

Prune Harvesting Cost Studies

comparative studies of harvesting with catching frames and with picking machines conducted in Napa and Sonoma counties

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Two unusual methods of prune harvesting—catching frames and a picking machine—were subjects of cost studies in 1957 in Napa and Sonoma counties, where hand picking is the usual method of harvesting.

Normally, the prunes are left on the trees to ripen and drop or until they can be shaken easily from the trees. Shaking is usually done with poles and the fallen fruit is picked up by hand and placed in boxes. Shaking may be hired separately or included in a higher rate paid per box.

In 1957, the prevailing rates—in good picking—were \$1.00 an hour for shaking and 25¢–30¢ per 50–60-pound box for picking, or 30¢–35¢ a box for shaking and picking. At 36 boxes per ton, labor cost at the lower rates was \$10.80 per ton, plus supervision and small overhead costs. With the additional costs of loading and hauling to the dehydrator, the bonuses sometimes paid, and rates for final cleanup, the 1957 season's average cost was probably around \$15 a ton from tree to dehydrator.

Essentially, a catching frame set consists of two separate tubular frames covered with canvas, one for each side of the tree. The high sides of the frames have notches to fit around the tree trunk. Canvas flaps cover the gap between the

two side pieces. Each side slopes down away from the tree to a controlled opening where the fruit rolls into a box below. The lower outside edges make for easier access in filling boxes and in shaking with poles from beyond the frame.

In use, each side of the catching frame is moved from one tree to the next by two or three workers, who also close the flaps. The complete move takes about one minute. Two men usually shake while the other crew members fill boxes and pick up the fruit on the ground under the tree previously picked. If picking is started early in the harvest season—with a short lapse of time between pickings—the ground fruit rarely exceeds 15% of the total. The picking cycle usually takes five or six minutes per tree and yields from one to three boxes per picking.

Frames were observed in use with crews numbering from two to five workers. Although the highest output per frame was with a five-man crew, a crew of three had an output as high or higher per worker hour.

In one orchard—of Imperials—two five-man-crew frames were used in three pickings. The total output was 2,150 boxes—or 57 tons in 56 crew hours—about 3.85 boxes per man per hour. Payment of 90¢ an hour made the labor cost to the grower 24¢. This, plus

2.8¢ for overhead on the frames, came to 26.8¢, as compared to 30¢ paid ground workers. In a French prune orchard, the same crew picked 4,290 boxes from 2,350 trees in 66 crew hours. This was a final picking after a previous light picking from the ground. The crew was paid 25¢ a box, including loading. This was divided evenly among the 10 crew members, who made \$1.60 an hour with an average output of 6.5 boxes per man-hour. The total season's output per frame was 96 tons.

Another grower used two frames to pick 150 fresh tons in a single picking. Pneumatic shakers were used and the total crew was composed of five men and a foreman who moved the tractor with the air compressor. Usual output was 500 boxes of 47 pounds or 11.7 tons per 9-hour day, about nine boxes per man-hour, but yields were 5–6 boxes per tree.

The two-sided slope-out catching frame increases output per worker hour and reduces the number of workers needed by about one third and—because most of the prunes fall on the frame rather than on the ground—the fruit is likely to be cleaner and to have fewer cracks and punctures. However, there were many cases of frames being inefficiently used in 1957 because of lack of experience or time to train a crew.

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Prune catching frame showing the sloping sides leading to the controlled opening for box filling.



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MILK

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other constituent studied. The citrate ions combine with calcium ions to form a soluble calcium citrate thus reducing the calcium ion activity in milk. The calcium ion activity is important in acid and rennet coagulation, heat stability of milk, possibly gelation of evaporated

milk, stability of frozen concentrated milk, and to certain properties of ice cream mix. Citrate fluctuations may well be the key to seasonal changes in milk properties.

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PRUNE

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The 1957 season was the sixth year in one orchard, and the fourth in another where the shaken ripe fruit was picked up from the ground by machines. A successful picking job was done in both cases, although average total tonnage per machine did not come up to expectations. Heavy rains before completion of the harvest reduced the tonnage that would have been picked by machine. Even with less than full capacity use, total harvesting cost was less with machine than with hand picking.

