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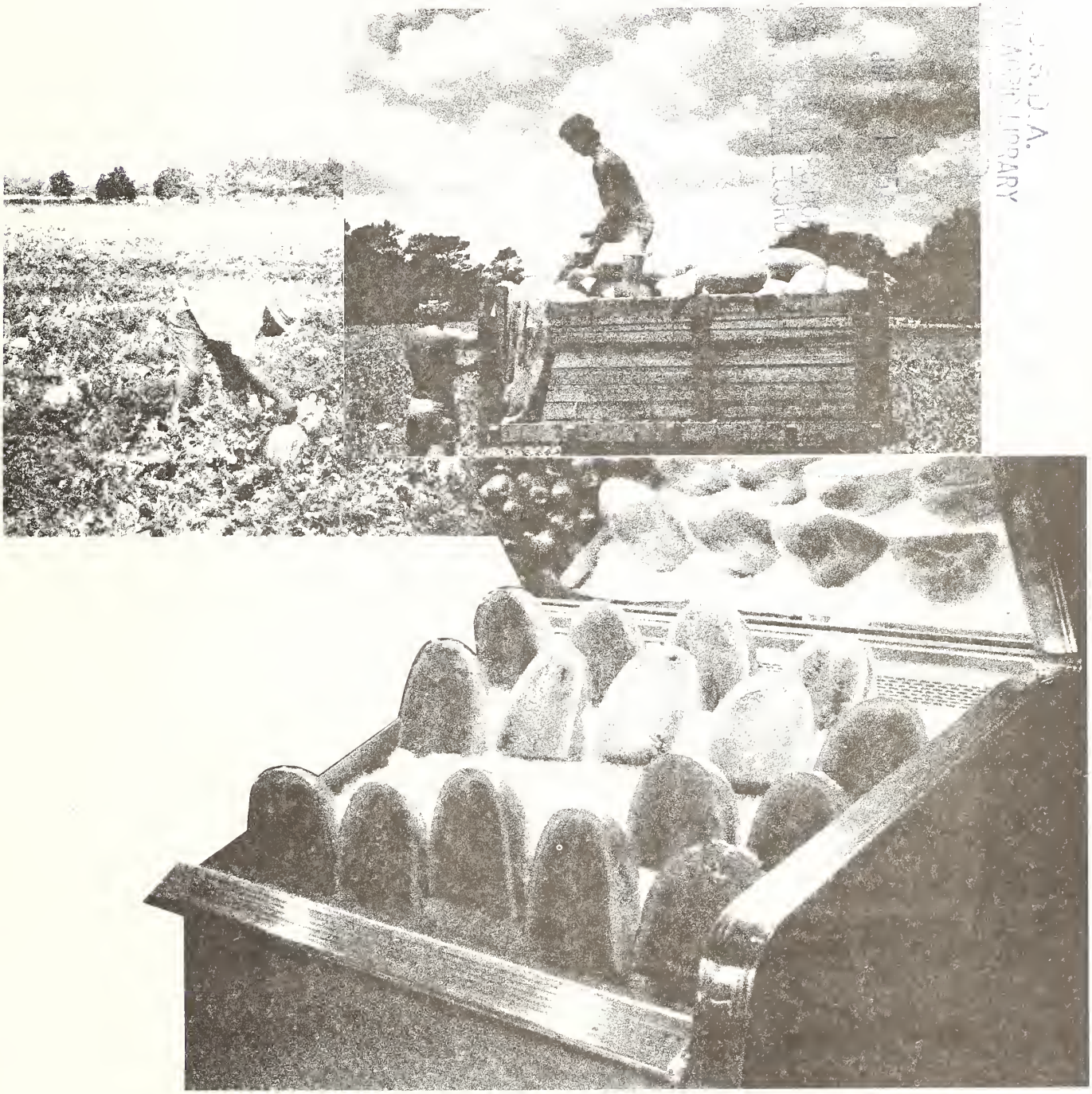
Research Report
Number 1141

Costs of Watermelon Handling from Grower to Retailer



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Acknowledgment

The authors thank the growers, shippers, carriers, wholesalers, and receivers of watermelons who made their facilities available and gave their time for this study.

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Costs of Watermelon Handling from Grower to Retailer

By Robert C. Mongelli, Joseph P. Anthony, Jr., William G. Kindya, and A. Perry[1]

Summary

Labor, equipment, and material costs were developed to determine the cost of handling and transporting watermelons from the field to the retail store.

Two systems of handling, bulk and bin, are commonly used in marketing watermelons. In the bulk system, watermelons are stacked five to seven layers high in over-the-road trailers. In the bin system, the fruit is loaded into bins, which, in turn, are packed in trailers for shipment to the wholesaler.

The bin system was found to be the least expensive method of handling. This system begins after the watermelons are moved from the field by trucks. The melons are loaded onto the over-the-road trailer for shipment to the wholesaler.

At the wholesale warehouse the bins are loaded on a trailer with other produce items for delivery to the retail store. The empty bins are returned to the wholesale warehouse but not to the the growing area.

The total cost for this system is $1.2219 per melon. Although this is the least cost method of handling, the system is not viable because produce managers cannot usually use all of the bins received in the process.

Cost per melon for all systems ranged from $1.2219 to $1.2988, a difference of 6.3 percent or 7.69 cents per melon.

Costs for specific segments of the marketing system are as follows:

The hand harvesting cost was $0.0358 per melon. Bulk shipment loading, in which the over-the-road trailer was loaded directly from the field truck, had a cost of $0.0361 per melon. It was the lowest of the three methods observed. Bin shipment loading at a dock, instead of using a mobile conveyor to load bins full of melons, had the lower cost $0.0214 per melon.

