Efficiency in Fruit Marketing

accounting for fruit by separate-lot system studied in sample apple, pear packing and olive processing plants

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Part VIII of a series of reports 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 United States Department of Agriculture under the authority of the Research and Marketing Act of 1946.

The separate-lot system enables packing and processing houses to account for fruit received from a grower by keeping his products apart from those received from other growers.

The individual identity of each grower's product must be maintained until it is sorted, graded, sized, and the amount in each size-grade determined. To prevent the mixing of products from several growers, each lot is run separately, with a delay or break in plant operations at the end of each lot. During this delay period the amounts of product in each of the several classifications are determined and recorded. In fresh-fruit packing houses, the delay also permits the packing out of products remaining in the bins or packing belts, so that the actual packout can be determined.

Ideally, such a system should provide an accurate accounting for each grower, subject only to minor errors resulting from weighing procedures and the estimates of the tare weight of containers. But a complete separation of lots would usually require relatively long break or delay periods, and this would greatly increase plant-operating costs.

To increase efficiency and reduce costs, various short-cut procedures are used. They reduce the break-for-lot period, but also introduce opportunities for error, because the short-cut methods usually do not separate each lot completely, and the amount of product in the overlap is obtained by estimate rather than actual measurement. In addition, errors may result from estimating the weight of fruit in some grades—by applying conventional standard weights to the number of boxes, where the standards may differ from actual weights.

Despite these possibilities for error, practices observed in California fruit packing houses are reasonably accurate and protect the interests and equities of grower and packing house.

The direct cost of a separate-lot system includes the cost of weighing and tallying the amount of fruit in the several grades. A more important effect on cost is the impact of the plant delays or breaks on over-all output and efficiency. The interruption of the flow of fruit through the plant means that some workers are idle during this period while others are forced to work at slower speed. The loss of effective working time depends on such factors as the plant volume per hour, the number of dumping units and sorting-packing lines, the average size of lot for individual growers, and the length of the delay or break-for-lot period.

The upper table on page 14 summarizes the results of studies of separate-lot systems in a number of plants packing apples or pears or receiving olives for processing. The factors the plant manager can most easily control or change are the average size of lot and the length of the break period. In apple or pear plants, the average break-for-lot period ranged from less than one minute in Plant S to more than 11 minutes in Plant N. Individual break-for-lot periods ranged even more widely—from less than one-half minute to more than 20 minutes. In the olive plants, the break-for-lots averaged from two to five minutes, while breaks for individual lots ranged from one to ten minutes. The average break time for all olive, apple and pear plants studied was about three minutes.

Size of lot is determined primarily by the size and production characteristics of the individual grower. Plant managers can control size of lot by *1*, scheduling picking and hauling operations from orchards so larger average deliveries at the plant will result; *2*, consolidating several truck loads from the same grower into a single lot at the plant; and *3*, discouraging very small growers, or by combining the fruit from several small growers into a single lot for the purposes of plant accounting.

