

Efficiency in Fruit Marketing

effect of different types of equipment on in-plant transportation costs in fresh-fruit packing houses

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This article is the second section of Part VI of a series of reports of studies on the effects of packing-house equipment, plant layout, and work methods on efficiency and costs. These studies have been made co-operatively by the University of California Giannini Foundation of Agricultural Economics, and the Bureau of Agricultural Economics, United States Department of Agriculture, under the authority of the Research and Marketing Act.

Cost-reducing methods could save about 25% of in-plant transportation costs in fresh-fruit packing houses—even in relatively efficient plants.

Studies of in-plant transportation in a number of California pear and apple packing houses have shown a range in labor costs for transportation of \$0.209 to \$1.140 per 1,000 pounds of fruit run through the house. The most important factor contributing to this difference is probably the type of equipment used.

The effects of different types of equipment on transportation costs can be measured by comparing season total transportation costs in plants that are standardized, except for differences in transportation equipment or method. In this procedure, such factors as transport distance, load size, and fruit quantity run per hour and per season are kept uniform in all cases. Costs are compared on the

basis of variation only in the type of transportation equipment used.

As actual plants can not be standardized in this manner, cost comparisons for standardized plants must be made in terms of estimated costs. Such comparisons for two basic types of in-plant transportation equipment—hand trucks and fork trucks—are given in the graph below by the heavy, sloping cost lines.

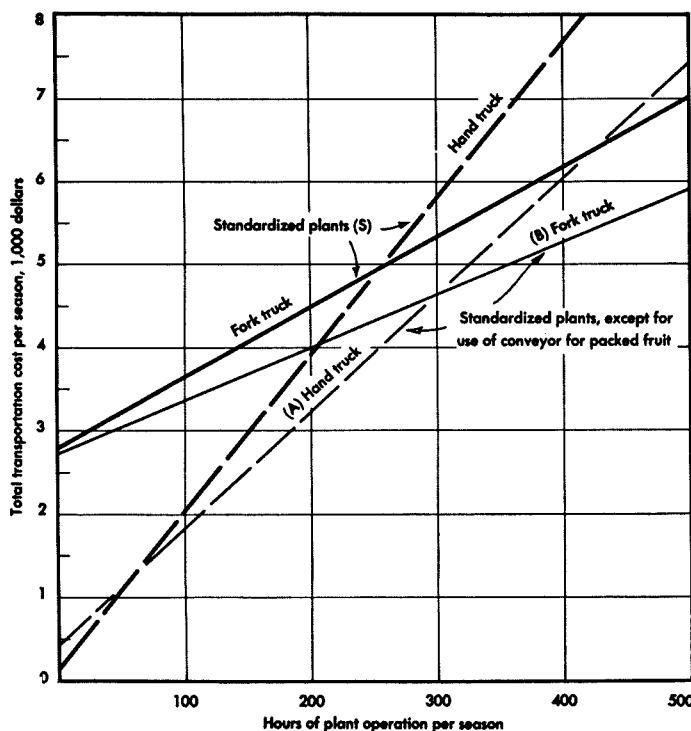
The left graph on this page reflects the two components of season total costs. Annual fixed costs for equipment are indicated by the point where the sloping cost lines intersect the vertical scale—with fork-truck equipment at about \$2,800 and, with hand truck equipment at about \$130. Direct costs are reflected in the slope of the cost line. The relatively steep slope of the cost line with hand trucks reflects a direct cost of \$18.80 per hour in contrast with a direct cost

of \$8.40 per hour with fork trucks. These differences in costs stem primarily from the lower labor requirements—but higher capital outlay—with fork trucks in contrast with hand trucks.

