (*16*).

Packed cantaloupes are usually transported to wholesale markets by refrigerated trailers, though rail transport is sometimes used. Data on shipments of cantaloupes to eight major markets—Boston, New York, Philadelphia, Baltimore/Washington, Atlanta, Chicago, Los Angeles, and San Francisco/Oakland—revealed that more than 81 percent of the volume received arrived by truck (*20*). In this study, only truck movement was considered.

Melons should be precooled before shipment. Cantaloupes picked at the hard ripe stage are subject to chilling if held at temperatures below 36 °F for longer than 1 week. For normal truck shipments of less than 1 week, temperatures between 32 and 34 °F will not be harmful and will prevent overripening (*2*).

For good air circulation through nonunitized loads, one container can be subtracted in every other layer. With this type of load, caution must be taken to load each stack exactly the same way, or an odd stack will block the lengthwise air channels. Also, at least 2 inches of space must be provided between the surface of the bulkhead and the first stack. This prevents blockage at the bulkhead of air that returns to the refrigeration unit through the air channels. This 2-inch space can be achieved by attaching vertical strips to the bulkhead or by constructing vertical air channels in the first several stacks against the bulkhead (fig. 15).

Each of the four methods of transporting cantaloupes from packing plant to wholesale warehouse consists of three basic elements—loading, transporting, and unloading. The four methods include handstacked, palletized, slipsheet, and bins. In the handstacked method, containers of melons are simply stacked in the trailer. In the palletized method, the containers are shipped on either wooden disposable or permanent pallets. Slipsheets are fiberboard sheets that serve the same purpose as disposable pallets. In the bin method, melons are shipped in either permanent wooden or disposal fiberboard bulk bins on pallets. Hourly ownership and operating costs for equipment used with the four transporting methods are shown in table 3.

Handstacked

In the handstacked method a forklift truck at the packing plant was used to place each pallet unit into a refrigerated highway trailer. Two workers removed the containers of cantaloupes from the pallet and stacked them in the trailer. The labor and equipment cost to load 840 containers (a full trailer load for the handstacked method) was $12.56 as shown in table 4. In some small packing plant operations, containers of cantaloupes were moved from the end of the packing line into the highway trailer with electric and roller conveyors. When a conveyor was used, one worker placed containers on the conveyor and two workers stacked containers from the conveyor in the trailer. Table 5 shows the labor and equipment cost ($20.01) when conveyors were used for loading.

At the wholesale warehouse, after the rear doors of the trailer were opened and the dock plate positioned, warehouse personnel or the truck driver secured a stack of pallets and positioned them on the loading dock near the rear of the trailer. As a pallet was needed, the driver either hand-carried it into the trailer or moved it with a palletjack. Assisted by a helper, the driver handstacked the cantaloupe containers on the pallet. When the pallet was loaded, it was removed from the trailer with an electric palletjack and moved to temporary storage. From temporary storage a warehouse employee transported the full pallet to storage in the warehouse.

The labor and equipment costs to unload 840 containers from a refrigerated highway trailer and move them to storage are shown in table 6. Total cost to stack the containers on the pallets, remove them from the trailer, and transport them to storage was $22.04. Of this amount, labor cost to handstack containers on pallets was $14.40 or about 65 percent of the total unloading cost at the wholesale warehouse.

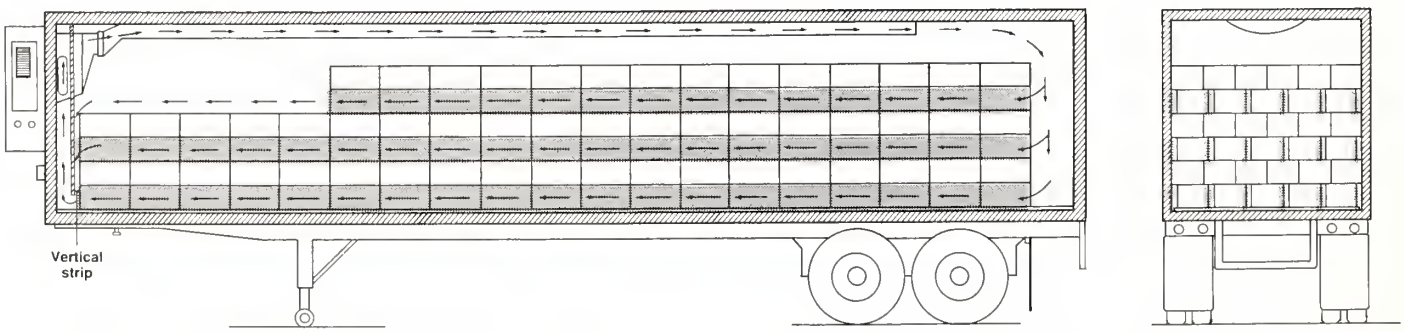

Figure 15.—An airflow loading pattern for a cantaloupe load with continuous lengthwise air channels between rows in every other layer. Note the vertical strips attached to the bulkhead to prevent air returning to the blower from becoming blocked (2).

Table 3.—Hourly ownership and operating costs for equipment used with the four transportation methods