The upper table on page 14 indicates

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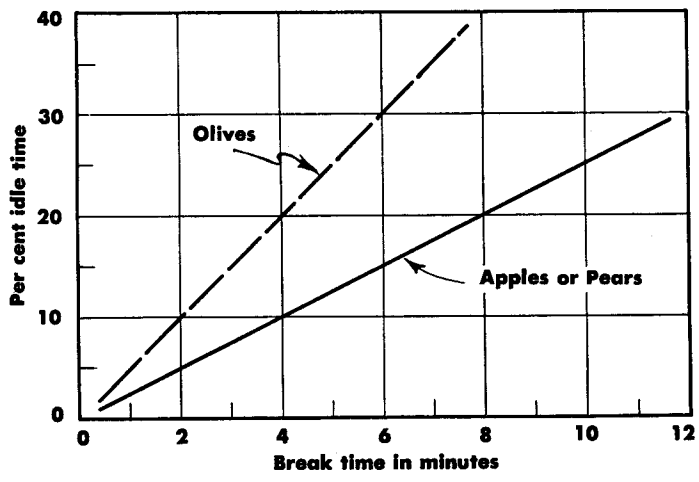
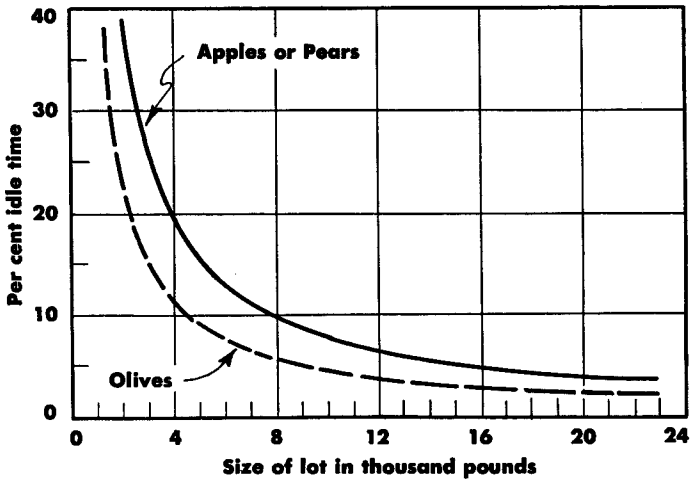
***Left:* Effect of length of break-for-lot period on the utilization of total plant time. *Right:* Effect of size of lot on the utilization of plant time.**





EFFICIENCY

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that average volume per lot ranged from 4,000 to 23,000 pounds for apple and pear plants, with an average of 10,000 pounds for all plants. Individual lots handled at these plants during the period of study ranged from less than 1,000 to more than 70,000 pounds.

Lots were much smaller in olive plants, averaging 3,000 pounds. Individual plants averaged from 2,000 to more than 5,000 pounds. These averages were greatly influenced by a few relatively large cases, while many lots were very small. Individual lots observed during the study ranged from 400 to 26,000 pounds; 25% of all lots were less than 1,000 pounds and 32% between 1,000 and 2,000 pounds.

The table also indicates the effects of the separate-lot system on effective working time.

In apple or pear plants, the loss of time ranged from 3% in Plant S to 28% in Plant N. This extreme variation is due primarily to the difference in the length of the break period—less than one minute for Plant S and more than 11 minutes for Plant N. The 14% loss in Plant L is primarily the result of unusually low average lot size and the consequent increased number of break periods per hour. Plant U has a break time per lot that is about average, but with lots averaging more than 23,000 pounds the time loss is only 6%.

With relatively smaller lots and typically more break-for-lot periods per hour, the loss in effective working time is typically greater in olive plants than in apple or pear plants. The table indicates that the time loss ranged from 7% in Plant I to 24% in Plant IV. The large losses in Plants IV and IX are due to small lot size relative to plant volume—and so to relatively large numbers of breaks per hour. Plant I has the lowest average lot size of all the plants studied, yet has the lowest time loss. This is due to the very low plant volume per hour, and the related small number of lots run per hour.

The effects of size of lot and break time on effective working time are indicated in the diagrams on page 13 for typical plants. The diagrams are based on typical values for plant volume, lot size, and average break time. In individual plants these factors may differ considerably from typical values. In such cases the time loss would differ from that indicated by the diagrams.

With these limitations in mind, the left diagram indicates how increases in the average break-for-lot period cause corresponding increases in the time loss. In general, each increase of one minute in break time will increase by 2.5% the loss of effective working time in apple or pear plants. Because of smaller lot sizes, the effect of increased break time is more pronounced in olive plants—each one-minute increase typically results in a 5% loss in effective work time.

The diagram on the right shows the general effects of changes in average lot size on effective working time. Since increases in lot size usually mean fewer lots per hour and so less delay time, this diagram indicates that the loss of effective working time becomes smaller as lot size is increased. In apple or pear plants, lots as small as 2,000 pounds would mean an average loss of nearly 40% in effective working time. With lots of 10,000 pounds —the average lot size—the time loss would be reduced to 7.5% while larger lots would bring further reductions, approaching a minimum time loss of 3%.

