

# Efficiency in Fruit Marketing

grading costs may be reduced about 25% for pears and over 50% for apples by applying operating standards

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*Part II of a series of reports of studies on the effects of packing-house equipment, plant layout, and work methods on efficiency and costs 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. Detailed reports in mimeograph form are available by addressing a request to Giannini Foundation, 207 Giannini Hall, University of California, Berkeley 4.*

**Sorting costs** in eight apple packing houses averaged about 94¢ per thousand pounds of fruit and in 10 pear plants they were 62¢ per thousand pounds—in the 1950 season—with some 95% of the costs represented by the wages paid to the sorting crew. Studies of the operations involved in grading or sorting were undertaken with the co-operation of 18 California packing houses. The findings of the studies have been used to establish standards for reasonably efficient operation. Application of these standards should enable managers of typical packing houses to reduce sorting labor requirements an average of about 25% for pears and more than 50% for apples.

Differences between grading costs for apple and pear plants were the result of several factors. Apple plants in 1950 paid an average wage of about 82¢ an hour for sorters while pear plants paid an average wage of \$1.04 an hour. If apple plants had paid \$1.04 per hour—and assuming no change in productivity—their

average sorting costs would have been about \$1.19 per thousand pounds. Using this estimate to eliminate the effects of wage differences, the average apple house would have had grading costs about 57¢ per thousand pounds higher than the average pear house. This difference can be divided into three parts: 1, approximately 13¢ due to the extra labor required for apple plants where all fruit is handled and placed on belts; 2, about 30¢ due to the volume of operation, since the apple plants averaged only 9,600 pounds of fruit per table per hour as compared to 22,400 pounds per hour for the pear plants; and 3, the residual of about 14¢ due to greater efficiency in adjusting crew organizations to the volume of fruit available in pear packing houses.

## Labor Requirements

Grading labor in the 10 sample pear plants ranged from 0.38 to 0.84 hours and averaged 0.57 hours per thousand pounds

of fruit. In the eight sample apple plants the range was from 0.84 to 1.33 hours and the average was 1.10 hours per thousand pounds. These present labor requirements for the sample plants are represented by the heights of the bars in the diagram on page 8.

In addition to the average differences among plants, each plant had periods of relatively efficient and relatively inefficient operation during the season. The periods of relatively efficient operation for all plants were used to develop standard requirements for grading labor in pear and apple plants.

The standards for pear plants—as shown in the lower diagram on page 10—indicate the approximate effects of the amount of first-grade and subgrade fruit per hour per sorting table on the number of sorters required under reasonably efficient operating conditions.

All plants studied operated with grading labor crews about as low as or lower

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**Left, belt-conveyor type of pear sorting table commonly used in California. Pears enter the table from the washer and move past the sorters on belts at each side of the table. Cannery fruit is picked out, placed on the center belt, and moves on to be boxed. Culls are picked out and dropped in chutes to a cull belt below the table and carried to the cull boxing area. First-grade pears continue on the side belts to the end of the table, drop to another belt, and are conveyed to rope or curtain sizers and so move to packing tubs or bins. Number one cannery fruit is sized out of the first-grade fruit in this process.**

**Right, type of pear or apple sorting table frequently used in Washington and Oregon. Spiral rolls turn the fruit as it moves along the table. The table illustrated feeds three sizing machines; the first-grade fruit for two of these machines is delivered to belt conveyors directly from the spiral rolls while the fruit for the third is placed on the two center belts.**

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than these standards during some periods of the season. Considering the total of all operating days studied, the sample plants equaled or bettered these standards about 30% of time.

The same efficiency standards can be applied to sorting requirements in apple plants by adding 1.2 to the estimated average number of sorters indicated by use of the lower diagram on page 10.

### Reducing Sorting Labor Costs

Potential reductions in the amount of sorting labor per thousand pounds of fruit are indicated for the sample packing houses in the graph on this page as four stages or types of plant reorganization. The graph indicates only the effects of changes in crew and in volume on labor requirements and does not include possible improvements in sorting and grading methods.