[1]Robert C. Mongelli and Joseph P. Anthony are marketing specialists with the Market Research and Development Division, Agricultural Marketing Service, U.S. Department of Agriculture, Beltsville, Md. William G. Kindya is a marketing specialist with the Transportation and Packaging Research Branch, Office of Transportation, U.S. Department of Agriculture, Beltsville, Md. A. Perry is an agricultural economist with the Florida Department of Agriculture and Consumer Services, Tallahassee, Fla.

At the wholesale warehouse, receiving melons in bulk from origin and then loading them into bins and shipping as part of a mixed load, cost $0.2772 per melon. In contrast, the wholesale warehouse receiving and shipping cost for bin shipments from origin was $0.2556 per melon.

Retail store handling cost for bin-packed melons at the wholesale warehouse was $0.0283 per melon and $0.0277 for bin-loaded melons that were packed in Florida.

Bin return cost from retailer to wholesaler was approximately $0.012 per melon. If bins and pallets are returned to origin from the wholesale warehouse the cost per melon will be $0.0533.

In the United States watermelon production for 1982 totaled more than 23 million hundredweight. The value of this crop exceeded $150 million.

Watermelons are available from March through October, but more than 80 percent are marketed in June, July, and August.

Florida, the leading State in watermelon production, produces about twice as much as Texas, the second leading producer. Alabama, California, Georgia, Indiana, and South Carolina also are major watermelon producers.

Watermelons are usually harvested by hand and transported by field truck to a central location where they are loaded on over-the-road trailers for transport to destination. The overwhelming majority of these transport shipments are bulk loads. In bulk loads melons are stacked five to seven layers high. A cushioning of straw is placed on the floor and against the front and rear walls of the trailers to prevent melon damage.

In the last few years, receivers have expressed an interest in receiving over-the-road shipments of melons loaded in bins (holding approximately 50 melons with about 1,200-pound capacity). In this system the melons are loaded in bins in the growing area (origin) and transported to the receivers facilities. Many receivers felt that bin loads could be unloaded faster than bulk loads with the result that truck dock space would not be tied up as long as required for bulk loads. It also was speculated that since bin loads require less handling per melon, damage may be less.

The major purpose of this study was to determine the direct labor, equipment, and material costs to harvest and deliver watermelons from growing area to retail store by the two methods that are used (bulk and bin).

The study, although pursued, was carried out with difficulty since actual use of the bin method was infrequent.

The results reflect operations only at the particular facilities studied. Use of the same systems at different facilities may give slightly different results.

Methodology

In this study, handling is defined to include all operations from harvest in the field to the point where melons were displayed in the store.

Handling is considered in six segments: harvest, field truck unloading, loading of the over-the-road trailer, transportation from growing area to the receiver's warehouse, unloading at the warehouse, and movement from warehouse to the retail store.

The heart of the study, consideration of the bulk system versus the bin system, started at the point where the over-the-road trailer was loaded.

The harvesting segment started when field workers moved through the melon field and selected and cut melons from the vine. It ended when the melons were delivered to the field truck unloading site.

Time and cost measurements for field truck unloading started when the truck was in position for unloading at the unloading site and ended when the last watermelon was removed from the field truck.

For both the bulk and bin systems, loading of the over-the-road trailer started when the first watermelon was placed on the conveyor and moved to a stacker in the trailer or to a weigher on the dock. Loading was completed when the last melon or bin was placed in the trailer and the rear doors were closed and secured.

Transportation started when the trailer left the loading area at origin and ended with the arrival at the receiver's warehouse (destination).

Unloading at the receiver's warehouse started when the trailer doors were opened and the dock plate positioned. It was completed when the last melon or bin was removed from the trailer and placed in storage. Melons transported in bulk were placed in bins at this point.

The handling operation from wholesale receiver to retailer started when the watermelon bins were removed from storage and ended when the watermelons were placed in the display area at the retail store. This system included loading, transportation, unloading, and movement within the retail store.

To facilitate comparison of over-the-road transportation, only one shipping point—central Florida—and one receiving point—Washington, D.C.,—were used.

The equipment-hour requirements were converted to costs using hourly ownership and operating costs. See table 11.

To determine costs of the various systems, the following assumptions were made to reduce the number of variables.

Field Truck
1. A field truck holds 730 watermelons (15,000 pounds). The number of melons per truckload observed ranged from 670 to 750 and ranged in weight from 14,500 to 15,300 pounds.
2. The distance from harvesting field to unloading site was 5 miles. Actual distances ranged from 1 mile to just over 10 miles.

Bulk System
1. Watermelons weighed an average of 22.5 pounds each with a range of approximately 20-24 pounds.
2. An over-the-road trailer load of 2,000 melons weighed 45,000 pounds (22.5 lbs × 2,000 melons = 45,000 lbs).
3. Maximum gross weight of 80,000 lbs (vehicle and load). Tare weight of over-the-road vehicle: 30,000 lbs.

Bin System
1. Watermelons weighed an average of 22.5 pounds with a range of approximately 20-24 pounds.
2. An over-the-road trailer load of 1,836 watermelons weighed 41,310 pounds (22.5 lbs × 1,836 melons = 41,310 lbs).
3. Bin and pallet weight was 110 lbs. Thirty-six bins and pallets per load totaled 3,960 pounds. (36 bins and pallets × 110 lbs = 3,960 lbs). An average of 51 melons were packed per bin, (58 melons in upper bins and 45 melons in lower bins in the over-the-road trailer).
4. Maximum gross weight of 80,000 lbs (vehicle, materials, and load). Tare weight of over-the-road vehicle: 30,000 lbs.