The Effects of the Separate-lot System on Effective Working Time in California Apple, Pear, and Olive Plants

Plant	Volume of fruit: Per plant-hour	Volume of fruit: Per line-hour	Volume of fruit: Per lot	Lots run per line-hour	Break time per lot	Loss of effective working time: Per hour	Loss of effective working time: Per cent
	1,000 pounds				Minutes		
	APPLE AND PEAR PACKING HOUSES						
A	20.4	10.2	10.2	1.0	3.0	3.0	5.0
B	18.0	9.0	[a]	[a]	[a]	3.4	5.6
L	19.8	9.9	4.3	2.3	3.7	8.6	14.4
M	24.8	24.8	19.8	1.3	3.1	4.0	6.7
N	38.4	12.8	8.5	1.5	11.3	16.9	28.1
R	45.0	15.0	[a]	[a]	[a]	4.7	7.8
S	46.0	15.3	8.1	1.9	0.9	1.8	3.0
T	31.2	31.2	[a]	[a]	[a]	4.2	7.0
U	60.6	30.3	23.3	1.3	2.8	3.6	6.0
	OLIVE PLANTS						
I	3.1	3.1	2.0	1.5	2.9	4.5	7.5
II	13.3	13.3	4.6	2.9	2.7	7.9	13.2
III	10.0	10.0	1.8	5.4	2.0	10.9	18.2
IV	11.8	11.8	2.8	4.2	3.4	14.2	23.7
V	10.5	10.5	5.3	2.0	2.3	4.6	7.7
VI	7.2	7.2	2.9	2.5	4.2	10.6	17.7
VIII	5.2	5.2	2.8	1.9	4.9	9.1	15.2
IX	12.3	12.3	3.2	3.9	3.6	14.0	23.2

[a] Not available.

The Effects of the Separate-lot System on Potential Plant Volume and on Direct Labor Costs, California Apple, Pear, and Olive Plants

Plant	Present—with separate-lots: Plant volume 1,000 pounds per hour	Present—with separate-lots: Direct plant payroll per hour	Present—with separate-lots: Labor cost per 1,000 pounds	Potential—no separate-lots: Plant volume 1,000 pounds per hour	Potential—no separate-lots: Direct plant payroll per hour	Potential—no separate-lots: Labor cost per 1,000 pounds	Labor cost per 1,000 pounds for the separate-lot system
	APPLE AND PEAR PACKING HOUSES						
A	20.4	$62.40	$3.06	21.5	$61.40	$2.85	$0.21
B	18.0	73.90	4.11	19.1	72.80	3.81	0.30
L	19.8	82.80	4.18	23.1	81.70	3.54	0.64
M	24.8	58.70	2.37	18.2	57.70	2.13	0.20
N	38.4	140.00	3.65	53.4	136.80	2.56	1.09
R	45.0	119.70	2.66	48.8	117.60	2.41	0.25
S	46.0	134.20	2.92	47.4	132.10	2.79	0.13
T	31.2	103.90	3.33	33.5	102.80	3.07	0.26
U	60.6	120.40	1.99	64.5	117.30	1.82	0.17
	OLIVE PLANTS						
I	3.1	11.40	3.69	3.4	11.40	3.37	0.32
II	13.3	24.90	1.87	15.3	23.60	1.55	0.32
III	10.0	28.70	2.87	12.2	25.30	2.07	0.80
IV	11.8	21.00	1.78	15.5	19.10	1.23	0.55
V	10.5	25.20	2.40	11.4	24.00	2.10	0.30
VI	7.2	17.80	2.50	8.7	16.60	1.91	0.57
VIII	5.2	17.40	3.35	6.1	16.30	2.67	0.68
IX	12.3	21.30	1.73	16.0	18.80	1.18	0.55

In olive plants, lot sizes of less than 1,000 pounds—25% of actual lots fell in this category—would mean time losses of over 40% in typical plants. Average lots of 3,000 pounds would mean an average loss of 15%. Very large lots can be handled efficiently, with average time losses approaching 2%.

Costs

The major impact of the separate-lot system on plant operating costs is caused by the loss of effective working time, and by the resulting reduced volume of fruit handled per hour. In most plants, the elimination of the separate-lot system would permit only minor changes in the working force—grower-tally girls for packed fruit could be eliminated in fresh-fruit packing houses, and the number of men weighing and handling graded and sized olives could be reduced in some olive plants.

