

LABOR AIDS IN RAISIN

An analysis of raisin grape mechanization

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Conventional yard boxing of raisin rolls picked up by hand and brought from the field, stacked on a vineyard trailer. The boxing may be done directly or immediately after the raisins have moved over a shaker screen to remove trash.



Less lifting by hand, fewer workers, and lower costs per ton for the grower, were obvious results shown in this analysis of mechanical aids and bulk handling methods for all of the Fresno County raisin pickup and boxing operations studied. In six of the eight operations using mechanical aids, a savings of \$2 or more per ton was realized—over and above the cost of equipment. The switch from field boxes to bulk handling bins, alone, was an important factor in both labor saving and cost reduction. However, it was impossible in this study to separate benefits of bulk handling from benefits of pickup machines, because of the lack of uniformity between individual grower systems.

TABLE 1. DESCRIPTION OF RAISIN PICKUP AND BOXING OPERATIONS IN THE FRESNO COUNTY STUDY.

| Vineyard number | Pickup method | Field containers | Other equipment* | Crew description |
|-----------------|----------------------------|----------------------------------|---|--|
| 1 | hand-walking (traditional) | 2 vineyard trailers | 1 tractor, gravity rollers, electric hoist | 5 men |
| 2 | hand-walking | 1 bulk wagon with spreader | 1 tractor, gravity rollers, electric hoist | 4 men |
| 3 | hand-walking | 6, 1-ton gondolas | 2 tractors, gravity rollers, electric hoist, forklift with gondola dumper | 9 men (2 fld. crews of 3 men ea. + 3 men in yard) |
| 4 | hand-sitting | 10 tipster bins, 4 bin trailers | 2 tractors, forklift, mech. hopper, gravity rollers | 15 men (2 fld. crews of 5 men ea. + 5 men in yard) |
| 5 | hand-sitting | std. raisin bins, 2 bin trailers | 2 tractors, forklift, bin dumper & hopper on shaker, gravity rollers | 6 men (2 fld. crews of 3 men ea.). Same crew boxes in yard after pickup |
| 6 | machine | 2 bulk wagons with spreaders | 2 tractors, mech. hopper, gravity rollers, electric hoist | 7 men (4 in field + 3 in yard) |
| 7 | machine | 8 tipster bins, 4 bin trailers | 2 tractors, forklift, mech. hopper, gravity rollers, electric hoist | 7 men (3 in field + 4 in yard) |
| 8 | machine | sweat boxes on vineyard trailer | 1 tractor, electric hoist | 3 men |
| 9 | machine | 1 bulk wagon with tilt side | 1 tractor, gravity rollers, hoist | 3 men |

* Shakers were used in all vineyards except Nos. 8 and 9, and were built into wagons in No. 6.

CHANGES IN RAISIN HANDLING have been made to offset rising production costs by substituting labor with additional equipment and by using bulk handling methods. The increase in average vineyard size has also contributed to the need for these changes because the proportionate amount of labor that the average grower and his family could contribute to boxing has been reduced. This increased unit size has also made it feasible for growers to invest in more specialized equipment. In recent years, several local farm machinery shops have offered a standard line of raisin boxing equipment, including pickup machines and bulk handling units. Some growers have built their own raisin handling equipment, others have pooled their ideas with local welding shops and machinery manufacturers to develop new and improved equipment.

The mechanization of picking up the raisin rolls began in Fresno County in the early '50s. The difficulty of handling the rapidly filled "sweat boxes" in the field limited the efficiency of these early pickup machine operations. The recent increase in use of wooden bins and bulk handling

PICKUP AND BOXING

in Fresno County, 1968

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A commercial pickup machine which uses a draper chain to hold the raisin rolls as they move up the elevator. The trays are pulled by hand as they reach the shaker on top. Other pickup machines use cleated rubber or steel mesh conveyor belts.

methods, however, has paved the way for greater mechanization of the pickup and boxing operations.

This study examined new raisin pickup and boxing methods and their potential savings in labor and total cost. The study investigated equipment investment costs on a per ton basis and the amount of labor needed to operate with this equipment. It compared the new methods with traditional hand boxing in terms of total costs per ton. There are a wide variety of systems in use with various combinations and methods of pickup and bulk handling. The system most attractive to a grower will depend on the size of his operation, and on what equipment is already available to him. Obviously, a grower would use standard wooden raisin bins and a forklift if this equipment were already available to him, or he would want to continue to use gondolas or tipster bins if he had already invested in such equipment.