Transportation
1. Over-the-road shipments were from central Florida to wholesale markets in Washington, D.C.
2. A transport rate of $3.75 per hundredweight was used for bulk or bin shipments.

Wholesale Warehouse
1. For bulk loads: 50 melons were placed in each bin.
2. For bin loads: 51 melons were in each bin.
3. Mixed loads to the retail store in trailer consisted of 18 pallet loads of produce. Two pallets contained bins of melons.

Retail Store
1. A pallet jack was used to transport bins within the retail store.
2. Retail store handling costs were based on two bins of watermelons.

Harvesting

During harvesting, a crew walks through the field, cuts the watermelons from the vines (fig. 1), and turns them over so that the loading crew can tell by the pale underside which melons have been cut. After the watermelons are cut, a field truck loading crew goes into the field and transports the melons to the truck. The melons are either handcarried to the truck or passed to other loaders who in turn pass melons to a worker on the truck. The worker on the truck stacks the melons (fig. 2).

A harvesting crew of four workers required 37.376 minutes or 2.492 worker-hours to cut 730 watermelons, enough to fill one field truck (15,000 lbs).

A field truck loading crew then moved through the field carrying melons to the field truck that slowly moved along with the crew. A crew of five (one driver, one stacker on the truck, and three loaders) comprised the field truck crew. It took 50.297 minutes or 4.191 worker-hours to load the truck.

When the field truck was loaded it was driven to a packing plant, a centralized loading area, or the side of a field where an over-the-road trailer can be driven for loading. The trip for the truck from the field to the loading area required 0.36 hour based on 4 to 6 miles of travel. Travel time back to the field from the loading area required 0.30 hour.

Table 1 shows the labor and equipment times and costs to harvest 730 melons, load the field truck, and drive to the loading site and return. Total labor and equipment cost was $26.201.

Figure 1.—Cutting watermelons in the field.

Figure 2.—Worker stacking watermelons in field truck.

Table 1.—Labor and equipment costs to harvest, load field truck[1], and transport to and return from loading site.

Item	Labor time	Labor cost[2]	Equipment time	Equipment cost[3]	Total
	Worker-hours	*Dollars*	*Hours*	*Dollars*	*Dollars*
Harvesting	2.492	8.348	—	—	8.348
Loading field truck	4.191	14.040	0.838	0.896	14.936
Transportation[4]	.660	2.211	.660	.706	2.917
Total					26.201

[1]Field truck load of 730 watermelons.

[2]Wage of $3.35 per hour for harvesting and field truck crews.

[3]Hourly cost of $1.069 for field truck. See table 11 for equipment cost data.

[4]Driver's time from field to loading site and return.

Field Truck Unloading

Three procedures were used to unload the field truck. The watermelons could be loaded directly into an over-the-road trailer for bulk shipping, placed on a mobile conveyor for bulk or bin loading and shipping, or placed into bins at the packing plant for later loading and shipping in either bulk or bins.

Even though a field truck brought in 730 melons, some were damaged or were too small for shipment. During the study it was found that a field truck of 730 watermelons had an average of 10 damaged melons and 220 melons that were too small for the usual over-the-road shipments. The smaller melons were diverted to shipments to fill specific orders for small melons or they were sold locally.

Table 2 shows labor and equipment cost to unload a field truck of 730 watermelons by three methods. Unloading 730 melons into bins at the packing plant was $4.604, onto a mobile conveyor $5.682, and directly into a trailer $11.489.

Table 2.—Labor and equipment cost to unload field truck[1] by three methods

Item	Direct	Mobile conveyor	Bins at packing plant
		Dollars	
Labor cost[2]:			
Unload field truck	10.640[3]	5.136[4]	4.161[5]
Equipment cost[6]:			
Field truck	.849	.546	.443
Total labor and equipment cost	11.489	5.682	4.604

[1]Field truck load of 730 watermelons.

[2]At $3.35 per hour for all unloading workers.

[3]Total time to unload 0.794 hour for four workers (two unloaders, one worker in cull truck, and driver.) Time includes reloading small melons from trailer, repositioning field truck, and transferring melons to a cull truck.

[4]Total time to unload 0.511 hour for two unloaders and one driver. Conveyor cost not included. See trailer loading section.

[5]Total time to unload 0.414 hour for two unloaders and one driver. Time to weigh melons, construct bins, and place in bins by workers on dock not included. See trailer loading section.

[6]Hourly cost of $1.069 for field truck. See table 11 for equipment cost data.

Directly from Field Trucks

When the unloading was directly into an over-the-road trailer, the field truck was positioned alongside the trailer, and workers removed the watermelons from the field truck and stacked them into either a closed (fig. 3) or open top trailer (fig. 4).

Damaged melons were discarded. But, since the field truck was full when unloading began, small melons were placed in the over-the-road trailer and then returned to the field truck when room became available. This was a major drawback with this method of unloading. When the field truck was almost unloaded, a third truck was positioned next to the field truck, and the culls were transferred into it.

Figure 3.—Unloading field truck directly into closed trailer.

Figure 4.—Unloading field truck directly into open top trailer.

Since scales were not available for weighing the watermelons during unloading, melon weight could only be estimated. This method of unloading used four workers—two unloaders, one driver, and one worker in the cull truck.

Mobile Conveyor

In this unloading method, the field truck was driven to a central unloading site where a mobile conveyor (fig. 5) was parked. The field truck was positioned adjacent to a conveyor, and workers placed melons onto the conveyor. Three workers were used—two unloaders and the driver.

