UNITIZED SHIPPING OF FRESH CITRUS

by
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Compared cost of nonunitized and unitized shipping systems for citrus.

Increasing labor costs and the scarcity of labor during the citrus shipping season, coupled with the relatively low price of citrus per carton, are forcing citrus shippers to look for ways to reduce shipping costs.

Unitized handling[1] offers possibilities for reductions in labor costs and in product loss and damage. Unitization is being used extensively in the grocery industry for handling and shipping canned goods and other dry products. Its use for handling and shipping fresh fruits and vegetables has been negligible because of their bulky nature and because of the special environmental conditions required for their protection during storage and transport.

Present System

Before we look into unitized handling, let us glance at the present system of handling cartons of fresh citrus manually after they leave the packing line. In the present system a box of citrus is handled a minimum of four times, as follows:

1. Onto a pallet directly from the packing line.

2. Onto the floor of the transport vehicle.

3. Onto a pallet at unloading.

4. Onto a pallet for delivery to the retail store.

This system is labor-intensive, and labor costs comprise about 90 percent of the loading and unloading costs. The product is subject to pilferage at the packing plant and receiving warehouse. The loading and unloading times are long. Manual handling presents more opportunities for employee accidents. Multiple individual handlings can increase the incidence of damage to the shipping container and its contents. This product damage is usually in the form of bruising that does not show up for 7 to 10 days.

Study of Citrus Shipping Costs

Four shipping systems for moving citrus from Florida packing plants to Midwest receivers' warehouses were studied. These systems consisted of two that were nonunitized - the forklift and the conveyor systems, and two that were unitized - the pallet and the slipsheet systems. For the studies, simple cost models were constructed and then the various model limits were applied to the basic loading, transporting, and unloading operations.

The two nonunitized shipping systems differed from each other only in their method of loading. In the pallet system, packed shipping containers were moved from storage on pallets by a conventional forklift and handstacked in the trailer. In the conveyor system, they were moved from storage by conveyor and handstacked in the trailer.

In the pallet unitized system, the pallets were reused under a pallet

exchange arrangement. In the slipsheet unitized system, the slipsheets were made of disposable fiberboard and used only once.

Model Limits

Because of the enormous number of variables (in such factors as products transported, transport vehicles, shipping containers, stacking patterns, and pallets), the following limits were placed on the models constructed:

1. Product: Oranges were selected as the representative citrus fruit; however, data are equally applicable to other citrus fruits.

2. Shipping points: The representative trip was movement by truck from central Florida to Cincinnati, Ohio.

3. Shipping container: The representative shipping container chosen was the 4/5 bushel one (O.D. 17.7 by 11.5 by 10.6 in.).

4. Trailer: The representative trailer was a refrigerated highway trailer with inside dimensions of 37 ft. 3 in. by 7 ft. 4 in. and a loading capacity of 2,003 cu. ft.

5. Transportation rate: The transportation rate, $0.80/carton, charged by exempt carriers of agricultural products to transport oranges between the specified shipping points was obtained from the citrus shippers.

6. Wage rates: For the various job categories, wage rates plus fringe benefits for the required operations were obtained from the Bureau of Labor Statistics for the two shipping points. For central Florida, the wage rate was $3.51/hr. for laborers and $3.76/hr. for forklift operators; and for Cincinnati, Ohio, the wage rate was $4.44/hr. for laborers and $4.84/hr. for forklift operators.

7. Materials:
   a. Pallets: The representative pallet was 48- by 40- by 5-in., had a four-way entry, and weighed an average of 80 lb. Pallet costs consisted of a purchase price of $5.00/pallet and repairs and expenses of $9.00/pallet for 36 uses, for a total pallet cost of $14.00/pallet, or $0.389/pallet used in a pallet-exchange arrangement. One roll of reinforced tape ($2.50/roll) per truckload secured the top layer of each unit load.
   b. Slipsheets: The representative slipsheet was made of expendable fiberboard (B-flute, 200 lb. test) and cost $0.35. One roll of reinforced tape ($2.50/roll) per truckload secured the top layer of each unit load.

8. Gross weight of shipment:
   a. Estimates of average weights were used for all shipments.
   b. When the additional weight of pallets resulted in a loss of revenue to the carriers, adjustments were made in the number of cartons carried so as to nullify this loss. It was assumed that a trucker would not accept less revenue for transporting a palletized shipment than he would for transporting a floor-loaded shipment.
   c. All shipments consisted of 864 containers of citrus.

9. Stacking pattern: Commercially used loading patterns were used for floor-loaded shipments. For all unitized shipments, determination of the loading pattern and number of containers loaded in a shipment were based on estimates of container strength, adequacy of air circulation, and capacities of the transport vehicles.

Forklift Nonunitized Shipping System

In this system, a forklift transported palletized units of shipping containers from storage to the loading area. Two men depalletized the containers manually and handstacked them in the trailer. A third man served as a checker-supervisor.

For better utilization of handling equipment, one conventional forklift transported containers to two trailers that were being loaded simultaneously. Since the dock foreman supervised other operations in addition to the loading operation, he did not supervise the entire loading but was present periodically.

To unload the trailer, one man removed the container from the trailer and stacked them manually on a pallet. He used a pallet-jack to move the palletized containers from the trailer and onto the dock. A conventional forklift then carried the palletized unit from the dock to the storage area. One forklift served three trucks. A dock foreman supervised all of these unloadings.

