

Efficiency in Fruit Marketing

orchard-to-plant transportation method and equipment important factors in determining labor requirements

L. L. Sammet

Part III of a series of reports of studies on the effects of packing-house equipment, plant layout, and work methods on efficiency and costs made cooperatively 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. Detailed reports are available by addressing the Giannini Foundation, 207 Giannini Hall, University of California, Berkeley 4.

The labor required for the receiving operations at the packing house and for the loading of full lugs and the distribution of empty lugs in the orchard ranged—for the growers observed in this study—from 32 to 120 man-minutes per 100 lugs of fruit.

Over-the-road hauling between the orchard and the packing house required additional labor ranging from 2.5 to 32.5 man-minutes per 100 lugs for each mile from the orchard to the packing house.

This wide range in labor requirements results from substantial differences in the equipment and methods used. Four of the methods observed are described below.

Truck and Orchard Trailer

Growers often use a tractor-drawn low-bed orchard trailer to pick up full lugs in orchards where layout and topography—or highway conditions—prevent driving into the orchard with a highway truck or trailer.

The full lugs are transferred by hand from the orchard trailer to a highway

truck for transportation to the packing plant. Empty lugs are returned to the pickers by a similar operation.

With a two-man crew consisting of a loader-driver and a stacker and a load size of 216 lugs the labor required for these operations is approximately 75 man-minutes per 100 lugs. This is exclusive of highway travel time.

Truck and Tractor Fork-lift

Some growers avoid the manual transfer of lugs between the orchard trailer and highway truck by using a tractor with a fork-lift attachment.

The fork-lift is used in the orchard to pick up full lugs and distribute empty lugs and, at the transfer point, to load and unload the highway truck.

With a one-man crew—a loader-driver—the labor required for a 216-lug load is 54 man-minutes per 100 lugs.

Truck Loaded in Orchard

Where tree size and spacing permit, many growers load directly in the orchard

on a standard flat-bed truck. The crew ordinarily consists of a driver and a helper—the helper usually performs other work in the orchard such as picking when the truck is en route between the orchard and the packing house.

Average labor requirements for orchard-to-plant transportation based on a truck loaded in the orchard with 216 lugs by a two-man crew amounted to 46 man-minutes per 100 lugs, excluding highway travel time.

Highway Trailer

Highway trailers usually are tractor-drawn and may be either two-wheeled semi-trailers or four-wheeled trailers. Lugs are loaded directly in the orchard. With the four-wheeled trailer, one to three trailer units may be hitched to a single tractor. One man may serve as both loader and driver.

With a three-unit highway trailer of 216 lug capacity, total labor requirements in the orchard and at the plant—excluding highway travel time—averaged 32 man-minutes per 100 lugs.

Left, flat-bed highway truck at transfer point, receiving full lugs from orchard trailers, transferred by hand. Right, fork-lift attachment placing palletized load of field lugs on highway truck.



Labor Requirements

The large differences in labor requirements in the orchard and at the plant with the four methods are illustrated in the bar diagram in columns two and three.

Labor requirements range from 85 man-minutes per 100 lugs with the truck and orchard trailer to only 32 man-minutes per 100 lugs with the highway trailer.

The difference between the two methods is 53 man-minutes per 100 lugs, or nearly 71% of the requirements with the truck and orchard trailer.