Bins at Packing Plant

With this method the field truck was unloaded at the packing plant where the melons were moved from the field truck to the loading dock, weighed, and placed in bins. The bin-loaded melons could later be shipped as a bin load or a bulk load in either a closed or open top trailer. Small melons were separated from the larger melons and were placed in other bins. Damaged melons were discarded. Three workers also were used with this method—two unloaders and the driver.

Usually, there was no time break from unloading the field truck to loading the over-the-road trailers. It was a continuous operation. In some instances, however, a field truck could be unloaded and the melons placed in bins for later loading. In this study, in order to show each operation, field truck unloading and over-the-road trailer loading are presented separately.

Figure 5.—Mobile conveyor used for unloading field trucks.

For a bulk load, it took four field trucks of watermelons (2,000 melons) to fill a trailer. For a bin load (1,836 watermelons), 3.672 field trucks of melons were needed.

Costs for labor, equipment, and material used in loading the trailers are reported in tables 3 and 4. When studying these results remember that costs for the field workers are included in the unloading segment.

Table 3 shows the labor, equipment, and material cost to bulk load an over-the-road trailer with 2,000 watermelons by three different methods. The direct-from-the-field-truck method had the lowest total cost, $40.939 per trailer load. The total costs per trailer load from the conveyor and from the bin were $82.924 and $96.913, respectively.

Table 4 shows the labor, equipment, and material costs to load an over-the-road trailer with 1,836 melons in 36 bins by two methods. The total cost per trailer from the mobile conveyor was $1,053.313. Transfer into bins was $1,035.890. The cost of the bins and pallet for both methods was $1,008 per trailer load. Bin and pallet costs represented 96 percent of the total cost for the conveyor method and 97 percent of the total cost for the bins-at-packing-plant method.

It must be remembered that the bins and pallets may be used later within the wholesale warehouse and retail stores for shipment of watermelons, potatoes, pumpkins, and other produce items. This could greatly reduce the cost per use.

Bulk Loads

The three methods of loading watermelons for bulk transportation were direct from the field truck, from a mobile conveyor, or from holding bins at the packing plant.

Directly from Field Truck In this method of loading, handlers in the trailer took melons directly from workers in the field truck and handed them to a stacker in the trailer. Usually four bales of straw were used as cushioning for the melons. The straw was placed on the floor and against the front and rear walls of the trailer. Four bales of straw cost $7.00 ($1.75 per bale × 4).

With this method of loading three workers were involved—three in trailer (two handlers and one stacker).

Mobile Conveyor In this method of loading the watermelons moved on a conveyor to a grader with a scale (fig. 6). The grader directed the watermelons to the over-the-road trailer (fig. 7) or to a truck for culls. Four bales of straw were used for cushioning.

With this method of loading, four workers were involved—two stackers in the trailer, one grader, and one stacker in the cull truck.

Figure 6.—Watermelons move along conveyor to grader at weighing station.

Figure 7.—Loading over-the-road trailer with watermelons from a conveyor.

Table 3 —Labor, equipment, and material cost to bulk load an over-the-road trailer[1] by three methods

Item	Direct	Mobile conveyor	Bins at packing plant
		Dollars	
Labor cost:[2]			
Construct bins	—	—	4.279[3]
Load trailer	13.939[4]	28.810[5]	52.066[6]
Equipment cost:[7]			
Mobile conveyor	—	27.114	—
Forklift truck	—	—	10.771
Bins and pallets	—	—	2.797
Materials:			
Straw	7.00	7.00	7.00
Wood for rear door	20.00	20.00	20.00
Total	40.939	82.924	96.913

[1]Trailer load of 2,000 watermelons.

[2]At $3.35 per hour.

[3]Total time to construct 40 bins with inserts, which would hold 2,000 watermelons (1.277 hours) for one worker.

[4]Total time of 1.387 hours for three workers.

[5]Total time of 2.150 hours for four workers.

[6]Total time of 5.250 hours for two workers and 2.521 for two workers. Includes time for grading and bin loading (4.342 hours), and transporting bins from storage area and return (0.908 hour) and bin unloading into trailer (2.521 hours) for two workers.

[7]See table 11 for hourly equipment cost data.

Table 4.—Labor, equipment, and material cost to bin load an over-the-road trailer[1] by two methods

Item	Mobile conveyor	Bins at packing plant
	Dollars	
Labor cost:[2]		
Assemble bins[3]	3.846	3.846
Load bins	19.752[4]	19.744[5]
Load bins in trailer	2.211[6]	3.042[7]
Equipment cost:[8]		
Mobile conveyor	18.589	—
Forklift truck	.915	1.258
Materials:		
Bins, liners, pallets (36 × $28)	1,008.000	1,008.000
Total	1,053.313	1,035.890

[1]Trailer load of 1,836 watermelons.

[2]At $3.35 per hour.

[3]Total time to assemble 36 bins with inserts, which would hold 1,836 watermelons (1.148 hours) for one worker. Average number of melons per bin was 51; 58 in top bin, 45 in lower bin stacked in trailer.

[4]Total time of 1.474 hours for four workers (one grader, two bin loaders, and worker in cull truck).

[5]Total time of 5.894 hours for one worker. Includes time to grade melons and also load culls in bins.

[6]Transport time of 0.660 hour from dock to trailer and return.

[7]Transport time of 0.908 hour from storage to trailer and return.

[8]See table 11 for hourly equipment cost data.

Holding Bins at Packing Plant In this method of loading, a forklift truck was used to move watermelons in bins into a trailer. The melons were removed from the bins and stacked on the trailer floor. As in other loading procedures for bulk transport, four bales of straw were used for cushioning.