Stage I of sorting-crew reorganization eliminates the sorters not needed even when the plant is operating with peak volumes of fruit. The potential Stage I savings for the sample packing houses studied would average about 8% for pear plants and 14% for apple plants.

Further efficiencies are possible in Stage II by adjusting the hours of daily operation and the number of sorting and packing lines to keep the hourly volume per table at or near the peak rates. When lower rates of handling the fruit are unavoidable, this can be accompanied by changing the sorting crew in line with the standards provided in the lower diagram on page 10.

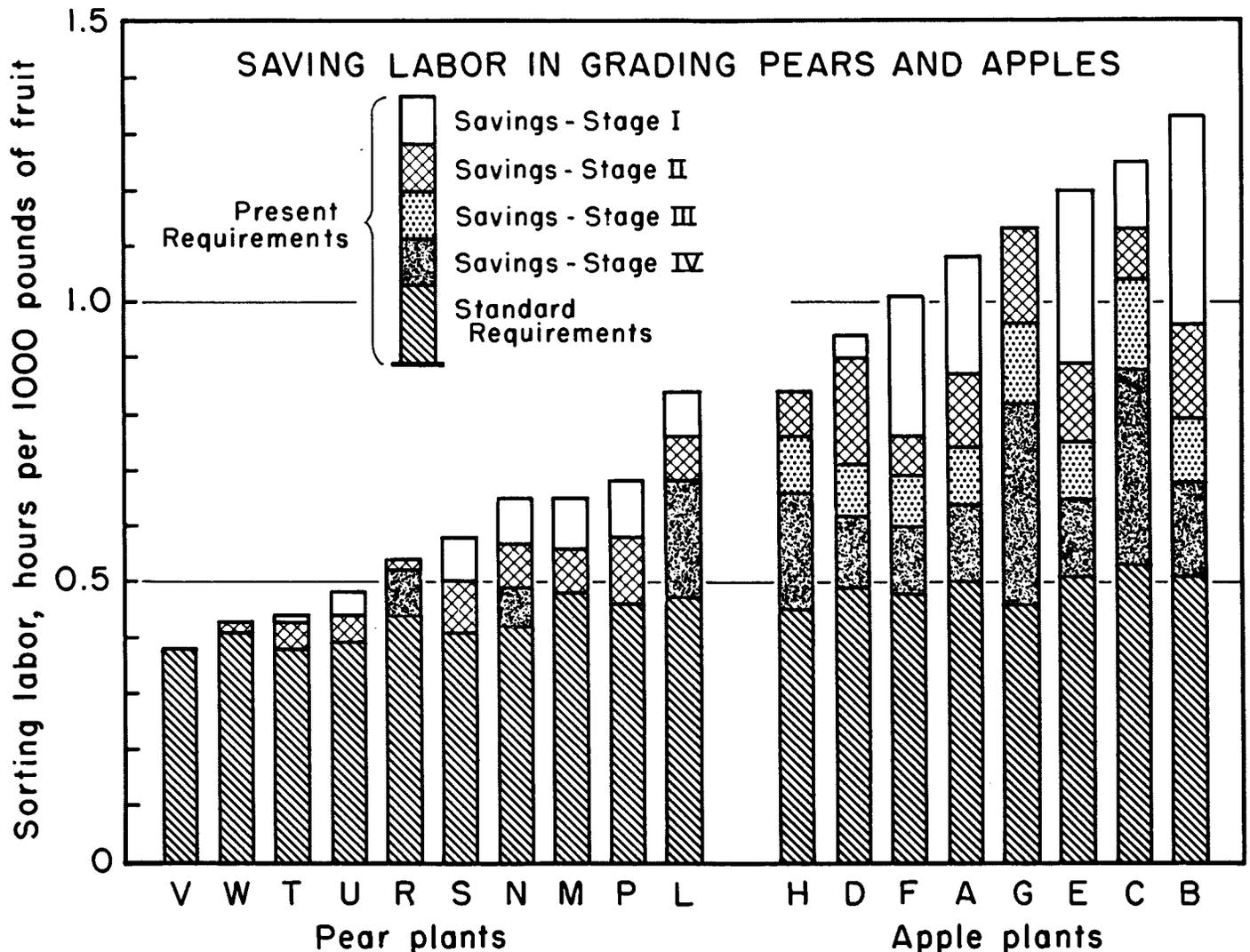
Plants able to take full advantage of potential Stage II efficiencies would average an additional savings of about 10%. Possibilities vary considerably from plant to plant—one of the 18 sample plants actually operated as efficiently as the Stage II standards while in some of the other plants the potential savings ranged as high as 20%.