Type of equipment	Annual ownership costs						Annual operating costs			Total ownership and operating cost per	
	Initial cost per unit	Years of depreciation[1]	Depreciation	Interest[2]	Insurance and taxes at4%	Total	Power[3]	Maintenance[4]	Total	Year	Hour
	Dollars	*Number*	*Dollars*								
Forklift truck 4,000-lb capacity	11,000	10	1,100.00	495.00	440.00	2,035.00	296.00	165.00	461.00	2,496.00	[5]1.248
Pallet jack	3,800	10	380.00	171.00	152.00	703.00	296.00	57.00	353.00	1,056.00	[5].528
Forklift truck with push-pull attachment	14,000	10	1,400.00	630.00	560.00	2,590.00	296.00	210.00	506.00	3,096.00	[5]1.548
Four-wheel selector truck	50	12	4.17	2.25	2.00	8.42	—	.75	.75	9.17	[5].005
Wooden bin	28	8	3.50	1.26	1.12	5.88	—	[6]2.00	2.00	7.88	[5].004
Pallet (48 X 40 inch)	8.25	3	2.75	.37	.33	3.45	—	[6]1.40	1.40	4.85	[5].002
Electric tugger	4,000	7	571.43	180.00	160.00	911.43	—	60.00	60.00	971.43	[5].486
Mobile cart	200	5	40.00	9.00	8.00	57.00	—	3.00	3.00	60.00	[5].030
Tractor	25,000	6	4,100.07	1,125.00	1,000.00	6,291.67	—	—	1.57/mile	6,291.67	[7]2.029
Refrigerated trailer	14,000	8	1,750.00	630.00	560.00	2,940.00	—	—	—	2,940.00	[7]1.089
Roller conveyor	600	5	120.00	27.00	24.00	171.00	—	9.00	9.00	180.00	[8].180
Electric conveyor	5,000	7	714.28	225.00	200.00	1,139.28	140.00	75.00	215.00	1,354.28	[5].677
Two-wheel handtruck	50	12	4.17	2.25	2.00	8.42	—	.75	.75	9.17	[5].005

— = Not applicable.
[1]Straight line depreciation.
[2]Computed interest is 9 percent for half the equipment life prorated over the full life.
[3]Power cost for battery charging of electric-powered vehicles, computed from manufacturers' specifications.
[4]Maintenance of 1.5 percent of cost.
[5]Based on 2,000 hours per year.
[6]Estimated.
[7]3,100 hours for tractors and 2,700 hours for trailers.
[8]1,000 hours of use per year.

Handling cost of the handstacked method totaled $34.60, including hand-loading the containers in the trailer at the packing plant ($12.56) and unloading by hand at the wholesale warehouse ($22.04). Cost per container was $0.041 ($34.60 ÷ 840). If the more expensive conveyor method ($20.01) is used at loading at the packing plant, cost per container for the handstacked method will increase by approximately 1 cent ($0.041 to $0.050).

Palletized

With the palletized method, containers of cantaloupes were stacked on disposable wooden pallets and loaded into the highway trailer with a forklift truck. The labor and equipment cost to load 840 containers unitized on 20 pallets was $7.46 as shown in table 7.

A disposable 48- by 40-inch wooden pallet costing $5 was used in this method. Total cost for 20 pallets was $100.

Table 4.—Handstacked method: Labor and equipment cost to transport 840 palletized containers of cantaloupes from storage or processing line and handstack in trailer at packing plant

Element	Labor		Equipment		Total cost
	Time	Cost[1]	Time	Cost[2]	
	Worker-hrs	*Dollars*	*Hours*	*Dollars*	*Dollars*
Transport containers from storage by forklift truck (20 palletloads, round-trip 175 feet)	0.53	3.18	0.53	0.66	3.84
Handstack containers in trailer from pallets	1.26	7.56	[3].64	.80	8.36
Remove empty pallets from trailer	.05	.30	.05	.06	.36
Total	1.84	11.04	1.22	1.52	12.56

[1]Based on $6 per hour.
[2]Based on $1.25 per hour for forklift truck.
[3]During handstacking in trailer, forklift truck occasionally remained in trailer.

Table 5.—Handstacked method: Labor and equipment cost to transport 840 containers of cantaloupes from processing line by roller conveyor and handstack in trailer at packing plant[1]

Element	Labor		Equipment		Total cost
	Time	Cost[2]	Time	Cost[2]	
	Worker-hrs	*Dollars*	*Hours*	*Dollars*	*Dollars*
Remove containers from processing line, by conveyor and stack in trailer	2.94	17.64	0.92	[3] 0.79	18.43
Wait for containers in trailer	.25	1.50	.09	[3].08	1.58
Total	3.19	19.14	1.01	[3].87	20.01

[1]Data adapted from (*1*).
[2]Labor and equipment costs per hour, respectively, at $6, $0.677 for electric conveyor, and $0.18 for roller conveyor.
[3]Equipment cost combines hourly costs for both types of conveyors.

Table 6.—Handstacked method: Labor and equipment time and cost to unload 840 handstacked containers of cantaloupes and move to storage

Element	Labor[1]		Equipment[2]		Total cost
	Time	Cost	Time	Cost	
	Worker-hrs	*Dollars*	*Hours*	*Dollars*	*Dollars*
Position dock plate and remove brace bars	0.02	0.16	—	—	0.16
Position pallets	.07	.56	—	—	.56
Handstack containers on pallets (42 containers for 20 pallets) and apply warehouse location sticker on load	1.80	14.40	—	—	14.40
Remove pallet load from trailer by palletjack (20 roundtrips of 125 feet each)	.27	2.16	0.27	0.14	2.30
Move loaded pallet from temporary storage by forklift truck, place in storage rack, and return (20 roundtrips of 200 feet each)	.50	4.00	.50	.62	4.62
Total	2.66	21.28	.77	.76	22.04

— = Not applicable.
[1]Based on $8 per hour.
[2]Based on $0.53 per hour for palletjack and $1.25 per hour for forklift truck.

Table 7.—Palletized method: Labor and equipment time and cost to transport 840 palletized containers of cantaloupes from storage and load in trailer at packing plant

Element	Labor		Equipment		Total cost
	Time	Cost[1]	Time	Cost[2]	
	Worker-hrs	*Dollars*	*Hours*	*Dollars*	*Dollars*
Transport containers from storage to dock by forklift truck (20 pallet loads, roundtrip: 175 feet)	0.53	3.18	0.53	0.66	3.84
Move 20 loaded pallets into trailer by forklift truck	.50	3.00	.50	.62	3.62
Total	1.03	6.18	1.03	1.28	7.46

[1]Based on $6 per hour.
[2]Based on $1.25 per hour for forklift truck.

