Pear Packing Plant Economies

study shows possible variations in plant organization and operation offer potential reductions in inplant packing costs

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Most pear packing plants in California are relatively efficient, but two types of adjustment—aside from innovations in method—could lead to further cost reduction. These are *1,* selection of the most efficient techniques in individual plants and *2,* adjustment in hours of plant operation per day and in the number and size of plants. The potential saving to the industry from these adjustments is estimated as about $700,000 per year, which represents about 20% of the inplant packing costs—excluding materials.

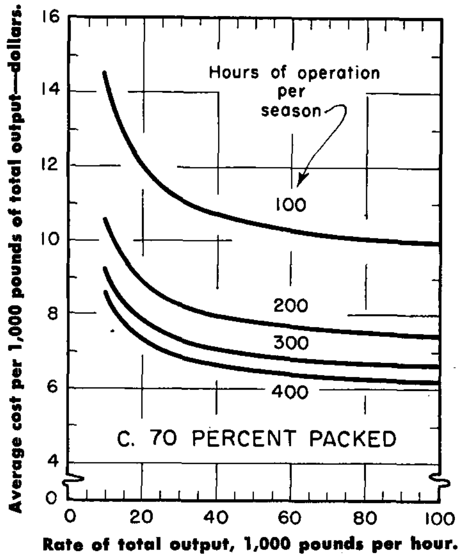
The possibilities of cost-reducing adjustments are suggested by the variations in operating procedures observed. Among the plants studied, capacity output ranged from 20,000 to 75,000 pounds of fruit per hour, and length of operating season ranged from three to five weeks. Among the plants studied, four or five different types of equipment and methods were observed for performing each of the major packing plants' operations.

Selecting the most economical method in each operating stage and integrating these into plant operations with least cost per unit output are the major ways to reduce packing costs with presently available technology. If applied to the entire industry, this kind of adjustment would reduce costs about $420,000 per year.

Since some methods that are economical in large plants with long operating seasons are not economical with small-capacity, short-season operations, these factors must be considered in choosing the low-cost methods.

With regard to the dumping and grading of incoming fruit, for example, the studies show the most economical method to be hand dumping in combination with a small grading table if the plant capacity is less than 15,000 pounds per hour. In larger plants operating more than 300 hours per season, automatic stack dumping equipment—in combination with a large grading table—is the most economical method; while in plants of capacity greater than 60,000 pounds per hour, the stack dumping machine is most economical even with short-season operation. For the distribution of empty boxes to the packers, an overhead monorail conveyor system was found to be most economical in small capacity plants operating more than 100 hours per season. However, as plant capacity increases, longer season operation is required if this method is to compare economically with an alternative method by which boxes are assembled on a mezzanine and distributed to the packers by gravity conveyor. Similar choices of method in the design of efficient plants are encountered in the other stages of plant operation.

By following a process similar to the above, it is possible to specify the techniques in each plant stage that will give the least cost output in plants of different capacities and with varying lengths of operating season. Estimates of costs developed on this basis are given in the accompanying chart, which shows how average total costs per 1,000 pounds of fruit run in efficiently organized plants are affected by size of plant and hours of operation per season.



The effect of capacity rate of output—size of plant—and hours of operation per season on average costs per 1,000 pounds of total fruit run. Packed fruit, 70% of total run; 1954 price level. Package materials costs are excluded but are estimated to be about 60¢ per standard box—48 pounds net weight. Inclusion of package materials costs would increase the level of cost in the diagram by about $8.75 per 1,000 pounds.

The costs shown in the diagram are based on the assumption that 70% of the total fruit run is packed in standard pear boxes of 48 pounds net weight, with the remainder diverted to cannery use and culls. The costs have been adjusted to the 1954 price level. Rates typical for the industry were used in estimating the costs of labor and other variable factors, and the fixed costs of equipment were computed on the basis of a standardized percentage of the current equipment replacement cost. The costs of supervision and office overhead are included but not the cost of package materials.

The estimating procedures on which the cost curves are based provide good estimates of the level of costs to be expected in plants of different sizes. Substantially higher costs are indicated in low-capacity plants. In a plant operating 200 hours per season, for example, average costs drop from about $9 per 1,000 pounds in plants of 20,000 pounds per hour capacity to about $7.50 per 1,000 pounds in plants of 80,000 pounds per hour capacity. This effect, however, decreases rapidly and is not very important in plants of capacity greater than 50,000 pounds per hour.

Most packing plants in the industry fall outside the size range of rapidly decreasing costs, but consolidation of some small plants would reduce costs significantly. If applied throughout the industry, plant consolidation could yield savings of about $120,000 annually.