Effective—and economical—machine harvesting requires better management than other methods. The size of the orchard and the dehydrator capacity must be sufficient to justify at least daily half-time use of the machine and other equipment during the harvesting season. Removal of limb props at first picking is no great handicap but trees without propping would be desirable. Good land preparation—by some type of drag or plane and roller—is essential because the orchard soil must be free of surface clods and stones. Fruit is picked up from the ground by mechanical means and dumped—with some clods and leaves—into a tub of water on a trailer behind the harvester. Filled tubs are hauled by fork lift to the dehydrator where the washer-separator is located. This method is limited to farms with dehydrators.

There has been no evidence in Napa and Sonoma counties that the quality of the final product of the French variety picked by machine differs from that of prunes picked by hand.

The table on this page shows in detail the investment and harvesting costs with machines under an assumed set of conditions for 40 acres and 200 tons of fresh prunes, which is near the low limit of size for which this method is suited. A machine under average yield and good conditions could probably pick 60 acres with a total yield averaging 300 tons of fresh fruit, but varying from 200 to 500 in different years.

The performance rate of a picking machine varies greatly with the yield because the machine picks about an acre an hour. Hence, in any picking, it could

pick from one tub or ton an hour up to six if the haul were sufficiently short to permit a fork lift to replace the tubs fast enough. Maximum use over the years will seldom be attained because of occasional unfavorable soil or weather conditions, distance to the dehydrator, or dehydrator capacity.

When using the machine for the first picking, three crew members keep a few rows ahead of the machine; two men shaking and one raking the prunes out of the tree row with the small engine-driven side rake and from around the trunks by hand with a spring-tine lawn rake. In the second or last picking where the trees are cleaned, four men hand shaking, or two men pneumatic shaking, may be needed. For a season average, sample costs shown in the table assume four men hand shaking and raking nine hours daily, which would probably be ample, even for a heavier yield.

In machine-picking, the harvesting includes delivering the prunes and dumping them into a washer-separator at the dehydrator. From there, they are mechanically moved to the tray loader. In both cases observed, the fork lift had a tilting device enabling the operator to tilt the tub and pour the prunes and water into the washer. No lug boxes are needed and part of the saving in this method is in transportation. The fork lift—having many other uses, particularly with lift bins at the dehydrator—is charged in the sample harvesting costs, shown on the table below, at one half its cost.

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Sample Investment and Total Harvesting Costs for Three Methods
Assumed: A 40-acre orchard, 200 fresh tons, 20-day season, 2 pickings

	Hand		Frames		Machine	
	Quantity	Cost	Quantity	Cost	Quantity	Cost
INVESTMENT						
Shaking poles @ \$8.00.....	6	\$ 48	4	\$ 32	4	\$ 32
Buckets @ \$1.00.....	12	12	2	2		
Lug boxes @ \$1.00.....	600	600	600	600		
Catching frames @ \$450.00.....			2	900		
Picking machine.....					1	2700
Side rake with engine.....					1	400
Trailer for tubs.....					1	250
Tubs @ \$40.00.....					4	160
Fork lift \$1200, 1/2 to picking.....						600
Washer.....						600
Miscellaneous small and shop tools.....		20		40		200
Total original cost.....		\$680		\$1574		\$4942
ANNUAL OVERHEAD COSTS						
Interest on 1/2 cost @ 5%.....		\$ 17		\$ 39		\$124
Depreciation.....		70		230		496
Repairs, mounting, etc.....		18		40		125
Total annual overhead.....		\$105		\$309		\$745
COSTS PER TON						
Average annual overhead.....		\$ 0.53		\$1.53		\$3.73
Extra ground preparation @ \$5.00 per acre.....						1.00
Shaking and sweeping @ \$1.00.....					3.6 hr.	3.60
Shaking and picking @ 30g, 25g.....	36 bx.	10.80	36 bx.	9.00		
Picking machine operator @ \$1.50.....					.5 hr.	.75
Supervision, loading, driving truck or fork lift @ \$1.25.....	1.4 hr.	1.75	.9 hr.	1.13	.5 hr.	.63
Tractor for machine @ \$1.50.....					.5 hr.	.75
Truck @ at \$2.50 per hour.....	.5 hr.	1.25	.5 hr.	1.25		
Fuel, etc, for sweeper, fork lift.....						.30
Total cost per ton.....		\$14.35		\$12.91		\$10.76