Table 8.—Palletized method: Labor and equipment time and cost to unload 840 palletized containers of cantaloupes and move to storage

Element	Labor		Equipment		Total cost
	Time	Cost[1]	Time	Cost[2]	
	Worker-hrs	*Dollars*	*Hours*	*Dollars*	*Dollars*
Position dock plate and remove bars to dock	0.02	0.16	—	—	0.16
Pick up palletized units with palletjack, move from trailer (20 roundtrips of 125 feet)	.27	2.16	0.27	0.14	2.30
Apply warehouse location stickers on load	.17	1.36	.17	.09	1.45
Move loaded pallet to storage by forklift truck, place in storage racks, and return (20 roundtrips of 200 feet each)	.50	4.00	.50	.62	4.62
Total	.96	7.68	.94	.85	8.53

— = Not applicable.
[1]Based on $8 per hour.
[2]Based on $0.53 per hour for palletjack and $1.25 per hour for forklift truck.

Table 9.—Slipsheet method: Labor and equipment time and cost to transport 840 unitized containers of cantaloupes from storage and load in trailer at packing plant

Element	Labor		Equipment		Total cost
	Time	Cost[1]	Time	Cost[2]	
	Worker-hrs	*Dollars*	*Hours*	*Dollars*	*Dollars*
Transport containers from storage to dock by forklift truck with slipsheet attachment (roundtrip: 175 feet)	0.53	3.18	0.53	0.82	4.00
Move 20 loaded slipsheets into trailer with forklift truck with slipsheet attachment	.87	5.22	.87	1.35	6.57
Total	1.40	8.40	1.40	2.17	10.57

[1]Based on $6 per hour.
[2]Based on $1.55 per hour for forlift truck with slipsheet attachment.

At the wholesale warehouse, pallet loads were moved from the trailer to the dock by one worker using an electric palletjack. From the dock or temporary storage, the palletized containers were transported with a forklift truck and placed in storage.

The labor and equipment costs to unload 840 palletized containers from a refrigerated highway trailer and transport them to storage totaled $8.53 (table 8).

Handling cost of the palletized method totaled $15.99, including loading at the packing plant ($7.46) and unloading at the wholesale warehouse ($8.53). Cost per container was $0.019 ($15.99 ÷ 840).

In California, the leading cantaloupe-producing State, all shipments of melons are palletized, usually on 43- by 45-inch disposable wooden pallets (*17*). Use of this size pallet allows loading of 24 units in a highway trailer. A larger size pallet, 48 by 40 inches, is favored by some shippers in California as well as in other areas of the country (*19*).

In operations in which wholesalers receive palletized shipments of cantaloupes on permanent pallets, the wholesalers use the pallets in their daily operations after the containers of cantaloupes are removed.

Slipsheet

With the slipsheet method, a forklift truck with a push-pull attachment pulled the palletized unit onto the tines of the forklift truck, carried it to a highway trailer, and placed it inside. The cost of 20 slipsheets (payload surface 48 by 40 inches) at 85 cents each for a full trailer load was $17.00.

Labor and equipment costs to load 840 containers of cantaloupes unitized on 20 slipsheets totaled $10.57 (table 9).

At the wholesale warehouse, a forklift truck with a slipsheet attachment transported the slipsheet unit from the trailer and positioned it on a pallet. A conventional forklift truck picked up the loaded pallet and moved it into storage.

Table 10.—Slipsheet method: Labor and equipment cost to unload 840 containers of cantaloupes on slipsheets and move to storage

Element	Labor		Equipment		Total cost
	Time	Cost[1]	Time	Cost[2]	
	Worker-hrs	*Dollars*	*Hours*	*Dollars*	*Dollars*
Position dock plate and remove brace bars	0.02	0.16	—	—	0.16
Manually position 20 pallets on dock	.13	1.04	—	—	1.04
Transport 20 slipsheet loads from trailer to dock and place on pallets using a forklift truck with slipsheet attachment (20 roundtrips of 125 feet)	.87	6.96	.87	1.35	8.31
Apply warehouse location sticker on load	.17	1.36	.17	.26	1.62
Move loaded pallets to storage by forklift truck, place in storage racks, and return (20 roundtrips of 200 feet each)	.50	4.00	.50	.62	4.62
Total	1.69	13.52	1.54	2.23	15.75

— = Not applicable.
[1]Based on $8 per hour.
[2]Based on $1.55 per hour for forklift truck with slipsheet attachment and $1.25 for forklift truck.

Labor and equipment costs to unload 840 containers, unitized on slipsheets, from a refrigerated highway trailer and move them to storage totaled $15.75 (table 10).

Handling cost of the slipsheet method totaled $26.32, including loading at the packing plant ($10.57) and unloading at the wholesale warehouse ($15.75). Cost per container was $0.031 ($26.32 ÷ 840).

If the receiving wholesale warehouse uses racks to store unit loads, the slipsheet loads must be placed on pallets, as described above. If racks are not used, the slipsheet loads can be moved directly from the dock to storage without first placing them on pallets. The labor and equipment time and cost saved by not transferring the 20 slipsheet loads to pallets would be $4.62. This saving would reduce the cost per container by approximately one-half cent. Cantaloupes are not transported on slipsheets on a large scale.

Table 11.—Permanent bin method: Labor and equipment time and cost to transport 40 bins of cantaloupes from storage and load in trailer at packing plant

Element	Labor		Equipment		Total cost
	Time	Cost[1]	Time	Cost[2]	
	Worker-hrs	*Dollars*	*Hours*	*Dollars*	*Dollars*
Transport bins from storage to dock by forklift truck (roundtrip: 175 feet)	1.05	6.30	1.05	1.31	7.61
Move 40 loaded bins into trailer with forklift truck (two at a time)	.27	1.62	.27	.34	1.96
Total	1.32	7.92	1.32	1.65	9.57

[1]Based on $6 per hour.
[2]Based on $1.25 per hour for forklift truck.