The cost curves also show significant reductions in costs as hours of operation

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REPLANT

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parative purposes, each seedling variety was grown in the original soil adjusted to 100 ppm inorganic nitrogen. The reduced growth effect of the previous cropping to citrus on the seedlings varied from 0% to 88%. The magnitude of growth reduction varied with the rootstock grown for both the final and the previous croppings.

Previous cropping to trifoliate orange seedlings exerted the least depressed growth effect, followed by Cleopatra mandarin, Troyer citrange, Rangpur lime, and sour orange in ascending order. Trifoliate orange also grew best—relative growth—as a replant. It was followed by Troyer citrange, sour orange, Rangpur lime, and Cleopatra mandarin. The third crop of trifoliate orange seedlings grew just as well in this soil as did the first crop. Except when following trifoliate orange, Cleopatra mandarin grew very poorly, especially following sour orange and Rangpur lime. At harvest time, the roots of Cleopatra mandarin showed considerable decay. The roots of other seedlings showed only slight to moderate root decay.

The second test was repeated using a walnut soil from Santa Paula. Trifoliate orange seedlings grew rather poorly in this soil and were therefore replaced by sweet orange seedlings. Previous cropping to Cleopatra mandarin exerted the least reduced growth effect on subsequent plantings of the other seedling varieties, but this rootstock made the poorest growth as a replant seedling. As in the previous soil, the roots of the Cleopatra mandarin showed considerable decay. The soil was examined for citrus root nematode and for *Phytophthora* spp. with negative results. Apparently other organisms caused the root rotting.

After the third cropping, the soil was mixed, repotted, and planted to a variety of crops. The original walnut soil was used as a check. All noncitrus crops grew just as well in the soil previously cropped to citrus seedlings as in the original walnut soil. Two crops—rye and brome grass—grew better in the old citrus soil. This indicates that the reduced growth factors were probably specific for citrus.

Leaf and feeder root analyses of the seedlings for nitrogen, calcium, magnesium, potassium, sodium, sulfur, chlorine, phosphorus and manganese showed no significant differences attributable to previous cropping history.

Observations

Trifoliate orange seedlings reduced growth of subsequent plantings of several seedling varieties less than did sour orange, Troyer citrange, Rangpur lime, or Cleopatra mandarin, and also grew better than these varieties as a replant. Troyer citrange grew relatively well as a replant but greatly reduced growth of the other seedlings planted following it. Cleopatra mandarin exerted less of a reduced growth effect on seedlings that followed than did sour orange, sweet orange, Troyer citrange, or Rangpur lime seedlings, but was itself the poorest replant seedling following all the seedling varieties tested.

These studies involved the use of rootstock seedlings only, but the nature and selection of the bud no doubt could exert marked effects on the performance of the rootstock.

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TOMATOES

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of the plant breeder, many of the undesirable or defective traits of the tomato behave as if completely or nearly completely recessive. If one line with a defect is crossed with another line in which the desired alternative trait is present, the hybrid usually bears the desired trait. This pattern of inheritance has been found in the following undesired traits: *1*, poor fruit-setting ability; *2*, large core; *3*, rough or grooved fruits; *4*, nipple formation at stylar end of fruit; *5*, softness of fruit; and *6*, susceptibility to blossom-end rot. On the contrary, a few traits, such as compact determinate habit, were observed to behave in opposite fashion. Disease resistance is often inherited as a dominant condition, thereby suggesting a way for improving future tomato hybrids. The F_1 hybrid breeding technique therefore provides a unique opportunity for achieving in one generation improvements that would require much more time and would be more difficult with other breeding methods.

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PACKING

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per season are increased. For example, in a plant of 40,000 pounds per hour capacity, costs with 100 hours of operation per season average about $10.80 per 1,000 pounds but drop to $6.50 per 1,000 pounds with 400 hours of operation per season. The decrease in average costs results from spreading the fixed costs of equipment over a larger annual volume as hours of operation per season are increased.

While substantial economies are indicated through increasing hours of operation per season, the possibilities of this kind of adjustment are limited in some respects. With no storage of field-run fruit—for later packing—the length of operating season is, for practical purposes, limited to the harvest period. Variation in season hours is then possible only through variation in hours of operation per day.

Extension of hours of operation beyond the customary eight hours per day is possible through operation on an overtime or double shift basis. If a 50% higher wage is paid for overtime work—as is required in many plants—costs will be higher than with straight-time operation unless the season is short—less than 25 days—and the season volume is less than five to seven million pounds. Double shift operation might be feasible in some areas. Even with the payment of a 10% higher wage for the second shift and allowance for increased storage costs for incoming fruit, potential savings for the industry with double shift operation would amount to approximately $160,000 per year.

While some of the potential savings could be achieved in the short run, most of them involve changes in durable facilities which would be economical only as existing facilities are worn out. As a practical matter, it is likely that only a part of the possible savings can be attained. However, a substantial cost reduction could be realized.

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