With this method of loading five workers were involved—two stackers, one grader and bin loader, one bin assembler, and one forklift truck operator. In some cases, there was a time break between field truck unloading and over-the-road trailer loading. The melon-loaded bins were set aside and moved to the over-the-road trailer when it arrived later in the day.

Bin Loads

Two methods by which a trailer for bin loads could be loaded were observed. The melons were loaded from a mobile conveyor into bins or hand transferred into bins (without the use of a conveyor) at the packing plant.

Mobile Conveyor In this method of loading, the watermelons moved on a conveyor to a grader with a scale. The grader directed the watermelons to the bin loading area or to a cull truck.

At the bin loading area a supply of wooden bins, fiberboard inserts, and pallets were stored. Bins were assembled by a worker.

The bins were hand loaded with watermelons that arrived at the bin loading area on the conveyor (fig. 8). When the bins were filled a driver used a forklift truck to transport the bins into the over-the-road trailer (fig. 9).

Figure 8.—Bin loading of watermelons from a conveyor.

Figure 9.—Bin being loaded in over-the-road trailer using a forklift truck.

With this method, six workers were involved—two bin loaders, one grader, one worker in the cull truck, one bin assembler, and one forklift truck driver.

Bins at Packing Plant In this method of loading the watermelons, which had been graded and placed in bins during the field truck unloading, were transported into a trailer using a forklift truck. The bin assembly operation was the same as described in the previous section.

With this method of loading four workers were involved—one grader, one bin assembler, one forklift truck driver, and one bin loader (for shipment and culls). In many instances there was a break in time between field truck unloading and over-the-road trailer loading.

Transportation

Transportation of watermelons started when the trailer was loaded and left the loading site at origin and ended with arrival at the wholesale warehouse.

The transport shipping rate can vary throughout the shipping season. During the study the rate was $3.75 cwt for bulk or bin loads. The transport charge for the bulk load was $1,687.50 ($3.75 × 450 cwt) and for the bin load $1,549.12 ($3.75 × 413.1 cwt). For the bin shipment the transport carrier did not charge for the weight of bins and pallets. This extra weight amounted to 3,960 pounds and was transported without added cost because of reduced unloading time and cost at destination. Unloading a bin shipment at the wholesale warehouse took 0.572 hour compared with 3.786 hours to unload a bulk shipment.

Unloading at Wholesale Warehouse

At the wholesale warehouse the over-the-road trailer was backed up to the unloading dock, the rear door opened or removed, a dock plate positioned, and unloading started.

Bulk

In bulk unloading a member of the unloading crew gets a supply of bins and pallets and assembles the bins as they are needed. Wooden, wire, or fiberboard bins are used during this phase of the distribution system.

The empty bins were transported into the trailer using a pallet jack, loaded with 50 watermelons (fig. 10), removed from the trailer, and placed in temporary storage. After the unloading of the bulk trailer was completed, the driver, helper, or warehouse crews cleaned the straw and damaged watermelons from the dock. Most decayed and damaged melons and straw remained in the trailer.

Figure 10.—Loading a bin at the wholesale warehouse.

Table 5 shows the labor, equipment, and material time and cost to unload 2,000 watermelons from a bulk-loaded trailer. Total cost was $45.072.

The cost for bins and pallets shown in table 5 ($1.264) is based on hours of use during unloading of the bulk-loaded trailer.

During the early part of the consumer purchasing season for watermelons, retail stores usually do not sell as many melons as they do later on. Therefore, retail store produce managers will request that the warehouse send bins containing only 35, 40, or 45 melons. Therefore, the loader will fill the bins with the number of melons requested for that time of year.

Table 5.—Labor, equipment, and material time and cost to unload a trailer with a bulk load of 2,000 watermelons

Element	Time	Cost
	Hours	*Dollars*
Labor:[1]		
Prepare to unload[2]	0.030	0.240
Assemble bins[3]	.693	5.544
Load bins[4]	3.281	26.248
Transport bins[5]	.762	6.096
Miscellaneous[6]	.395	3.160
Clean up	.080	.640
Equipment:		
Pallet jack[7]	3.521	1.880
Materials:		
Bins and pallets[7,8]	3.601	1.264
Total	—	45.072

[1]Based on $8.00 per hour.

[2]Open rear door or remove rear supports and position dock plate.

[3]Includes getting supply of bins and pallets, assembly, and move into trailer.

[4]Approximately 50 damaged melons; therefore, fill 39 bins (50 melons × 39 bins = 1,950 melons).

[5]Transport full bins to storage and return to dock (150 ft. round trip).

[6]Includes releasing side supports on open trailers (0.059 hour), moving straw away from bins and pallet jack during bin loading (0.041 hour) and delays (0.295 hour).

[7]See table 11 for cost per hour of use.

[8]These bins and pallets are used in the company's internal operation on a continuing basis; therefore, a cost per hour of use is used.

Bin

In bin unloading, once the dock plate is in position, a driver using a forklift truck begins unloading the bins. The full bins are transported to a storage area for later assembly into mixed produce loads for shipment to retail stores.

Table 6 shows the labor and equipment time and cost to unload 36 bins (1,836 watermelons) from a trailer. Total cost was $10.944.

During retail store produce order selection, bins of watermelons are selected as they are needed for the mixed load. Usually a pallet is placed on the bin so that other produce can be stacked on top (fig. 11).