The lower table on page 14 summarizes data on plant volumes and estimated direct labor costs for the apple, pear, and olive plants included in the study. This table shows that the elimination of the separate-lot system would result in increases in the potential plant volume per hour. The volume increases would be small where the present system results in small reductions in effective working time, and large where present time losses are large. Most plants would be able to reduce the direct labor payroll per hour, although these changes would be relatively minor. The combined influence of direct labor reductions and increased volume per hour would be reductions in average direct labor costs—exclusive of packing labor and other piece-rate workers—ranging from $0.13 to $1.09 per thousand pounds of apples or pears, and from $0.30 to $0.80 per thousand pounds of olives. These costs of the separate-lot system may not seem large but they may be quite significant in terms of the total volume of fruit handled by a plant in any season. Moreover, the range in costs emphasizes that many plants can improve efficiency and reduce costs by adjusting their separate-lot systems in order to minimize the loss in effective working time.

A subsequent part in this series will deal with the sampling system—the second system used in California fruit-packing and processing houses to account to growers for products received. This part will also compare plant costs under the separate-lot and sampling systems to determine the particular method most economical under varying conditions.

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DEPRECIATION

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record aids in farm management and accounting and is almost a must for farm income tax reporting. The table on page 6 lists the usual lives and depreciation rates for certain groups of depreciable farm assets.

In accounting for income tax purposes, farmers have the option of considering certain development costs as current expense or as capital outlay to be spread over the useful life—of an orchard, for example—in the form of depreciation. There is a clear-cut line between what is actually a capital outlay for an improvement—or piece of equipment usable over a period of years—and what is maintenance or repairs chargeable as current expense.

Not all capital outlay is for a depreciable asset. The original leveling of land is a capital outlay considered to be permanent and not to be written off in the form of depreciation. However, releveling to restore land to its previously level condition can be considered as current expense. Where releveling goes beyond that and results in a better job than the original, it becomes, in part, an additional capital outlay and should be so divided.

A capital and depreciation record should provide for the listing by groups of all individual depreciable farm assets. Such a listing should show age, year acquired, original cost, subsequent additional capital outlay, prior depreciation, and for each year the remaining value, added capital, estimated remaining life and depreciation for the year. With such a listing for any requested inspection only group totals need be inserted in the Farm Schedule for Income Tax.

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The California Farm Record Book contains model forms of capital and depreciation records, inventories and net worth statements. It may be obtained for $1.00 from Agricultural Publications, 22 Giannini Hall, University of California, Berkeley 4, or from the local office of the Farm Advisor.

DEER

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dispersed. Therefore, the figures obtained from the plots were not strictly comparable. However, it is significant that deer actually had to pass through Common Sudan or Sudan 23 to reach the Sweet Sudan.

Deer use on the planting of oats and the oat-vetch mixture was heaviest during the midwinter and spring months. Pellet group density checks indicated relatively little difference in utilization until the late spring period after the middle of April. Then as the oats matured there was a definite shift to the end of the field containing vetch. Deer preference for legumes at this season and into the summer is well known.

These tests are not precise, but they do indicate that it is possible to plant certain crops relatively less attractive to deer than are other similar crops.

Sudan 23 is known to be less palatable for livestock than Sweet Sudan but it produces up to 25% more feed than other strains. This together with its low palatability for deer make it a good choice.

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Oat and Vetch Plots

Plot no.	Planting	Date checked March 12, 1952	Date checked April 11, 1952	Date checked June 6, 1952
		Pellet groups per acre	Pellet groups per acre	Pellet groups per acre
1	Oats	1800	300	200
2	Oats	2500	100	1100
3	Oats	3700	100	300
TOTAL		8000	500	1600
AVERAGE		2667	167	533
Days		127	30	61
Deer Days Per Acre		210	13	42
Deer Days Per Acre Per Day		1.57	0.43	0.69
4	Oats and Vetch	1900	300	1600
5	Oats and Vetch	1700	200	1400
6	Oats and Vetch	2200	200	700
TOTAL		5800	700	3700
AVERAGE		1933	233	1233
Days		127	30	61
Deer Days Per Acre		152	18	96
Deer Days Per Acre Per Day		1.19	0.60	1.58

One deer day = 12.7 Pellet groups.