Eight operations

An analysis of eight different operations was made in 1968 and evaluated along with the traditional hand boxing



TABLE 2. INDIVIDUAL RECORDS OF NINE RAISIN PICKUP AND BOXING OPERATIONS SHOWING VINEYARD SIZE AND YIELD, EQUIPMENT COSTS, AND

| | | | | | | | | | |
|---|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Acres | 80 | 60 | 160 | 105 | 140 | 150 | 300 | 76 | 120 |
| Yield per acre, tons | 2.3 | 2.5 | 2.2 | 2.2 | 2.2 | 2.8 | 2.8 | 1.5 | 2 |
| Total tons | 180 | 156 | 352 | 210 | 308 | 413 | 825 | 122 | 330 |
| Equipment costs | | | | | | | | | |
| Original cost of equip. (except tractors) | \$1846 | \$2126 | \$3360 | \$4324 | \$2463 | \$4056 | \$6331 | \$2086 | \$2290 |
| Deprec. (15 yr. life) | 123 | 142 | 244 | 288 | 164 | 270 | 422 | 139 | 153 |
| Interest on investment (6% on 1/2 cost) | 55 | 64 | 110 | 74 | 122 | 190 | 63 | 63 | 69 |

by obtaining a breakdown of equipment and labor requirements and costs. No comparison between growers was intended because of the variation in the speed at which they wish to box. Also, not all of the operators used shakers to eliminate trash and off-grade raisins. Of those using shakers, however, some deliberately spend more man-hours than others in raisin sorting which affected the delivered quality.

Method

Table 1 lists the method and equipment used in pickup and boxing for each of the operations in the study. Pickup of the raisin rolls was accomplished by one of three methods: (1) walking and hand pickup—vineyard operations 1, 2, and 3; (2) riding and hand pickup from a sitting position—vineyard operations 4 and 5; or (3) machine pickup—vineyard operations 6, 7, 8, and 9. The raisins were transported from the field in rolls, either in standard vineyard trailers (see photo) or, after the pulling of the trays, in bulk containers—such as sweat boxes, standard wooden raisin bins, tipster (self-tilt-

ing) bins, two-wheel wine grape gondolas, or bulk wagons (see photos). The sweat boxes, wooden bins or tipster bins were hauled on vineyard trailers or low chassis bin trailers. Other equipment, including gravity rollers, hoists, etc., used in boxing and handling is standard except for the hoppers needed in bin operation (vineyard operations 4, 5, and 8).

Costs and labor

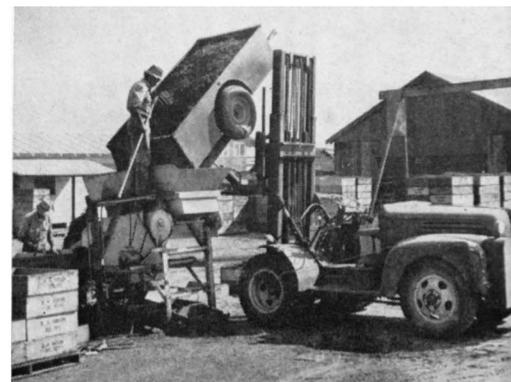
The size of the vineyards in the study varied from 60 to 300 acres and the total tonnage of raisins from 122 to 825 (table 2). The yield figures are taken from 1966 records because severe hail and frost damage in the spring of 1967 substantially lowered the yields in many Fresno County vineyards. Labor rates are for 1968, however, as are the costs of equipment. The spread of investment in equipment (table 2) is a reflection of the tonnage involved and the particular handling system. The depreciation rate of the raisin handling equipment is based on an estimated 15-year life and is applied uniformly to all of the vineyard operations studied. It may not be completely accu-