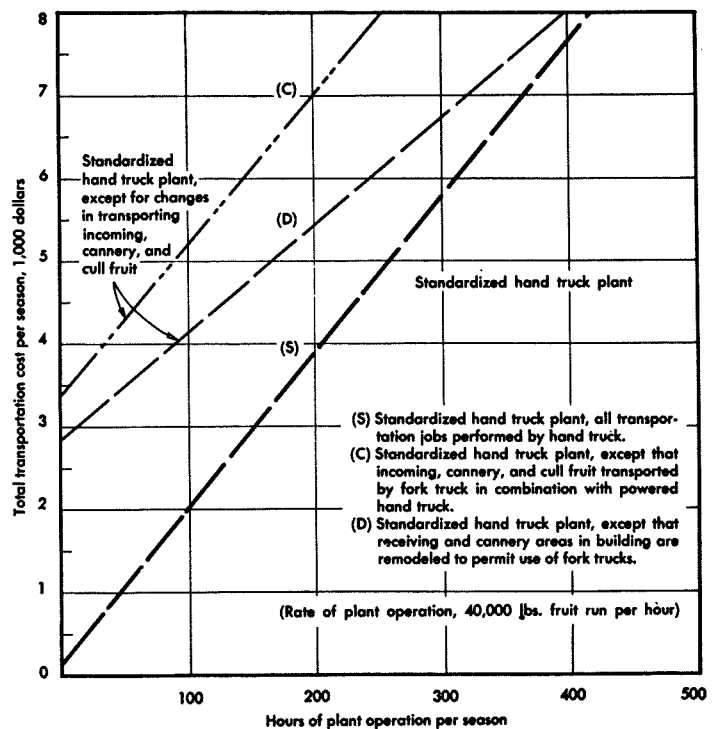
The cost lines for the hand truck and fork-truck equipment in the standardized plant intersect at a length of season of about 260 hours. At this point, the costs with the two types of equipment are the same—slightly under \$5,000 per season. This intersection of the cost lines indicates the break-even point in regard to costs. For seasons shorter than 260 hours, the savings in direct cost through the use of fork trucks are not great enough to outweigh their higher fixed costs, and transportation costs are lower in the hand truck plant. For seasons longer than 260 hours, total costs with fork trucks are less than with hand trucks. With 300

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Season total transportation costs in standardized fork-truck and hand truck plants in contrast with costs in plants using power conveyors for packed fruit.



Season total transportation costs in standardized hand truck plants contrasted with costs in plants using fork-trucks and powered hand trucks for incoming and cannery fruit.



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hours of operation per season, the graph indicates the total season cost with hand trucks to be about \$5,800 and with fork trucks \$5,300. The saving through use of fork trucks instead of hand trucks is thus about \$500 per season.

In certain plants, other equipment may be substituted for trucks on some of the transportation jobs. The effect of one such substitution on costs is illustrated by the light cost lines in the left graph on page 7. These cost lines show the total season costs in the standardized hand truck and fork-truck plants if the packed fruit were transported directly to the car by a power conveyor instead of by truck. As indicated in the graph, costs with the revised situation would be substantially lower than in the original plants. With 300 hours of operation per season, the use of packed fruit conveyor equipment would result in a saving of about \$1,100 per season in the hand truck plant and about \$700 per season in the fork-truck plant.

The effects on costs of two additional variations in method are illustrated in

the right graph on page 7. It compares transportation costs when three different methods are used for handling incoming, cannery, and cull fruit. The basic method involves the use of hand trucks. One variation in method—line C in the graph—involves the use of a fork-truck for loading and unloading highway trucks plus a powered hand truck for moving pallet loads of fruit and lugs over the wood floor of the existing packing house. In the second variation—line D in the graph—the existing building is remodeled so as to permit all transportation work in connection with incoming, cannery, and cull fruit to be done with fork trucks. These variations in method are illustrated by the schematic building cross-sections on page 11.

The right graph on page 7 shows that annual fixed costs for equipment are higher with the revised methods than in the hand truck plant. One reason for this increase is the higher capital outlay for equipment required with the new methods. An additional factor is the capital outlay required for alterations to the building and for the construction of a concrete unloading apron.

The diagram also shows that direct

costs are substantially less with the method represented by line D than with the original hand truck plant, line S. This saving in direct cost, however, is not great enough to outweigh the higher fixed costs with the revised methods, except in a relatively long season. The break-even point in relation to costs with the standardized hand truck plant occurs with about 500 hours of operation per season. For longer season, estimated costs with the revised system are less than in the hand truck plant.

With the method represented by line C, annual fixed costs are much higher, but direct costs are only slightly less than in the hand truck plant. There would be no transportation cost advantage derived from this change in method.