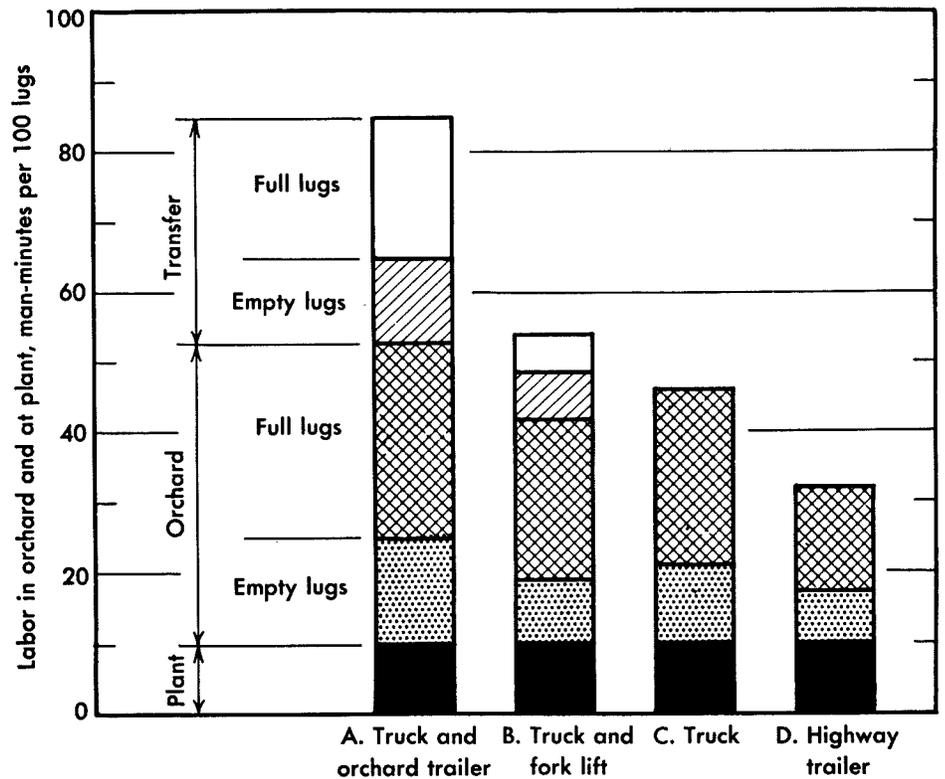
In the bar diagram on this page, the labor requirements for each method are divided into several categories. The at-plant labor is the same in the four methods, as the operations performed at the plant are similar and the load size in each case is 216 lugs.

With the orchard trailer and highway truck, the labor required to transfer lugs by hand between the two vehicles is almost as great as that required to pick up and distribute empty lugs in the orchard. The transfer labor is much less with the fork-lift attachment, however, and it is eliminated entirely when the highway equipment is loaded directly in the orchard.

The labor required to pick up full lugs and distribute empty lugs in the orchard with the highway trailer is noticeably less than with the other methods.

Total labor requirements per 100 lugs, including the time used in highway travel, depend on the size of the load and the speed of travel.

Based on the road speeds observed in these studies, and assuming the trip to the plant is made by only one man, the round-trip time requirements with a truck of 216 lugs capacity were 2.9 man-



Orchard and at-plant labor requirements for orchard-to-plant transportation with four different types of equipment.

minutes per 100 lugs per mile one-way distance between the orchard and packing house. With the highway trailer of 216 lugs capacity, the travel time was 3.9 man-minutes per 100 lugs per mile one-way distance.

The effects of distance and road speed on total labor requirements per 100 lugs for the four methods are shown in the left diagram on page 12.

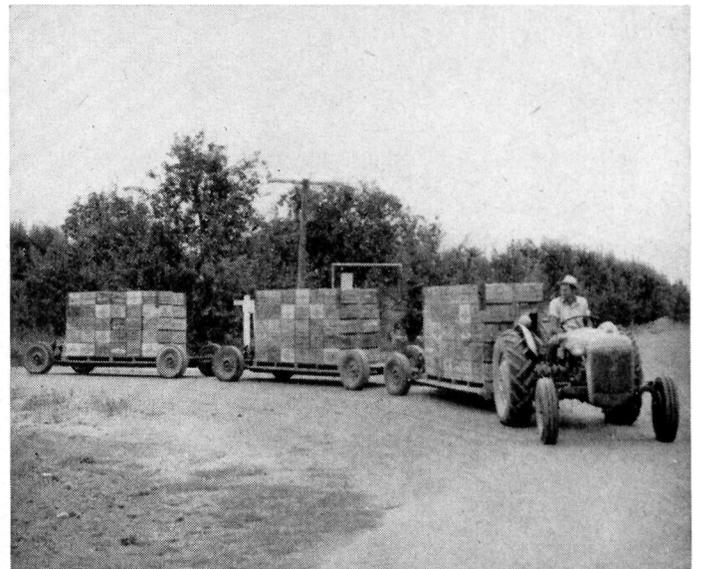
The orchard and plant labor per 100 lugs is shown for each method by the

height at which the sloping intersects the vertical scale at the left of the diagram. The additional labor required per 100 lugs for highway travel is given by the sloping lines, the total labor required increasing as the orchard-to-plant distances increases.