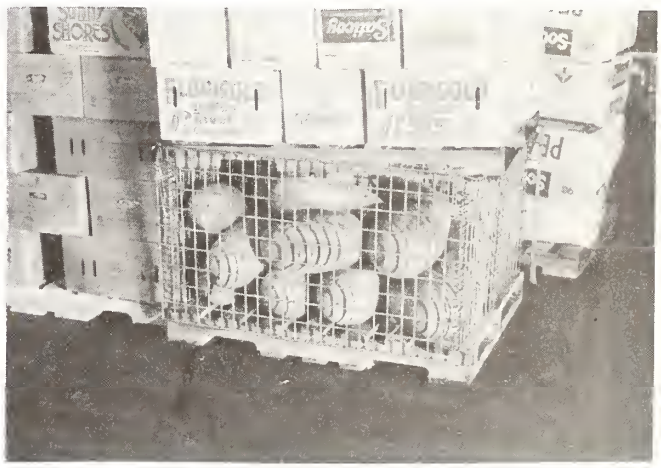

Figure 11.—A bin of watermelons as part of a mixed produce load prior to loading into trailer for delivery to retail store.

Table 6.—Labor and equipment time and cost to unload a trailer with a bin load of 1,836 watermelons

Element	Time	Cost
	Hours	*Dollars*
Labor:[1]		
Prepare to unload[2]	0.020	0.160
Remove 36 bins from trailer	.552	4.416
Transport bins[3]	.594	4.752
Equipment:		
Forklift truck[4]	1.166	1.616
Total	—	10.944

[1]Based on $8.00 per hour.

[2]Open rear door and position dock plate.

[3]Transport full bins to storage and return to dock (150 ft. round trip),

[4]See table 11 for cost per hour of use.

Moving to the Retail Store

The bins of watermelons and other produce are transported from the storage area and loaded on the trailer for delivery to the retail store. The labor and equipment requirements and costs to select, load, and deliver a trailer load of 18 pallets of produce, of which two are watermelon bins, are shown in table 7. Labor, equipment, and material cost per two bins of watermelons was $8.240.

The transport trailer made an 80-mile round trip during delivery. With a fixed cost of $3.39 per hour (see table 11) for tractor and trailer for 8 hours (8 × $3.39 = $27.12), total fixed cost was $27.12. Operating cost was $1.60 per mile or $128.00 per round trip, for a total transport cost of $155.12 for an 18 pallet load trailer. Transport cost for the watermelon load (two bins) was $17.235 ($155.12 ÷ 9).

Total labor, equipment, and materials cost for order selection, loading, and delivery for the watermelon part of the mixed produce load was $25.475 ($8.240 + $17.235).

Table 7.—Labor and equipment time and cost to select, load, and deliver a mixed produce load on 18 pallets (two bins of watermelons) from warehouse to retail store

Element	Per trailer load[1]	Per watermelon load	Cost per watermelon load
	Worker-hours		*Dollars*
Labor:[2]			
Select produce	4.87	0.541	4.328
Load pallet in trailer	.62	.069	.552
Deliver to store and return	3.39	.377	3.016
Equipment:[3]			
Pallet/jack	—	.611 (hours)	.326
Materials:[3]			
Bins and pallets	—	.986 (hours)	.018[4]
Total			8.240

[1]Shaffer, P. F. and D. M. Steckler, Comparative Methods of Handling Produce From Warehouse Slots to Holding Areas in Retail Store. ARS-NE-49, November 1974.

[2]Based on $8.00 per hour.

[3]See table 11 for cost per hour of use.

[4]Cost for melons which arrived in bulk and were placed in bins at warehouse. Also, see footnote 8, table 5.

Retail Store

When the trailer from the warehouse arrives at the retail store, a pallet jack is used to remove the watermelon bins and other pallet loads of produce. The produce is usually placed in a temporary storage area and moved to the display area in the store as needed (fig. 12). Some watermelons are cut into sections and sold (fig. 13).

Figure 12.—A bin of watermelons for sale at the retail store.

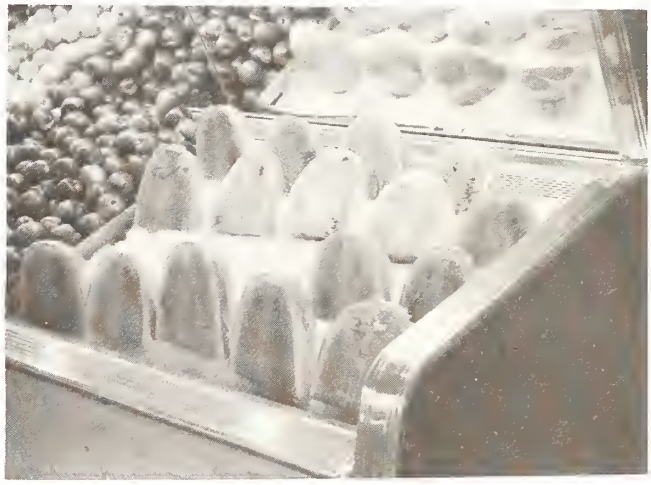

Figure 13.—Cut watermelons for sale at the retail store.

Table 8 shows the labor, equipment, and material time and cost to unload a mixed produce load on 18 pallets and handle watermelons at the retail store. Total cost per watermelon load (two pallet bins) was $2.830.

Table 8.—Labor, equipment, and material time and cost to unload a mixed produce load[1] on 18 pallets and handle watermelons within the retail store

Element	Per trailer load	Per watermelon load	Cost per watermelon load
	Worker-hours		*Dollars*
Labor:[2]			
Unload[3]	2.65	0.294	2.352
Transport bin from storage	—	.020	.160
Set up display	—	.018	.144
Equipment:[4]			
Pallet jack	—	.314 (hours)	.168
Materials:[4]			
Bins and pallets	—	.332 (hours)	.006[5]
Total			2.830

[1]Including two bins of watermelons.

[2]Based on $8.00 per hour.