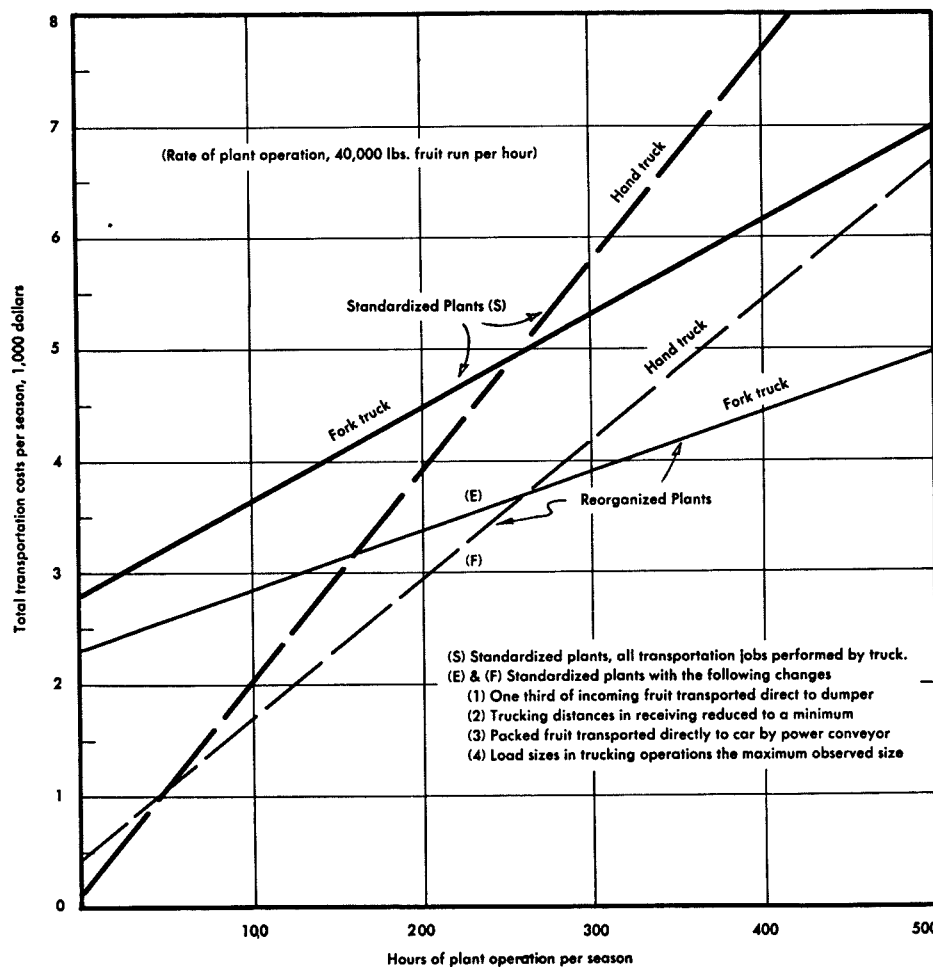
Other variations in equipment and method are possible. The effect of combining several such changes to produce a low-cost method are illustrated in the graph on this page. In the low-cost method described in this graph, the load sizes for the main transportation jobs are the maximum observed, rather than the typical load sizes used in standardized plants. Transportation distances are reduced to a minimum in the low-cost method in contrast with the standardized plant. And, in contrast with the standardized plant, one third of the incoming fruit is transported directly to the dumper rather than via a temporary storage, and the packed fruit is transported directly to the car by power conveyor rather than by truck.

The graph on this page shows that total transportation costs for the low-cost method are much less than in the standardized plants using hand trucks and fork-trucks throughout. The amount of the difference depends again on the length of season. With 300 hours of operation per season, the reduction in cost in the hand truck plant is about \$1,600; in the fork-truck plant about \$1,400. These savings amount to approximately 27% of the transportation costs in the standardized plants.

The season total transportation cost estimates given in the graphs are based on a rate of plant operation of 40,000 pounds of fruit run per hour. For other rates of operation, the level of costs would be different than those shown, but relative costs with the different transportation methods would not change greatly.

The estimated transportation costs given for the standardized plants represent costs with commonly used methods assuming efficient operation. They thus represent a level of costs that is lower than is found in many plants, but which can be attained in the more efficient operations. In the low-cost method shown in the graph on this page, cost-reducing methods observed separately in different

Season total transportation costs in standardized hand truck and fork-truck plants in contrast with plants with improved organization of transportation methods.



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DAIRY

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amount of milk consumed as a beverage by each group and the per capita consumption of other milk and other dairy products. These estimates were compared with the quantities of dairy products suggested by the United States Bureau of Human Nutrition and Home Economics in their food plans for good nutrition at moderate cost.

On the average, children 12 years and younger consumed more than the suggested quantities—from 8% to 25% more. Boys, from 13 through 20 years of age, averaged 4% to 19% more than the amounts suggested. The girls in this age group in Los Angeles consumed 2% to 11% more; the girls in Oakland, 4% to 11% less than the quantities of dairy products suggested.

Only one group of adults over 20 years consumed on the average more than the quantities suggested. The men from 21 through 29 years in Los Angeles consumed 22%, and those in Oakland 8% more than the suggested amounts. However, the women in the same age group consumed 12% to 14% less than the amounts suggested.

In all age groups over 30 years, men came nearer to consuming the suggested quantities than women. In Oakland, the men consumed from 20% to 32% less,

and in Los Angeles 1% to 18% less than the amounts suggested. The women in Oakland consumed from 30% to 45% less, and those in Los Angeles from 14% to 27% less than the suggested quantities. Women 70 years and over in Oakland consumed on the average 45% less than the quantities suggested.