Table 12.—Permanent bin method: Labor and equipment time and cost to unload 40 bins of cantaloupes and move into storage

Element	Labor		Equipment		Total cost
	Time	Cost[1]	Time	Cost[2]	
	Worker-hrs	*Dollars*	*Hours*	*Dollars*	*Dollars*
Position dock plate and remove brace bars	0.02	0.16	—	—	0.16
Pick up bins with forklift truck, move from trailer (20 roundtrips of 125 feet)	.35	2.80	0.35	0.44	3.24
Apply warehouse location sticker on load	.34	2.72	.34	.42	3.14
Move loaded bins to storage by forklift truck, place in storage and return (20 roundtrips of 200 feet each)	.50	4.00	.50	.63	4.63
Total	1.21	9.68	1.19	1.49	11.17

— = Not applicable.
[1]Based on $8 per hour.
[2]Based on $1.25 per hour for forklift truck.

Bin

Two bin methods were observed during the study. One used permanent wooden bins and the other, disposable fiberboard bins.

Permanent Bins.—With the permanent bin method, a forklift truck transported full wooden bins (net weight 850 pounds) on pallets from storage and placed them in the highway trailer, two at a time (fig. 16). The cost of forty 48- by 40- inch wooden bins and pallets at $28 each for a full trailer load was $1,120—a major expense item with this method. The later use of bins and pallets within the wholesale warehouse and retail stores for shipment of melons, potatoes, pumpkins, and other produce items could greatly reduce the cost per use.

The labor and equipment costs to load 40 bins of cantaloupes totaled $9.57 (table 11).

The wholesalers who received the bin shipments used their own transportation equipment to transport the bins from the grower to their wholesale warehouse or directly to the retail stores.

At the wholesale warehouse, one worker using a forklift truck moved two bin loads at a time from the trailer to the dock. After warehouse location stickers were placed on the bins at the dock, the bins were transported to storage with a forklift truck.

The labor and equipment cost to unload 40 full bins from a refrigerated highway trailer and transport them to storage totaled $11.17 (table 12).

The permanent bin method was used on a very limited basis for relatively short trips (less than 200 miles) by a grower/shipper who produced 20-40 trailer loads of cantaloupes per season of which only 3 or 4 were bin loads. This method was used when the customers requested bin shipments and could return the empty bins to the grower. Usually, the customer owned the bins, but the shipper did supply some bins. Most of this grower's production was transported in fiberboard containers.

Handling costs of the permanent bin method totaled $20.74, including loading at the packing plant ($9.57) and unloading at the wholesale warehouse ($11.17). In this method 34,000 pounds of cantaloupes, the equivalent of 809.52 containers each holding 42 pounds, were shipped. The equivalent cost per container was $0.026 ($20.74 ÷ 809.52).

Disposable Bins.—With the disposable bin method, a forklift truck transported full fiberboard bins (net weight 600 pounds each) on pallets from storage and placed them, three high, in the highway trailer. Usually two bins were loaded together and then a third bin was placed on top of the other two. A disposable fiberboard bin and disposable 48- by 40-inch pallet (fig. 17) costing $11.50 (bin and bottom cap, $6.50; and pallet $5) were used in this method. Total cost for 60 bins and pallets was $690.

Figure 16.—Permanent wooden bins being loaded on a highway trailer at the packing plant.

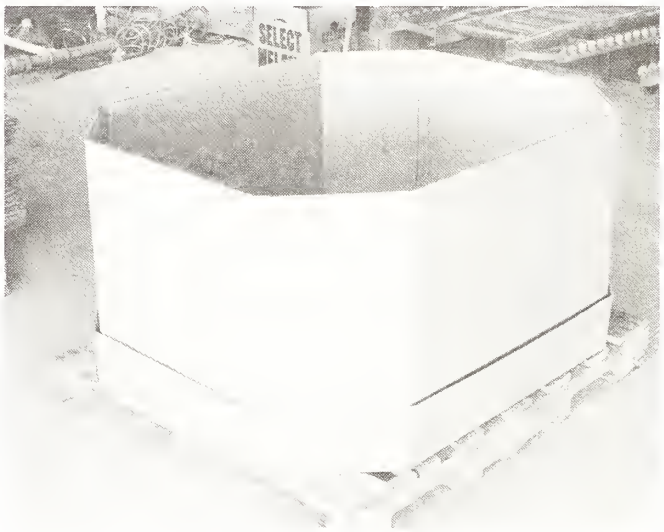

Figure 17.—Fiberboard bin used for shipping cantaloupes. Note octagonal shap of bin.

The labor and equipment cost to load 60 bins of cantaloupes totaled $7.76 (table 13).

At the wholesale warehouse, one worker removed bin loads from the trailer to the dock, using a forklift truck. The top two bins of each three-bin stack were removed together, and then the bottom bin was removed and placed on top of the other two. After the warehouse location stickers were placed on the bins, three bins at a time were transported to storage with a forklift truck.

The labor and equipment costs to unload 60 bins from a trailer and move them to storage totaled $15.70 (table l4).

The grower/shipper who used this method of transporting cantaloupes shipped all of his product nationally. However, he indicated that only 5 percent (10 to 15 trailer loads) of his shipments per season were bin loads as specifically requested by his customers; the other 95 percent were palletized.

Handling cost of the disposable bin method totaled $23.46, including loading at the packing plant ($7.76) and unloading at the wholesale warehouse ($15.70). In this method 36,000 pounds of cantaloupes, the equivalent of 857.14 containers each holding 42 pounds, were shipped. The equivalent cost per container was $0.027 ($23.46 ÷ 857.14).

