Harvesting Canning Tomatoes

reduction of labor requirement per ton pending development of economic mechanized tomato harvesting is subject of study

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Newest among the several types of equipment developed to study the harvest of canning tomatoes—where hand labor constitutes 88% of the cost—is a wheelbarrow harvester.

Hand labor has not been replaced in the harvest of tomatoes and—until a plant breeding program develops a variety whose fruit will ripen all at one time, so it can be shaken free of the plant—growers will use hand labor.

In the last harvest of pear-shaped tomatoes, the plants usually are cut by hand at the ground level and the fruit shaken from the plants. The acceptable fruit is picked up and put in lug boxes. If all or most of the fruit is to meet the state grade, each individual fruit has to be handled.

In studies on the reduction of hand labor, a wheelbarrow device was tested. The tomatoes were shaken onto a screen, culls were removed and the good fruit was poured into a box by lifting one end of the screen. The screen was of hardware cloth—3′ × 4′—hinged to the front edge of a low one-wheeled frame supplied with handles. The edges of the hardware cloth were turned up to prevent the fruit from rolling off. Angled sides funneled the fruit into lugs.

The table indicates that considerable time can be saved by the use of the wheelbarrow device when there is a low percentage of culls.

In these trials a substantial number of tomatoes fell onto the ground, when the cut plants were lifted for shaking, and had to be picked up. The combined opcration required 4.9 minutes per 50 pound lug of tomatoes.

A comparison of wheelbarrow harvesting with hand picking brings out certain observations. The hand picker searches, selects, picks, and carries fruit to the box in what is apparently one operation. With the wheelbarrow, the picker must cut and shake the plant, sort and dump the fruit, and pick up the fallen fruit from the ground. The only operation that could be eliminated is the last one, and then only when varieties that hold their fruit until shaking time are available. The other operations are subject only to more efficient management.

Labor aid equipment speeds harvesting primarily by reducing the time used to handle materials. Conveyor belts would fall into this classification. They have been used successfully for green wrap tomatoes, and have been tested on canning tomatoes off and on since 1952. In most cases, the operator has been dissatisfied with results. In 1958, one canning tomato grower harvested his entire crop with a conveyor belt. The actual cost for picking was about the same as by the conventional method. However, there was less vine damage, better quality control, a 5% saving in roadway space, no rejected loads, and mold of only about 3%.

Labor management is important with or without labor aid equipment. All new tomato pickers should be taught the most efficient and least tiring way to pick tomatoes. There are two basic operations in picking tomatoes: *1*, searching the plant, picking, and placing the fruit in the box; and *2*, handling materials such as the empty or full boxes. The lug box should be close to the picking area, so the harvested fruit is moved only a short distance. Workers should pick with both hands and fill their hands with fruit before moving to the box. Proper picking methods can increase output 50% or more. Awkward picking methods are both fatiguing and time consuming.

Pickers differ in the rates at which they harvest. A fast picker starts the day slowly, reaching a maximum speed about 11 or 12 o'clock. He maintains this rate through the middle of the day, slowing perhaps near quitting time. The slow picker is erratic in his rate of picking and does not use good handling methods.

Relations between grower, picking boss, and crew can affect output. A picking crew angered by the grower or picking boss usually works at a slower rate for the rest of the day and remains disgruntled for a longer period.

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Use of wheelbarrow and screen to sort tomatoes. Screen lifted to pour sorted tomatoes into lug box.

Relative Speed of Picking Pear Type Tomatoes by Several Methods. Average of Six Tests. Yield 20 Tons per Acre. Variety Red Top No. 9. Time in Minutes Per 50 Pound Lug Box.

	Wheelbarrow only. 64.5% fruit	Pick fallen fruit from ground 35.5%	Combination 64.5% wheel barrow 35.5% off ground	Cut plants shake pick up	Pick fruit from vine
Cut	0.48*	...		0.46	....
Shake	0.98	...		0.61	....
Pick	...	7.55		6.32	12.50
Sort	1.37	...		...	....
Dump	0.33	...		...	....
Carry	0.23	0.20		0.19	0.22
Total	3.39	7.75	4.94	7.58	12.72

* Machine cutting of plants would reduce this time to 0.10 minute.

cubic feet against 1.5″ pressure. In actual operation the static pressure was 1.2″ when the potatoes were 10″–12″ deep on the belt. The wire screen belt is driven through a speed reducer by a one-half horsepower motor. The speed of the belt can be changed by varying the pulley ratio between the motor and the speed reducer.

The dryer was tested to a limited extent in two different packing houses in Kern County. The first was at Shafter, in the spring of 1958. Potatoes were discharged directly into the dryer from a water eliminator with sponge rubber rolls. Both units were located between the end of the sorting belt and the sacker for the No. 1 potatoes. Because of the small volume of potatoes being handled, the conveyor belt was run at a speed which retained the potatoes in the dryer for five minutes. No auxiliary heat was used, because sufficient time was allowed to accomplish drying with natural air. Potatoes came out dry in four out of five tests, as shown in the upper table.

The second test was at Tehachapi in late summer, 1958. Auxiliary heat was not used because no convenient gas supply was available. To handle the volume of potatoes being packaged, potatoes were retained in the dryer only two minutes.