Conveyor Nonunitized Shipping System

Although many packing plants in Florida are replacing conveyors with the forklift as an internal handling method, several packing plants continue to load from conveyors. For this system in the studies described, conveyor belts carried packed shipping containers from storage to the loading dock. Portable roller conveyors that were placed in the trailer moved the containers from the conveyor belts to two workers who handstacked them in the trailer. Another worker "fed" the containers from the conveyor belts onto the roller conveyor. A fourth worker tallied the containers and supervised the loading.

The same unloading method was used in this system as in the forklift nonunitized system.

Slipsheet Unitized Shipping System

In this system, the loading operation was performed with a modified forklift that had a special push-pull attachment. This attachment grasped the lip on the slipsheet that extended beyond the handling unit on one side and pulled the unit onto the tines of the forklift. This attachment also included a side-shifting feature that enabled the driver to position the unit without moving the forklift.

The only labor that was required for slipsheet unitized loading, other than that of the forklift operator, was that of a checker-supervisor who tallied the unit loads and supervised the loading.

A modified forklift loaded one trailer at a time. The dock foreman supervised the loading operation as part of his job.

For unloading, a modified forklift moved the handling unit from the trailer and onto the dock where a man placed and positioned it on a pallet. The loaded pallet was then picked up by a conventional forklift and moved into storage while the modified forklift returned to the trailer to remove the next handling unit. A laborer placed and positioned the pallets on the dock to help the forklift operator. A dock foreman supervised the unloading operation.

A modified forklift was necessary for each trailer being unloaded. One conventional forklift can serve more then one trailer.

Pallet Unitized Shipping System

With the pallet in unitized shipping system, the containers of citrus were stacked on wooden pallets which were then loaded into trailers by conventional forklifts. The only labor required for palletized loading, other than the forklift operator, was a checker-supervisor who tallied the unit loads and supervised the loading.

At unloading, a conventional forklift unloaded each trailer and moved the palletized units to a storage area. A dock foreman supervised the unloading operation.

Summary

Table 1 shows the labor requirements and costs, transport costs, equipment costs, materials costs, and total cost per load and per shipping container for the four shipping systems studied.

The unitized systems (slipsheet and pallet) reduced the labor requirements an average of 4.211 man-hours per total shipping system and labor costs an average of $15.56 per total shipping system as compared with the nonunitized systems (forklift and conveyor). Equipment costs ranged from a low of $2.98 per trailerload for the forklift shipping system to a high of $5.13 per trailerload for the conveyor shipping system. The equipment cost for both unitized systems was between these two extremes.

Because of the nature of unitized handling, the two unitized systems had a materials cost that ranged from $8.80 to $9.50 per trailerload, whereas the nonunitized systems had no similar cost. The palletized shipping system was the lowest total system cost ($716.76/load) which was $4.38/load less than the slipsheet unitized system ($721.14/load), $5.70 less than the forklift, nonunitized system ($722.46/load), and $11.86 less than the conveyor, nonunitized system ($728.62/load). Potential savings to the Florida fresh citrus industry through the use of the less costly unitized system can range from about $1 to $3 million per year.

Conclusions and Recommendations

The following conclusions can be drawn from the study:

1. The unitized systems for shipping and handling citrus can reduce total labor requirements and costs.

2. In spite of materials costs not required in the nonunitized systems, the unitized systems had lower total system costs.

3. The size of the dock crews for loading and unloading can be reduced by using the unitized systems.

4. With a workable pallet-pool arrangement, the palletized shipping system can produce the greatest savings.

To meet the needs of the citrus industry and other commodities and the systems discussed above, the following nine recommendations concerning unitization should be considered:

1. Since refrigerated trailers and van containers vary in interior widths (because of differences in design, construction, and insulation thickness in the walls), the unitized units used must be adaptable to loading in the trailers and vans of the most common interior widths.

2. To achieve a satisfactory payload, units should be staked high enough to utilize as much of the load room in the van as possible. However, the top of

Table 1. Comparison of Costs of Four Systems for Shipping Citrus in Highway Trailers

Systems	Labor		Transport Costs	Equipment Costs	Materials Costs	Total Cost	
	Requirements	Costs				Per Load	Per Carton
	Man-Hours	Dollars	Dollars	Dollars	Dollars	Dollars	Cents
Forklift	6.790	28.28	691.20	2.98	-	722.46	83.618
Conveyor	8.219	32.29	691.20	5.13	-	728.62	84.331
Slipsheet	3.717	16.72	691.20	4.42	8.80	721.14	83.465
Pallet	2.870	12.72	691.20	3.34	9.50	716.76	82.958

load should be at least 12 to 18 inches below the ceiling of the van.

3. To achieve reasonably good vehicle payloads, the palletized units should occupy about 90 percent of pallet or slipsheet surface area. The stacking patterns used for the units should help prevent container failure and product damage.

4. The pallet used should be inexpensive, lighweight, and take up as little vertical space as possible.

5. The stacking patterns for the units should be practical and uncomplicated and should lend themselves to rapid stacking.

6. The units should be reasonably compact but still provide channels or flues between the containers for circulation of air, and, if necessary, for use of top-ice.

7. The containers should be stacked so that the sides of the units are straight and in vertical alignment with the outside edges of the pallet deck.

8. The units should be stable during handling and transporting.

9. The pallets and slipsheets should be compatible with available materials handling equipment.

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