[3]Shaffer, P. F. and D. M. Steckler, Comparative Methods of Handling Produce from Warehouse Slots to Holding Areas in Retail Store. ARS-NE-49, November 1974.

[4]See table 11 for cost per hour of use.

[5]Cost for melons that arrived in bulk and were placed in bins at warehouse. Also, see footnote 8, table 5.

Wholesalers who purchase melons in bins (wooden or fiberboard) usually do so because their truck dock space is tied up less when receiving bin shipments compared with bulk, and because damage may be less with bins. Unloading time was 0.572 hour for bin shipments compared with 3.786 hours for bulk shipments. Wholesalers who purchase melons in wooden bins usually plan to reuse the bins within their organization after the melons are sold.

In this study, wooden bins were used, and the receiver paid for the bins and pallets. This is an expensive purchase, but because the wooden bins and pallets are used many times within the wholesale warehouse and retail store for shipments of watermelons, potatoes, pumpkins, and other produce items, costs per use to the wholesaler could be greatly reduced.

Empty bins and pallets from previous deliveries were held in the storage area at the retail store. When a substantial quantity had been collected, the warehouse sent a trailer to the stores to collect the bins and pallets. The cost to return 360 knocked down bins and pallet units (total weight of 38,500 lbs at 110 lbs for a unit) is shown in table 9. Total labor, equipment, and material cost was $68.258.

Table 9.—Labor, equipment and material time and cost to return 360 bin and pallet units to warehouse from retail store

Element	Time		Cost
	Worker-hours	*Equipment-hours*	*Dollars*
Labor:[1]			
Collapse bins and stack	.725	—	5.800
Load bins and pallets	.959	—	7.672
Unload at warehouse	.959	—	7.672
Driving time (40 miles)	3.390	—	27.120
Equipment[2]			
Pallet jack	—	1.918	1.024
Material:[2]			
Bins and pallets	—	6.033	18.970
Total	—	—	68.258

[1]Based on $8.00 per hour.

[2]See table 11 for cost per hour of use.

The transport trailer made an 80-mile round trip to pick up the bins and pallets. With a fixed cost of $3.39 per hour for tractor and trailer, total fixed cost was $27.12. Operating cost was $1.60 per mile or $128.00 round trip for a total transport cost of $155.12.

Total labor, equipment, material, and transport costs to return a full trailer load of 360 bins and pallets back to the warehouse from the retail store was $223.378 ($155.12 + $68.258) or $0.638 per bin and pallet unit.

At the present time there is no information available that a bin and pallet pool program exists on any large scale for returning bins and pallets to origin. In this concept bins and pallets are returned to origin (growing and shipping area) from the wholesale receivers. The cost to return a full trailer load of bins and pallets (360 units) from Washington, D.C., to Miami, Fla., was $956.00.[2] The total labor and equipment cost to load the trailer with 360 units and then unload in Florida was $22.26.[3] Total handling costs and transport charges were $978.26. The cost per unit (bin and pallet) was $2.72.

For a full bin and pallet trailer load (36 units), the cost would be $97.92 (36 units × $2.72). This is the cost to use the bins and pallets over again for a shipment.

Table 10 shows the total labor, equipment, material, and transport cost per watermelon for two systems (bulk and bin) for marketing watermelons and the costs for different methods of unloading the field truck and loading the over-the-road-trailer.

In harvesting only one method was observed. The cost for this phase of handling was $0.0358 per melon.

For bulk shipments three methods of field truck unloading were observed. Also, three methods of over-the-road-trailer loading were studied. The methods of field truck unloading are interrelated to the three methods of over-the-road-trailer loading. Unloading the melons directly from the field truck into the over-the-road-trailer (system A) had the lowest cost per melon, $0.0361 ($0.0157 + $0.0204). This compared to $0.0491 ($0.0077 + $0.0414) per melon for unloading onto a conveyor and loading the trailer from the conveyor (system B) and $0.0547 ($0.0063 + $0.0484) per melon for unloading melons into temporary holding bins at the packing plant and then unloading the melons from the bins into the over-the-road-trailer for a bulk shipment (system C).

For bin shipments loading the melons into bins instead of onto a conveyor and then loading the trailer had a cost of $0.0214 ($0.0063 + $0.0151) per melon (system E), excluding the cost of bins and pallets. The cost per melon to load onto a conveyor and then load the bins (system F) had a cost of $.0.0323 ($0.0077 + $0.0246) per melon, excluding the cost of bins and pallets. For field trucks unloading and trailer loading, system D had the same cost as system F and system G the same as system E.

Only one method was used for receiving bulk shipments and one method for receiving bin shipments at the wholesale warehouse at a cost of $0.0225 for bulk and $0.0059 for bin per melon, respectively. Also, only one method was used for sending these shipments from the wholesale warehouse to the retail store. The wholesale warehouse receiving and shipping costs were $0.2772 ($0.0225 + $0.2547) for the bulk shipments and $0.2556 ($0.0059 + $0.2497) for the bin shipments per melon, respectively.

[2]Telephone verification from a transport company.

[3]Labor and equipment loading and unloading data based on data from Materials Handling Standard Time Data. Department of Defense. DOD 5010.15. 1-M, March 1967.

Retail store handling was $0.0283 per melon for bulk melons that had been placed in bins (50 per bin) and $0.0277 for straight bin loaded melons (51 per bin).

Bin and pallet return cost from retail store to wholesale warehouse added $0.0127 per melon for bulk melons in bins and $0.0125 per melon for straight bin loaded melons. This difference in cost per melon results from 50 melons per bin in bulk-loaded shipments and 51 melons per bin in straight bin loaded melons.