Table 13.—Disposable bin methods: Labor and equipment time and cost to transpor cantaloupes from storage and load in trailer at packing plant

Element	Labor		Equipment		Total cost
	Time	Cost[1]	Time	Cost[2]	
	Worker-hours	*Dollars*	*Hours*	*Dollars*	*Dollars*
Transport bins from storage to dock with forklift truck. (Three bins at a time, 20 roundtrips of 175 feet each)	0.53	3.18	0.53	0.66	3.84
Move 60 loaded bins into trailer with forklift truck (two together for 40 bins, then one at a time)	.54	3.24	.54	.68	3.92
Total	1.07	6.42	1.07	1.34	7.76

[1]Based on $6 per hour.
[2]Based on $1.25 per hour for forklift truck.

Table 14.—Disposable bin methods: Labor and equipment time and cost to unload 60 bins of cantaloupes and move to storage

Element	Labor		Equipment		Total cost
	Time	Cost[1]	Time	Cost[2]	
	Worker-hours	*Dollars*	*Hours*	*Dollars*	*Dollars*
Position dock plate and remove brace barsith	0.02	0.16	—	—	0.16
Pick up bins with forklift truck, move from trailer (two together for 40 bins, then one at a time)	.61	4.88	0.61	0.76	5.64
Apply warehouse location sticker on loadther	.52	4.16	.52	.65	4.81
Move loaded bins to storage with forklift truck, place in storage, and return (20 roundtrips of 200 feet each)	.55	4.40	.55	.69	5.09
Total	1.70	13.60	1.68	2.10	15.70

— = Not applicable.
[1]Based on $8 per hour.
[2]Based on $1.25 per hour for forklift truck.

Since we have discussed handling cantaloupes into warehouse storage with transportation, the wholesale warehouse section of this report deals only with methods of delivering cantaloupes, as part of a mixed load, from the warehouse storage area to temporary storage at the retail store. Labor and equipment costs (table 3) were developed for the four methods of moving the product from wholesaler to retailer: (1) Handstacked delivery, (2) palletized delivery, (3) mobile cart delivery, and (4) bin delivery.

Handstacked

In the handstacked method of delivery, containers of cantaloupes and cases of other produce were selected and placed on four-wheel selector trucks pulled through the warehouse by an electric tugger. One worker on the dock took cases and containers of the mixed load from the selector trucks and stacked them in the trailer.

During delivery at the retail store, a gravity roller conveyor was used to unload the trailer. The labor requirements and costs to select, restock, load, deliver, and unload a trailer with 1,000 cases and containers (of which 10 are containers of cantaloupes) are shown in table 15. The labor cost per 10 containers of cantaloupes was $1.44, or $0.144 per container.

Table 16 shows the equipment time and costs for the handstacked delivery method. The equipment cost per cantaloupe load was 3 cents, or $0.003 per container.

The transport trailer made an 80-mile round trip during the delivery. With a fixed cost of $3.12 per hour for tractor and trailer for 8 hours, total fixed cost was $24.96, (8 x $3.12 = $24.96). Operating cost was $1.57 per mile. Total ownership and operating cost for the delivery trip was $150.56, or $0.151 per container.

The total labor, equipment, and transport cost to deliver handstacked containers of cantaloupes to the retail store from the wholesale warehouse was $0.298 per container (labor = $0.144, equipment = $0.003, transportation = $0.151).

Table 16.—Handstacked delivery method: Equipment time and costs for selecting, loading, and unloading handstacked containers of cantaloupes from warehouse to retail store as part of a mixed produce trailer load

Element	Time per cantaloupe load	Cost per cantaloupe load[1]	Cost per container[2]
	Hours	*Dollars*	*Dollars*
Use of electric tugger	0.05	0.02	0.002
Use of four-wheel selector trucks	.15	([3])	([3])
Use of roller conveyor for unloading	.06	.01	.001
Total	.26	.03	.003

[1]At $0.49, $0.005, and $0.18 per hour for the first, second, and third cost data respectively.
[2]For 10 containers.
[3]Negligible.

Table 15.—Handstacked delivery method: Labor requirements and costs for selecting, replenishing stock, loading, delivering, and unloading handstacked containers of cantaloupes from warehouse to retail store as part of a mixed-produce trailer load[1]

Element	Per trailer load	Per cantaloupe load	Cost[2]	
			Per cantaloupe load	Per cantaloupe container
	---Worker-hours---		*Dollars*	
Select containers of produce and stack on selector trucks pulled by electric tugger	5.08	0.05	0.40	0.040
Replenish stock	.73	.01	.08	.008
Load cases into trailer	2.58	.03	.24	.024
Deliver to store and return	3.20	.03	.24	.024
Unload at store	6.08	.06	.48	.048
Total	17.67	.18	1.44	.144

[1]Trailer load consists of 1,000 cases and containers of produce, of which 10 are containers of cantaloupes.
[2]At $8 per hour.

Figure 18.—A mixed produce load at the wholesale warehouse. Note wirebound crates of cantaloupes within load. They do not stack as well as the fiberboard containers of cantaloupes shown in the bottom two layers.

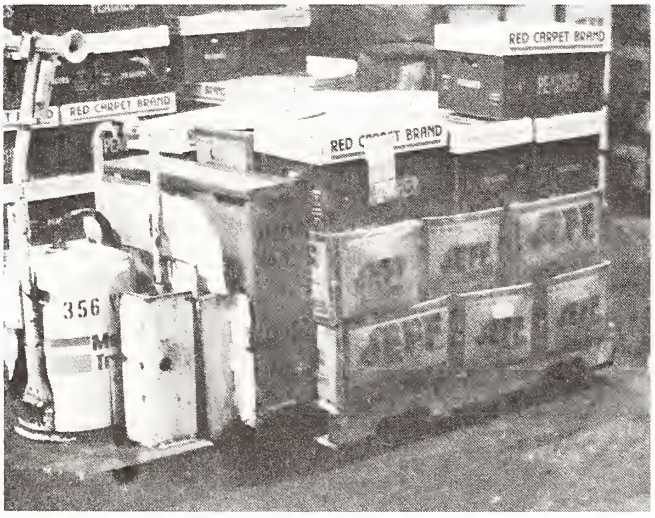

Figure 19.—Fiberboard containers of cantaloupes (bottom two layers) as part of a mixed produce load at the wholesale warehouse.