Stage III applies to apple packing plants only. In considering the standards for apple houses, Stages I and II included an average of 1.2 sorters more than the pear standards. This extra labor reflects the type of apple sorting tables commonly used in California where every apple must be picked from the table and placed on particular belts. In California pear houses and in many northwestern apple houses, several of the belts that serve the packing machines feed directly from the table and the fruit passes onto these belts without special handling. By adapting similar methods and equipment, California apple plants should be able to reduce sorting labor required an average of 14%.

If operated efficiently, a packing house with a volume of 5,000 pounds per hour per table would require about 1.2 hours of sorting labor per thousand pounds of fruit. A plant with a volume of 15,000 pounds per table-hour would require only 0.56 hours per thousand pounds. Labor requirements would continue to decrease

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Grading labor requirements in apple and pear packing plants, and the labor-saving opportunities in the several stages of reorganization.



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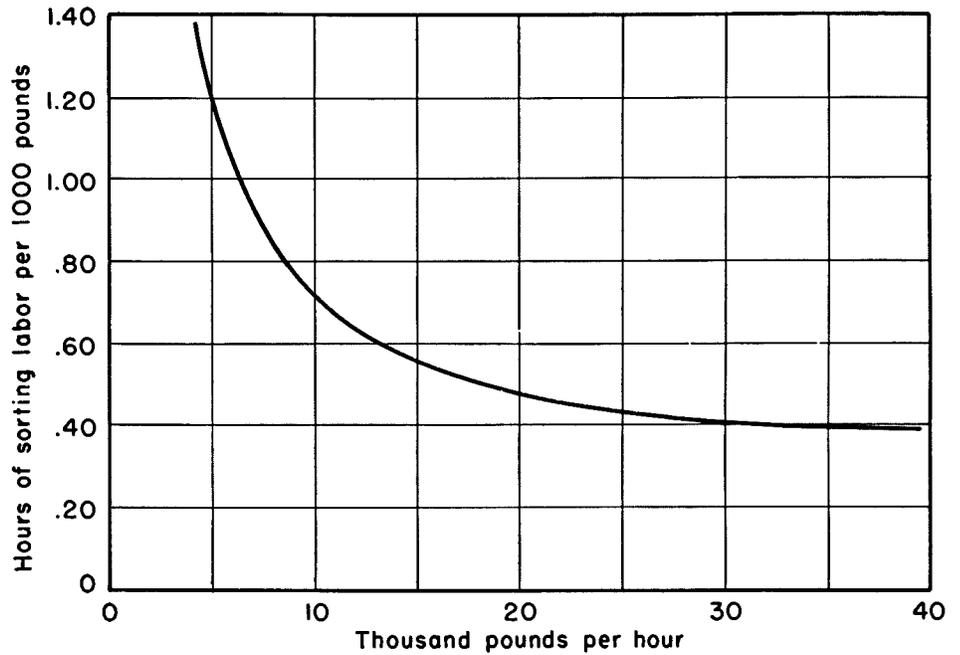
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beyond this range, but, even with volumes of 30,000 pounds per table-hour, a plant would require approximately 0.4 hours of sorting labor per thousand pounds of fruit handled.

Stage IV savings are based on the economies of large volume operation. They are related in part to the total plant volume but such savings also may be obtained through a reorganization of the plant layout and a reduction in the number of sorting tables.

In the sample plants where a reduction in the number of tables seemed advisable potential savings ranged from 0.07 to 0.35 hours per thousand pounds of fruit.