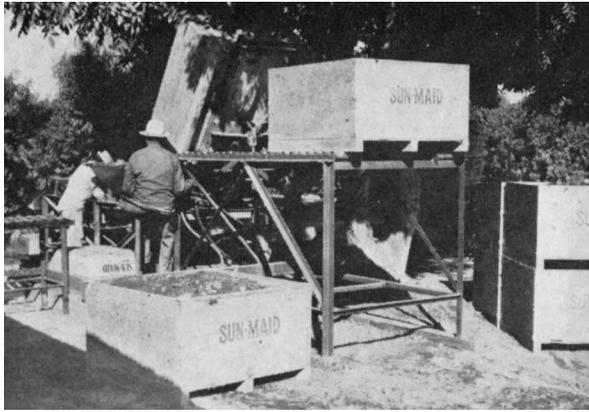
rate for the larger operations which might be expected to have a more rapid depreciation rate. However, a change of depreciation rates between individual records probably would not make too much difference in the final conclusions. Equipment such as the forklifts, which are used part of the year during the raisin harvest, are charged as investment costs for only a proportionate share of the total annual usage. In vineyards 4 and 7, forklifts were charged on a rental basis which accounts for the higher equipment cash costs. Since most of this equipment has not been used long enough in the raisin harvest for the maintenance and repair costs to be determined with accuracy, charges for these items have been minimized. It was recognized, however, that one of the commercially designed pickup machines requires new belting every five years at a replacement cost of \$200.

Labor

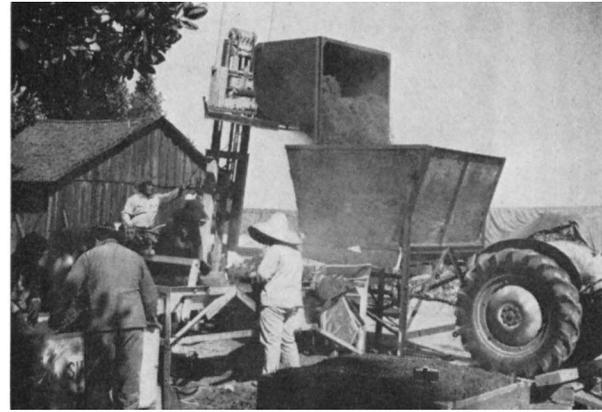
Labor requirements, reported as man-hours per ton, varied from 1.58 hours for the machine pickup-bulk trailer method in vineyard 9, to 3.75 hours for the traditional hand method (table 2). The other vineyard operations varied from slightly less than 2 man-hours per ton to about 2½ man-hours per ton. All of the newer methods resulted in a labor saving of at least 1 man-hour per ton. It must be noted that in vineyard operations 8 and 9, shaking prior to boxing was not used. Generally, shaking takes about 1 man-hour per ton and this cost could be added to those shown for operations 8 and 9 to compare costs more equitably. Cash costs were greatest for the hand method because of the higher labor requirement, and were at least \$2 more per ton than for any other system.

A spreader-type bulk wagon (left) with a built-in floor conveyor which feeds raisins onto the shaker at the rear of the wagon. It is a tractor PTO model used in combination with an elevator-type pickup machine. Boxing from a bulk wagon (center) with a tilting side. Note the cleated conveyor belt on the pickup machine which delivers the raisins to the wagon. Bulk handling of raisins (right) in a wine grape gondola with a hinged end. The forklift tilts the gondola and dumps the raisins directly onto the shaker.





Raisins are boxed by dumping them onto the shaker from wooden bins which were conveyed from the vineyard on low-chassis trailers.



Tipster, or self-dumping, bins are filled in the field while carried by bin trailers. Raisins are dumped by forklift into a mechanical hopper, which feeds the raisins onto a shaker.

The savings in man-hour-needs with these systems has been estimated at 30 to 50 per cent as compared with the old method used by each of the growers in the study. Most growers estimated savings of one-third, in man hours of labor needed, compared with the conventional hand method. Worker efficiency was notably increased with hand pickup of raisin trays from the low sitting position rather than having workers walk and bend over to pick up each tray. The simple adaptation of adding seats to the trailer should be attractive to the small or medium sized vineyard operator whose limited tonnage makes additional equipment costs difficult to justify.

Costs per ton

All of the mechanized operations were more economical than the traditional hand method when total costs per ton were compared (table 3). Adding the cost of shaking to the other costs incurred in vineyard 8, however, raised the total to

a value slightly higher. This vineyard was the lowest yielding per acre in the study and handled the lowest total tonnage, with the result that the total equipment cost per ton was the highest.