Palletized

With palletized delivery, containers of cantaloupes and other cases of produce were selected and stacked on pallets by electric pallet jacks and moved through the selection area to the loading dock and then into the trailer. Figures 18 and 19 show cantaloupes in wooden crates and fiberboard containers as part of a mixed-produce load. Use of wirebound crates, which are not as stable as fiberboard containers, can impair the integrity of the load.

At the retail stores, one worker used a pallet jack to unload and move product to temporary storage. The labor requirements and costs to select, restock, load, deliver, and unload a trailer with 1,000 cases and containers, of which 10 are containers of cantaloupes, are shown in table 17. The labor cost per 10 containers of cantaloupes was $1.04, or $0.104 per container.

Table 18 shows the equipment time and costs for the palletized delivery method. The equipment cost per cantaloupe load was 4 cents, or $0.004 per container.

Table 17.—Palletized delivery method: Labor requirements and costs for selecting, replenishing stock, loading, delivering, and unloading palletized containers of cantaloupes from warehouse to retail store as part of a mixed produce trailer load[1]

Element	Per trailer load	Per cantaloupe load	Cost[2] Per cantaloupe load	Cost[2] Per cantaloupe container
	–Worker-hours–		*–––Dollars–––*	
Select containers of produce and stock on pallets	4.87	0.05	0.40	0.040
Replenish stock	.73	.01	.08	.008
Load palletized units into trailer	.62	.01	.08	.008
Deliver to store and return	3.39	.03	.24	.024
Unload at store	2.65	.03	.24	.024
Total	12.26	.13	1.04	.104

[1]Trailer load consists of 1,000 cases and containers of produce, of which 10 are containers of cantaloupes.
[2]At $8 per hour.

Table 18.—Palletized delivery method: Equipment time and costs for selecting, loading, and unloading palletized containers of cantaloupes from warehouse to retail store as a part of a mixed produce trailer load

Element	Time per cantaloupe load	Cost per cantaloupe load[1]	Cost per container[2]
	Hours	*----Dollars----*	
Use of pallet jack	0.08	0.04	0.004
Use of pallets	1.54	(3)	(3)
Total	1.62	.04	.004

[1]At $0.53 per hour for pallet jacks and $0.002 per hour for pallets.
[2]For 10 containers.
[3]Negligible.

The transport trailer made an 80-mile round trip during the delivery. With a fixed cost of $3.12 per hour for tractor and trailer for 7.74 hours, the total fixed cost was $24.15 (7.74 by $3.12 = $24.15). Operating cost was $1.57 per mile.

The total ownership and operating cost for the delivery trip was $149.75, or $0.150 per container.

The total labor, equipment, and transport cost to deliver cantaloupes on pallets to the retail store from the wholesale warehouse was $0.258 per container (labor = $0.I04, equipment $0.004, transportation = $0.150).

Mobile Cart

In the mobile cart method of delivery, the containers of cantaloupes and cases of other produce were selected and loaded onto mobile carts that were then transported to the loading dock and loaded onto the trailer. All movement was accomplished with of an electric tugger.

At the retail store the carts were manually unloaded across a dock at truck-bed level. The carts were then transported to temporary storage in the store.

The labor time and cost to select, restock, load, deliver, and unload a trailer with 1,000 cases and containers, of which 10 are containers of cantaloupes, are shown in table 19. The labor cost per 10 containers of cantaloupes was $1.12, or $0.112 per container.

Table 19.—Mobile cart delivery method: Labor time and costs for selecting, replenishing stock, loading, delivering, and unloading containers of cantaloupes stacked on mobile carts from warehouse to retail store as part of a mixed-produce trailer load[1]

Element	Per trailer load	Per cantalooupe load	Cost[2]	
			Per cantaloupe load	Per cantaloupe container
	-----Worker-hours-------		*----------Dollars----------*	
Select containers of produce and stack on mobile carts	5.88	0.06	0.48	0.048
Replenish stock	.73	.01	.08	.008
Load mobile carts into trailer	1.05	.01	.08	.008
Deliver to store and return	3.79	.04	.32	.032
Unload at store	1.76	.02	.16	.016
Total	13.21	.14	1.12	.112

[1]Trailer load consists of 1,000 cases and containers of produce, of which 10 are containers of cantaloupes.
[2]At $8 per hour.

Table 20.—Mobile cart delivery method: Equipment time and costs for selecting, loading, and unloading containers of cantaloupes stacked on mobile carts from warehouse to retail store as part of a mixed-produce trailer load

Element	Time per cantaloupe load	Cost per cantaloupe load[1]	Cost per container[2]
	Hours	*Dollars*	*Dollars*
Use of electric tugger	0.06	0.03	0.003
Use of mobile carts	1.66	.05	.005
Total	1.72	.08	.008

[1]Based on $0.49 and $0.03 per hour for the first and second cost data, respectively.
[2]For 10 containers.

Table 21.—Bin delivery method: Labor and equipment costs for selecting, replenishing stock, loading, delivering, and unloading a bin of cantaloupes from warehouse to retail store as part of a mixed produce palletized trailer load

Element	Per trailer load	Per bin	Cost per bin
	Worker-hours	*Worker-hours*	*Dollars*
Labor:[1]			
Select produce	4.87	0.27	2.16
Replenish stock	.73	.04	.32
Load trailer	.62	.03	.24
Deliver to store and return	3.39	.19	1.52
Unload at store	2.65	.15	1.20
Equipment:[2]			
		Hours	
Use of pallet jack	—	0.49	.26
Use of bin	—	12.29	.05
Total	—	—	5.75

— = Not applicable.
[1]Costs based on $8 per hour.
[2]Costs based on $0.53, $0.004, and $0.002 per hour for pallet jack, bin, and pallet respectively.