The labor savings that may be achieved through changing from one hauling method to another can be estimated from the labor requirements presented in the

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Left, fork-lift attachment loading directly on flat-bed truck in orchard. Right, tractor-drawn highway trailer, consisting of three four-wheeled trailer units en route from orchard to plant.



EFFICIENCY

Continued from preceding page

diagram on this page. As an example a grower might be located five miles from the packing house and hauls 500 tons of fruit per season, using the truck and orchard trailer method.

The savings which might be made by changing to the truck and fork-lift method can be estimated from the diagram. At a five-mile distance the line *A* indicates a labor requirement of 100 man-minutes per 100 lugs. In the same way line *B* indicates 69 man-minutes per 100 lugs. The savings possible by the change in method are 31 man-minutes per 100 lugs which would amount to about 120 man-hours saved per season in hauling 500 tons of fruit—23,000 lugs with a net weight of 46 pounds per lug. The savings possible through other changes in method and for other quantities of fruit hauled per season could be similarly estimated.

A complete analysis would require that the grower also consider the overhead and operating cost for equipment, for savings in labor are frequently made possible by the use of more elaborate equipment. Usually, allocation of part of the equipment costs to other farm operations is necessary, as virtually all of the equipment used for hauling fruit is also used for other purposes. This allocation can be worked out by the grower in terms of the equipment that he has available, the new equipment that he would have to buy

or build to use a particular method, and the other uses the equipment will have on his farm.

On the basis of this information, and the savings in orchard-to-plant transportation labor resulting from a change in method, he should be able to judge which of the methods available is most economical.

For some growers, important savings in labor may be achieved by improving the present method rather than by changing to a new method. Two such possibilities involve the size of load hauled per trip and the size of loading crew used in the orchard.

The effect of size of load is illustrated for the highway trailer in the right diagram on this page. In this diagram, total labor requirements are given for one-, two-, and three-unit trailers with capacities respectively of 72, 144, and 216 lugs. As the size of load increases, the lines slope less steeply, indicating the reduction in labor requirements per 100 lugs. Labor requirements per 100 lugs are also less in the orchard and at the plant as the size of load increases. This is indicated by the decreased height at which the sloping lines intersect the left hand scale as the size of load is increased. Reading from the diagram, it appears that a grower located five miles from the packing house could reduce his total labor requirements from about 100 man-minutes per 100 lugs to 65 man-minutes per 100 lugs by changing from a single

trailer unit of 72 lug capacity to a two-trailer unit of 144 lug capacity. This is a saving of 35 man-minutes per 100 lugs, or 35% of the original requirements. Similar variations could be demonstrated with the other methods.

With a given type of equipment, using a larger crew increases the loading labor required per 100 lugs, although the elapsed time per trip is decreased. For example, growers hauling with a highway truck loaded directly in the orchard sometimes use a five-man crew—consisting of a driver, two loaders and two stackers—instead of the two-man crew used in the above estimates of labor requirements. Assuming the loading crew to be fully occupied during the day—either in loading or in some other work, such as picking—the labor required in the orchard would be approximately 64 man-minutes per 100 lugs with the five-man crew in contrast with a requirement of only 35 man-minutes per 100 lugs with the two-man crew. In this case, the larger crew requires over 80% more labor than the smaller crew. Elapsed time per trip, however, is reduced by about 10 minutes per trip.

There are important possibilities for increasing labor efficiency and many growers have reduced cash costs by adopting labor-saving practices.

L. L. Sammet is a Co-operative Agent of the California Agricultural Experiment Station and of the Bureau of Agricultural Economics, U. S. D. A.

Left, total labor requirements for orchard-to-plant transportation with four different types of equipment. Right, effect of size of load on total labor requirements with the highway trailer.