Table 4 lists the range of differences between the traditional method and the eight other systems in equipment costs per ton, including tractors. In two vineyards, 5 and 9, these costs were even lower than the costs of the traditional method. In the other vineyards increased equipment costs were offset to varying degrees by the decreased labor cost.

The future

While this study does not describe or analyze all of the raisin pickup and boxing methods in current use, the basic ideas of most of the newer methods of handling raisins have been presented. Further improvements can be expected to be introduced in the coming years. Several ideas for field separation of the paper trays from the raisins by mechanical

means have already been tried. Although these ideas have not been entirely satisfactory to date, eventual success is anticipated with continued efforts. One grower in the Biola area has already started to use a box-filling machine in his yard-boxing operation. A tractor-towed machine for turning and picking up raisins dried on a continuous tray has been available for some years. Complete mechanization of the raisin harvest, currently the subject of intensive research, will undoubtedly bring new practices and different raisin drying and handling methods. In the meantime, growers are expected to continue to develop new ideas and to use them in further improvement of present raisin handling methods.

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TABLE 3. COMPARISON OF PER TON COSTS OF RAISIN PICKUP AND BOXING USING 1966 YIELDS AND BOXING RATES AND 1968 WAGE RATES, FRESNO COUNTY.

| Vineyard..number: | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8* | 9* |
|-------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Per ton costs | | | | | | | | | |
| Tractor | | | | | | | | | |
| Cash | .60 | .64 | .51 | .28 | .47 | .60 | .56 | .75 | .53 |
| Deprec. | .60 | .64 | .51 | .28 | .47 | .60 | .56 | .75 | .53 |
| Int. | .22 | .23 | .18 | .10 | .17 | .22 | .20 | .27 | .19 |
| | \$1.42 | \$1.51 | \$1.20 | \$.66 | \$1.11 | \$1.42 | \$1.32 | \$1.77 | \$1.25 |
| Equipment | | | | | | | | | |
| Cash | — | — | .22 | .57 | .22 | .15 | .69 | .20 | .15 |
| Deprec. | .68 | .91 | .69 | 1.37 | .65 | .65 | .51 | 1.14 | .46 |
| Int. | .31 | .41 | .31 | .62 | .28 | .30 | .23 | .52 | .21 |
| | \$.99 | \$1.32 | \$1.22 | \$2.56 | \$1.15 | \$1.10 | \$1.43 | \$1.86 | \$.82 |
| Labor | | | | | | | | | |
| Cash | 6.53 | 4.50 | 4.09 | 3.62 | 4.24 | 3.70 | 3.45 | 4.34 | 2.77 |
| Total | \$8.94 | \$7.33 | \$6.51 | \$6.84 | \$6.50 | \$6.22 | \$6.20 | \$7.97 | \$4.84 |

Based on man labor @ \$1.70 and \$1.90 per hour (includes workmen's compensation, social security, and other benefits); medium-wheel tractor per-hour cash cost \$1.00; depreciation \$1.00; interest \$0.36.

* No shaker used

TABLE 4. DIFFERENCES BETWEEN THE TRADITIONAL HAND METHOD AND EACH OF EIGHT SYSTEMS IN MAN-HOURS, LABOR COST, EQUIPMENT COST, AND THE TOTAL COST PER TON.

| Vineyard number | Man-hours | Labor costs | Tractor and other equipment costs | Total costs |
|-----------------|---------------|-----------------|-----------------------------------|-----------------|
| 2 | per ton -1.18 | per ton -\$2.03 | per ton +\$0.42 | per ton -\$1.61 |
| 3 | -1.44 | -2.44 | +0.01 | -2.43 |
| 4 | -1.67 | -2.91 | +0.81 | -2.10 |
| 5 | -1.33 | -2.29 | -0.15 | -2.44 |
| 6 | -1.65 | -2.83 | +0.11 | -2.72 |
| 7 | -1.78 | -3.08 | +0.34 | -2.74 |
| 8* | -1.27 | -2.19 | +1.22 | -0.97 |
| 9* | -2.17 | -3.76 | -0.34 | -4.10 |

* No shaker used.