Table 20 shows the equipment time and cost for the mobile cart delivery method. Equipment cost per cantaloupe load was 8 cents, or $0.008 per container.

The transport trailer made an 80-mile round trip during the delivery. With a fixed cost of $3.12 per hour for tractor and trailer for 7.67 hours, the total fixed cost was $23.93 (7.67 x $3.12 = $23.93). Operating cost was $1.57 per mile. Total ownership and operating cost for the delivery trip was $149.53, or $0.149 per container.

The total labor, equipment, and transport cost to deliver cantaloupes to the retail store from the wholesale warehouse was $0.269 per container (labor = $0.112, equipment = $0.008, transportation = $0.149).

Bin

Most bin deliveries were made to the retail store through the wholesale warehouse, but some were direct. Direct deliveries were usually by local, small-scale cantaloupe growers/shippers who deliverd bin loads directly to the retail store from their packing plant. Since most bin deliveries were through a wholesale warehouse, only the costs for that type of delivery are given here.

During trailer loading at the wholesale warehouse, the bin or bins (wooden or fiberboard) of cantaloupes were moved by pallet jack from storage with the other palletized mixed-produce units. Therefore, the bin of cantaloupes was handled as one of the palletized units of the load. In this example, a bin held 850 pounds of melons, the equivalent of 20.238 containers each holding 42 pounds.

At the retail store the bin was handled as a regular palletized unit. The labor and equipment requirements and costs to handle one bin as part of an 18-unit palletized load are shown in table 21. The cost per bin was $5.75, or $0.284 per container ($5.75 ÷ 20.238).

Transport costs were the same as for the palletized delivery method. The cost for one bin was $8.31 ($149.75 ÷ 18 units), or $0.411 per container.

The total cost to deliver one bin of cantaloupes (approximately 850 pounds of melons) as part of a palletized load from wholesale warehouse to retail store was $14.06 (labor and equipment cost $5.75 and transportation $8.31), or $0.694 per container.

The handling of produce, including cantaloupes, from backroom storage in the retail store to display case was usually performed with a two-wheel handtruck, although shopping carts, four-wheel carts, and manual pallet transporters also were used. Two or three containers of cantaloupes were stacked on the cart or handtruck in the storage areas and transported to the display area as needed. After the cantaloupes were removed from the containers and placed in the display case, the empty containers were broken down and transported to the disposal area in the rear of the store. Bins of cantaloupes were moved from backroom storage to display area with a pallet jack.

Table 22 shows the labor and equipment time and costs to move containers of cantaloupes from storage to display case. Total labor and equipment cost was $0.26 per container. The cost to move a bin of cantaloupes from storage to display area and set up (table 23) was $0.42 (labor = $0.40 and equipment = $0.02). The equivalent cost per container was $0.02 ($0.42 ÷ 20.238).

Table 22.—Labor and equipment costs to handle containers of cantaloupes from storage to display case with a two-wheeled handtruck[1]

Element	Labor		Equipment		Cost per container[4]
	Time	Cost[2]	Time	Cost[3]	
	Worker-hours	*Dollars*	*Hours*	*Dollars*	*Dollars*
Load two-wheel handtruck[3]	0.009	0.072	0.009	([5])	0.036
Tansport load from storage area to display case (105 feet one way)	.009	.072	.009	([5])	.036
Place cantaloupes in display case	[6].031	.248	.031	([5])	.124
Break down empty containers, move containers to disposal area, and return to storage area (105 feet one way)	.015	.120	.015	([5])	.060
Total	.064	.512	.064	([5])	.256

[1]Average round trip of 210 feet.
[2]At $8 per hour.
[3]At $0.005 per hour.
[5]Negligible.
[6]Time for removing cantaloupes from container and placing them in the display case.

Table 23.—Labor and equipment costs to transport a bin of cantaloupes from storage to display area

Element	Labor		Equipment		Total cost per bin
	Time	Costs[1]	Time	Cost[2]	
	Worker-hrs	*Dollars*	*Hours*	*Dollars*	*Dollars*
Transport bin from storage to display area (round trip 210 feet)	0.03	0.24	0.03	0.02	0.26
Set up display	.02	.16	—	—	.16
Total	.05	.40	.03	.02	.42

—Not applicable.
[1]At $8 per hour.
[2]At $0.53 per hour.

Figure 20.—Melons in wirebound crates at wholesale warehouse. Note damage to crate and melon.

In general a large proportion of melon and other produce losses result from the interaction of several factors: inadequate temperature and humidity during storage and transport; improper packaging and handling; slow product movement and unexpected reductions in marketing demands; government regulations, or lack thereof; excessive moisture evaporation; and poor quality of product entering distribution (*7*).

In 1969 Kasmire stated that annual marketing losses for cantaloupes were estimated to exceed 820,000 crate equivalents (*3*). He attributed much of the loss to unsatisfactory handling practices and procedures used in harvesting, packing operations, transit, distribution, and marketing.

Little information on losses in harvesting and packing has been published. During this study, we observed visible damage (splits) to the cantaloupes after the field trucks arrived at the packing plant and were unloaded. A sampling of the cantaloupes at the packing plant showed a damage (splits) rate of I to I-I/2 percent.

Examination of full field truckloads during unloading confirmed our opinion that most of the damage was in the load when it arrived from the field; unloading did not significantly add to the damage.

This conclusion was also supported by the unloading crew who stated that most of the split cantaloupes arrived at the packing plant that way and that unloading caused relatively little additional damage. During culling operations in the packing plant, split and other damaged melons were removed and disposed of.

If pickers were more selective during harvesting, fewer damaged and overripe melons would find their way to the packing plant and ultimately into the marketing system. Usually, many of the overripe melons are culled from the system at the packing plant, wholesale warehouse, or retail store. In many instances, damaged melons are caused not so much by rough handling, but by the fragile nature of overripe fruit.