A high proportion of the total suggested quantities of milk—and its equivalent in other dairy products—was consumed as a beverage in the younger age groups. The proportion was much smaller among older persons.

However, the average quantity consumed by a group of persons did not take into account the proportion of individuals who consumed less than the average. When the quantity of milk consumed as a beverage by each individual was compared with the total suggested quantity of milk and its equivalent, about three fourths of the children and adolescents up to 20 years consumed less than the suggested quantities. Almost nine tenths of the adults consumed less milk as a beverage than the total suggested quantities of dairy products. Almost 95% of the women consumed less than the amounts suggested.

The quantities of dairy products other than milk, and of milk not consumed as a beverage, decreased the proportions in each age and sex group which had not consumed the suggested quantities of

milk and its equivalent in other dairy products. However, when estimated quantities of these products were added to the milk consumed as a beverage, large numbers still consumed less than the amounts suggested.

About 26% to 40% of the children up to 12 years consumed less than the suggested quantities. This was also true of 50% to 64% of the adolescents in Oakland for 30% to 53% in Los Angeles. About 70% of the adult men, and at least 80% of the adult women used less than the suggested amounts.

The quantities of the different nutrients recommended by the National Research Council and the quantities of milk and its equivalent in other dairy products suggested by the United States Bureau of Human Nutrition and Home Economics in their moderate-cost food plan are not the minimum amounts upon which persons of different ages and sex could survive. Although information was not available for their complete diets, the extent to which the consumption of dairy products by certain adult groups fell below the suggested quantities, seems to indicate a rather serious lack in their diets and points to the desirability of increasing their consumption of dairy products, especially of fluid milk.

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plants are combined in a single plant. The costs indicated for the low-cost method are less than those actually observed with efficient operation, but they represent a level of cost that could be attained by reorganizing the transportation methods along the lines indicated in this report.

The estimates of costs in this study include the fixed costs of owning the equipment. Rental is possible, particularly for mobile equipment such as a fork truck.

For short-season operations, equipment rental costs are less than the annual fixed costs of owned equipment. Rental may, in some instances, make the use of mechanized equipment economical with a much shorter season than is indicated by the cost graphs.

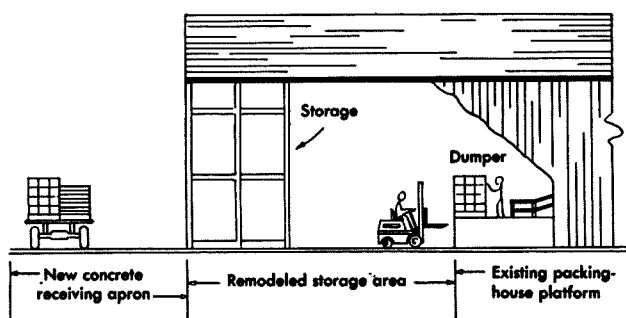
Although costs are a primary factor in selecting the most desirable type of equipment, other factors may also be important. In comparing hand truck and fork-truck equipment, the greater speed with which the grower's truck may be unloaded and the reduced number of workers required with fork-truck equip-

ment may indicate its use in situations where it may not be clearly justified on the basis of cost alone.

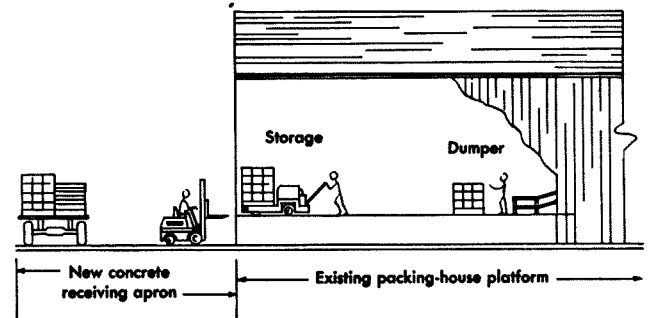
L. L. Sammet is Co-operative Agent of the University of California Agricultural Experiment Station, Berkeley, and the Bureau of Agricultural Economics, United States Department of Agriculture.

Other reports in this series compare house operations, methods, equipment, and arrangements. The comparisons may be used to establish standards for efficient and low-cost operation. With minor modifications, the results of these studies can be applied to many of the problems of packing and processing other fruits and vegetables.

Rearrangement of receiving area in hand truck packing house to permit use of fork-truck and powered hand truck equipment for the transport of incoming or cannery fruit.



(A) Hand truck plant remodeled to permit incoming fruit to be handled with fork-truck equipment.



(B) Hand truck plant, with incoming fruit handled with fork truck and powered hand truck.