Bin and pallet return cost per unit from wholesale warehouse to origin was $2.72. For a bin and pallet trailer load (36 units) the total cost was $97.92. The cost per melon was $0.0533 ($97 ÷ 1836). This applies to systems D and E.

The least-cost system (G) includes melons unloaded from the field truck and loaded into bins at the packing plant and then loaded onto the over-the-road-trailers. At the wholesale warehouse bin loads are received at a cost of $0.0059 per melon. Costs from the wholesale warehouse to the retail store and return of bins and pallets totals $0.2899. The total cost for this system (G) is $1.2219 per melon, which is $0.0769 per melon less than the most expensive system (D) that includes return of bins to the growing and packing area.

The decision of the wholesaler to buy watermelons in bulk or bin loads is based on several factors. The wholesaler usually cannot use all of the bins that would be available if he or she purchased all bin shipments. Some wholesalers may purchase a few bin loads per season to replace worn bins and pallets or to increase the inventory. Bin loads do not tie up dock space during unloading as much as bulk loads (unloading time of 0.572 hour for bin loads compared with 3.786 for bulk loads). This factor may be important to the warehouse having limited dock space.

Many wholesalers purchase only bulk loads and get the bins and pallets they need directly from the manufacturer. Some wholesalers say they cannot examine bin loads for damage as well as bulk loads, while others have stated they experience more damage in bin loads, because of collapsing bins, compared to bulk loads.

Watermelon damage associated with bulk and bin loads may be an important factor to a wholesaler. In an earlier study[4] Kindya, Close, et. al., estimated that watermelon losses that would occur through to the retail store were 3.27 percent for bulk loads and 2.14 percent for bin loads.

[4]Kindya, W. G., Close, E., Risse, L.A. and Mongelli, R. C. Transporting Watermelons in Bulk and Bins by Truck. OT-4, Office of Transportation, U.S. Department of Agriculture. Oct. 1982.

Table 10.—Total cost per watermelon with two major systems and various methods within phases of the distribution systems

System	Harvesting	Field truck unloading	Over-the-road trailer loading	Hourly cost of bins and pallets	Transportation	Wholesale warehouse		Retail store handling	Return of bins and pallets (to wholesale warehouse from retail store)[1]	Hourly cost of bins and pallets	Return bins and pallets to origin	Total cost per watermelon
						Receive	Deliver					
	Dollars	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
Bulk:												
A	0.0358	D 0.0157[1]	0.0204[2]	—	0.8435	0.0225	0.2547	0.0283	0.0127	0.0127[5]	—	1.2463
B	do	C .0077[2]	.0414[2]	—	do	do	do	do	do	do[5]	—	1.2593
C	do	B .0063[2]	.0484[2]	—	do	do	do	do	do	do[5]	—	1.2649
Bin:												
D	.0358	C .0077[2]	.0246[2]	0.0381[3]	.8437	.0059	.2497	.0277	.0125	—	0.0533	1.2988
E	do	B .0063[2]	.0151[2]	do[3]	do	do	do	do	do	—	do	1.2879
F	do	C .0077[2]	.0246[2]	.0127[4]	do	do	do	do	do	.0127[5]	—	1.2328
G	do	B .0063[2]	.0151[2]	do[4]	do	do	do	do	do	do[5]	—	1.2219

[1]Per bin and pallet return cost determined by number of watermelons per bin; bulk-loaded in bin = 50, straight bin = 51.

[2]D = direct, C = mobile conveyor, B = bins at packing plant.

[3]Based on total time of 9 days from storage and loading at origin, transporting to destination and return to origin.

[4]Based on total time of 3 days from storage and loading at origin and transportation to destination.

[5]Based on total time of 3 days from unloading at wholesale warehouse, shipping to retail store and return to wholesale warehouse.

Table 11.—Ownership and operating costs for equipment inputs for handling watermelons

Type of equipment	Intial cost per unit	Years of depreciation[1]	Depreciation	Annual ownership costs		Total	Annual operating costs		Total	Total ownership and operating costs	
				Interest[2]	Insurance and taxes at 5%		Power[3]	Maintenance[4]		Year	Hour
	Dollars	*Years*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
Field truck	11,000	6	1,833.33	550	550	2,933.33	750[5]	880[6]	1,630	4,563.33	$1.069[7]
Mobile conveyor	40,000	15	2,666.67	2,000	2,000	6,666.67	300	600	900	7,566.67	12.611[8]
Wooden bin with pallet	28	3	9.33	1.40	1.40	12.13	—	3.00[9]	3	15.13	.009[10]
Forklift truck, 4,00 lb capacity	11,500	10	1,150	575	575	2,300	300	172.50	472.50	2,772.60	1.386[11]
Pallet jack	3,800	10	380	190	190	760	250	57	307	1,067	.534[11]
Tractor	25,000	6	4,166.67	1,250	1,250	6,666.67	—	—	1.60 per mile	6,666.67	2.151[12]
Refrigerated trailer	14,000	8	1,750	700	700	3,150	—	210	210	3,360	1.244[12]

[1]Straight line depreciation.

[2]Computed interest is 10 percent for half the equipment life prorated over the full life.

[3]Power cost for battery charging of electric-powered vehicles computed from manufacturers' records.

[4]Maintenance of 1.5 percent of cost.

[5]Fuel costs calculated at $250 per month for 3 months.

[6]Maintenance of 8 percent of cost.

[7]Based on a total of 1,600 hours of annual operation multiplied by 0.375 or 600 hours (3 months).

[8]600 hours of use annually.

[9]Estimated.

[10]Based on 1,600 hours annual use.

[11]Based on 2,000 hours annual use.

[12]3,100 hours for tractor and 2,700 hours for trailer.

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