The first runs—without a water eliminator—left the potatoes wet. Before September 8, a sponge roll water eliminator was placed between the last washer and the sorting belt. Thereafter, the degree of dryness attained varied according to the temperature and relative humidity of the air. Results are given in the lower table. With an air temperature of 82°F and 30% relative humidity, practically complete drying was accomplished. With an air temperature of 74°F and 54% humidity, only partial drying was accomplished.

The general construction of the dryer has been satisfactory in the preliminary tests. Auxiliary heat will be necessary when air temperature is below 80°F and relative humidity above 30%. For maximum capacity, higher air temperature may be required. Observations indicated that 18″ is about the practical limit for the depth of potatoes, that two minutes is the minimum for drying and a longer time is necessary under some conditions, and that the maximum capacity of the experimental unit is about 300 sacks per hour. Greater capacity could be obtained by making the drying unit wider and longer.

It is possible that drying time could be reduced and capacity increased by using heated air at temperatures as high as 150°F. To reduce the amount of water to be removed, a water eliminator ahead of the dryer is very desirable.

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James B. Kendrick, Jr., Associate Plant Pathologist, University of California, Riverside, determined the conditions for development of bacterial soft rot. Charles Sill Co., Shafter, and Summit Farms Co., Tehachapi, cooperated in testing the dryer in their packing houses.

Development of the dryer was requested and funds provided by the Research Committee of the California Long White Potato Advisory Board.

The above progress report is based on Research Project No. 947.

Observations on Experimental Potato Dryer at Shafter, 1958

Date and hour	100-lb. sacks /hour	Air into dryer		Air in bottom of dryer		Air out of dryer		Condition of potatoes out of dryer
		Temp. °F	Humid. %	Temp. °F	Humid. %	Temp. °F	Humid. %	
April 16								
11 a.m.	150	78°	39%	76°	51%	74°	58%	Dry
8 p.m.	90	70°	68%	69°	76%	68°	80%	Dry
10 p.m.	105	66°	71%	66°	75%	65°	80%	Slightly damp
April 17								
1 p.m.	135	76°	44%	73°	53%	72°	57%	Dry
6 p.m.	180	74°	58%	72°	65%	70°	72%	Dry

Observations on Experimental Potato Dryer at Tehachapi, 1958

Date and hour	100-lb. sacks /hour **	Air into dryer		Air in bottom of dryer		Air out of dryer		Condition of potatoes out of dryer
		Temp. °F	Humid. %	Temp. °F	Humid. %	Temp. °F	Humid. %	
Sept. 3*								
11 a.m.	225	76°	38%	70°	55%	67°	75%	Wet
4 p.m.	225	80°	34%	72°	65%	70°	72%	Wet
Sept. 8								
3 p.m.	260	82°	30%	75°	62%	74°	65%	Dry
Sept. 10								
11 a.m.	250	74°	54%	70°	77%	70°	77%	Damp
2 p.m.	180	77°	42%	73°	57%	73°	61%	Slightly damp

* A sponge roll water eliminator was installed ahead of the dryer between September 3 and September 8.

** Potatoes were in the dryer 2 minutes.

HARVEST

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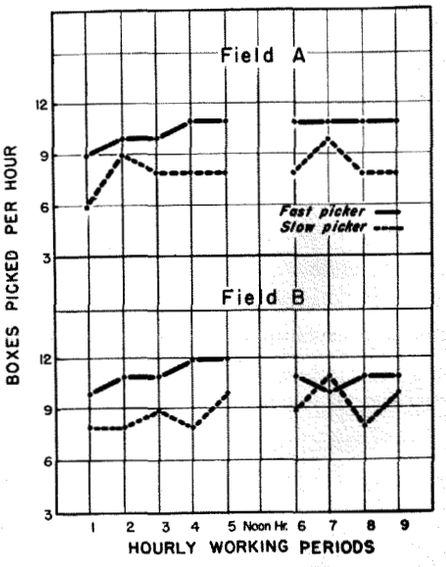
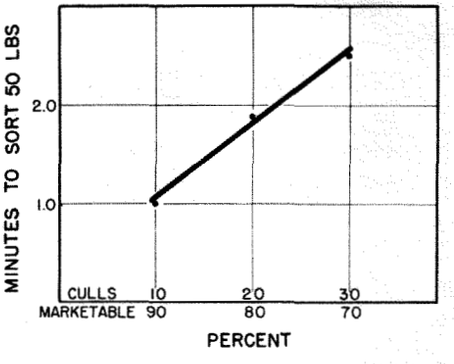
The most fatiguing operation is carrying the full lug boxes. In moving the boxes, an average picker usually carries 2.8 tons a distance of about 60′ in a day. When a man is carrying a box weighing 44–48 pounds, the pace that tires him least is 2.6 miles an hour or 228′ per minute. The best method of carrying the full lug box is on the shoulder.

Hourly picking rates of slow and fast pickers.



Sorting time increases with the amount of culls.



Good cultural methods will usually make the harvesting operation easier. Good yields and freedom from weeds let the pickers work faster and encourage them to greater output.

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Further details on work simplification methods for vegetable growers are given in Leaflet 57, which may be obtained without cost at the office of the County Farm Advisor or by addressing a request to Agricultural Publications, 207 University Hall, University of California, Berkeley 4.