Consolidating the number of receiving and sorting lines will affect several aspects of plant operation in addition to the direct effect on the number of sorters. The number of dumpers would be reduced. However, the revised system would require a more elaborate set of distribution belts to move the sorted fruit to the sizing and packing machines. The exact effects of these reorganizations on investments and fixed costs for tables and conveyors will depend upon the particular conditions in the plant, but in any event the equipment costs can be expected to be minor relative to labor costs and potential savings.



Effect of volume per table-hour on sorting labor requirements per thousand pounds of fruit.

When a plant handles many small lots of fruit and uses a break-for-lots system to determine the pack-out for each lot, the consolidation of receiving and sorting lines might adversely affect other plant costs. With a reduced number of lines,

this would mean an increase in the proportion of time that the plant was idle during a break and so a decrease in average efficiency.

The studies of the sample packing houses have indicated that differences in grading costs are related to three main factors: 1, the adjustment of the sorting crew to the volume of fruit handled, including adjustment to both the seasonal peak volume and the day-to-day fluctuations in volume; 2, the type of sorting table used with significantly higher labor requirements for tables that require the sorters to pick up each individual fruit; and 3, the volume per hour that is handled by each table.

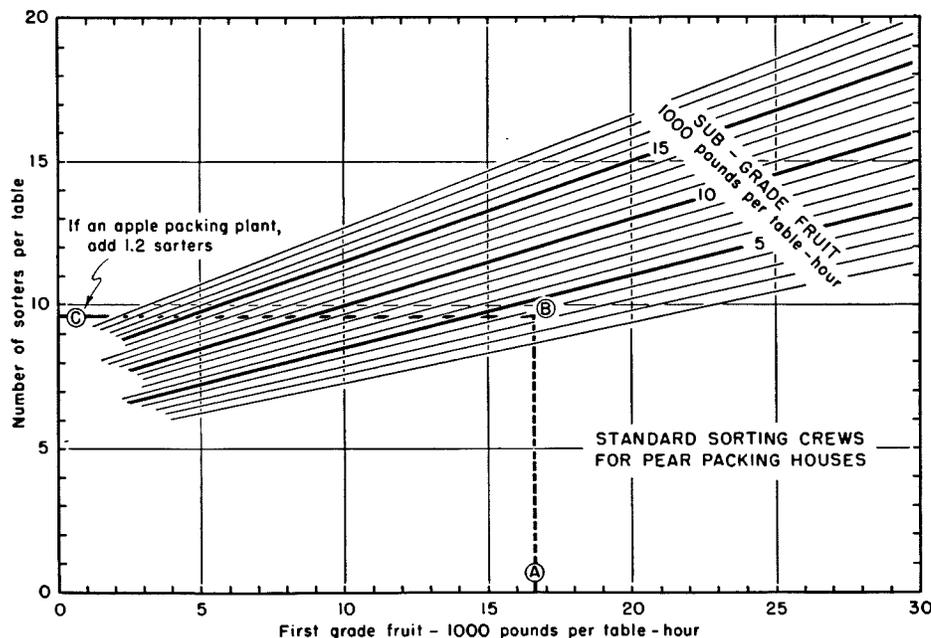
Potential savings in sorting labor requirements that can be expected from the application of these findings by packing houses managers will vary, depending especially upon the extent to which the house in question is already achieving the indicated efficiencies. On the average, however, the study suggests that typical California pear packing houses could reduce sorting labor about 25% and California apple packing houses could make more than 50% savings.

To be continued

Following reports in this series will compare house operations, methods, equipment, and arrangements. The comparisons may be used to establish standards for efficient 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.

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**Labor standards for efficient grading of pears and apples.** The use of this diagram may be illustrated by the operating details for one of the sample pear plants where—in the peak of the season—the volume per table-hour averaged 16,600 pounds of first-grade fruit plus 3,400 pounds of subgrade fruit. The volume of first-grade fruit is used as the entering point on the diagram at point A along the base-line scale. Moving vertically locates point B, between the 3,000 and 4,000 pound lines for subgrade fruit. Horizontal and to the left of B is point C at 9.6 or, in round numbers, 10—indicating that this plant could operate under peak-season conditions with not more than 10 sorters per table.