It was observed that damaged melons were more likely to be found at the smaller operations than at larger ones. At small operations pickers had less choice when picking, because of lower melon density in the field and less uniformity of product.

Wirebound crates used to pack melons were a source of melon damage in the past, but are less so today as more and more shippers convert to fiberboard containers. When cantaloupes are bulge-packed, especially in wooden crates, damage occurs, and marketing losses result (*19*). Figure 20 shows melons packed in wirebound crates and the resulting damage.

Discussion

During transportation and unloading at the wholesale warehouse, cantaloupes and other fresh produce are exposed to the risks of damage. The average annual losses for cantaloupes during transit and unloading were estimated at approximately 1 percent. Cantaloupe losses during marketing in the retail store were estimated at 4 percent. (*7*).

It is at the retail store that the consumer sees the quality of the product. In conducting this study, we interviewed six produce managers who sold both cantaloupes grown locally and those grown at distant locations. The managers felt that the inconsistent quality of the locally grown product, usually from small-scale operations, was a problem. In many instances overripe and damaged melons were being shipped. Quality of the melons from larger scale operations, which shipped greater distances, was more consistent.

Results of a retail store survey of locally grown and nationally marketed melons are shown in table 24. This survey was conducted between 1983 and 1985 and more than 5,000 melons were sampled. As indicated in the table all degrees of bruising totaled almost 15 percent for locally grown melons, but just under 7 percent for melons that were nationally marketed. Usually growers/shippers of locally grown melons do not have the quality control of larger growers/shippers who market their melons nationally.

Table 24.—Percentage of bruising of locally grown and nationally marketed cantaloupes found at the retail store

Degree of bruising[1]	Locally grown	Nationally marketed
	Percent	*Percent*
Slight	7.1	3.8
Moderate	4.0	1.2
Serious	3.7	1.9
Total	14.8	6.9

[1]Slight, more than three-fourths inch but less than 1 inch in diameter; moderate, more than 1 inch but less than 1-l/4 inches in diameter; serious, more than 1-1/4 inches in diameter.

Costs were developed for six harvesting methods. Four of the methods (methods 1, 2, 3, and 6) were used by growers/shippers who shipped nationally and produced more than 1,000 trailer loads per season. Methods 4 and 5 were used by relatively small growers/shippers whose production was marketed locally and who usually produced fewer than 50 trailer loads per season.

Method 3, in which a large bin on a field truck was used, had the lowest labor and equipment cost per ton ($10.18). Method 1, a field truck with rear ramps, had the next lowest cost per ton ($10.88). Third was method 2, a field truck with no ramps ($11.32). Method 6, with a self-propelled moving conveyor, had a cost of $14.36 per ton and ranked fourth.

Some growers stated that method 6, which used a conveyor, was too slow for harvesting cantaloupes and that fields had to have a certain layout to accommodate the conveyor. However, growers did indicate that the conveyor method was physically easier on the picking crews than the other methods and that lights could be attached to the conveyor for night harvesting during the hot summer months. If the self-propelled moving conveyor is used at night, the harvested melons would have a lower pulp temperature than those harvested during the day. The faster precooling possible for these night-picked melons could more than offset the higher labor and equipment cost of this method. More research is needed in this area.

Harvesting method 4 (with field baskets) and method 5 (with field bins) were used by two small-scale growers/shippers. These two methods cost $22.47 and $23.41, respectively.

Since most cantaloupes are shipped in fiberboard containers (net weight approximately 42 pounds), costs are equated to a cost per container to compare the six harvesting methods (2,000 pounds ÷ 42 pounds = 47.619 containers per ton of fruit picked).

In the packing plant phase of the marketing system, costs can vary based on efficiency of plant layout, employee skill, and volume of melons handled. Generally, the packing plant cost for approximately 42 pounds of cantaloupes in a fiberboard container ranged between $1.50 and $2.50. This cost included both direct and indirect costs. To avoid the high cost of packing cantaloupes in the packing plant, some producers pack cantaloupes in the field. But field packing poses a problem because quality control is harder to maintain. (*12*)

Of the four transporting methods examined, the palletized method had the lowest labor and equipment cost per con-

tainer ($0.019) to load at the packing plant and unload at the wholesale warehouse. The bin method was next lowest, with labor and equipment costs per equivalent container at $0.027 for disposable bins and $0.026 for permanent bins. The slipsheet method was next ($0.03l per container). The handstacked method had the highest labor and equipment cost, at $0.04l per container when pallets were used to bring the containers into the trailer for handstacked loading, and $0.050 per container when a roller conveyor was used for handstacked loading.

When cantaloupes arrive at the wholesale warehouse, they are stored until needed for shipment to the retail store. Four methods for moving cantaloupes from the wholesale warehouse to a retail store were examined. Palletized delivery had the lowest total cost per container ($0.258) for labor, equipment, and transportation. The costs per container for mobile cart delivery and handstacked delivery were $0.269 and $0.298, respectively. For the bin delivery method, labor, equipment, and transportation costs per equivalent container were $0.694.

The cost to move cantaloupes from the storage room to the display case at the retail store was $0.26 per container. Movement of a bin holding 850 pounds of melons from storage area to display area cost $0.42. The cost per equivalent container would be $0.02.

Information on damage and decay losses for cantaloupes, as well as for other agricultural products, is usually not available for most phases of the marketing system. Although some research has been done, more data are needed. In this study we found a damage rate between 1 and 1-1/2 percent immediately after the cantaloupes were unloaded from the field trucks at the packing plant. Further investigation showed that most of this damage occurred before the trucks were unloaded. If pickers were a little more selective during harvesting, fewer damaged and overripe melons would arrive at the packing plant.

At the retail store, locally grown cantaloupes had a higher damage rate than nationally marketed melons. All degrees of bruising totaled more than 15 percent for locally grown melons, but dropped to just over 7 percent for those marketed nationally. The lower rate is generally attributed to the better quality control methods of larger growers/ shippers who market nationally.

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