Handling Mechanically Harvested Fruit At The Processing Plant[1]

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Several promising mechanical harvesting systems have been developed to a prototype stage and operated under commercial, or near commercial, conditions. Until now, their acceptance has been limited but is expected to increase if harvesting costs continue to rise. Thus, in the future, it is expected that processing plants will receive an increasing amount of mechanically harvested fruit. Just how this will affect in-plant handling of the fruit is being studied at the Citrus Experiment Station. Already, with only limited experience and research, several problems have been encountered which will need attention. This paper describes the condition of the fruit which might be expected from present mechanical harvesting systems and dicusses some of the expected problems and their possible solutions.

Harvest Systems and Condition of Fruit

The limb shaker and catching frame system has reached a prototype stage of development (2). The fruit is detached by shaking limbs with a mechanical shaker. Catching frames collect the fruit which is automatically accumulated in a bin. A high-lift grove truck transports the fruit from the bin to a roadside semi-trailer for hauling to the processing plant. A system developed at the Citrus Experiment Station has been tested over a 3-year period in cooperation with Libby, McNeill, and Libby, Southern Fruit Distributors, and Coca Cola Company, Foods Division.

A second harvesting system, of which a version is being used commercially, employs a tractor-mounted mechanical limb shaker to detach the fruit, which is then raked into a windrow for pick up either by hand or by a pick-up machine (5). The fruit is then hauled to the roadside semitrailer in a high-lift grove truck. This system, using a tractor-mounted shaker and a pick-up machine, was tested in cooperation with Lykes-Pasco Packing Company, Plymouth Growers Association, and Southern Fruit Distributors.

A third harvest system that has been operated under near commercial conditions shakes the limbs with oscillating air to detach the fruit, and collects it on catching frames for delivery into a high-lift grove truck. As in the other systems, the fruit is hauled to the roadside and dumped into a semitrailer for transport to the processing plant.

Samples from trailer loads of mechanically harvested oranges were inspected for visible damage. Also, a count was made of fruit with stems attached (Table 1). Replicated samples of the fruit from all harvesting systems were stored at 70° F to determine decay after 3, 5, and 7 days (Table 2).

Most of the damage occurred as splits, plugs, punctures, and bruises (oleocellosis). The percentage of "plugged" fruit is less in mechanically harvested than in hand harvested fruit. On the other hand, the percentage of fruit with stems over ½-inch long was higher in the mechanically harvested fruit. The percentage of fruit with stems attached decreased in 'Hamlin' and 'Pineapple' oranges as the fruit loosened near the end of the harvest season. Fruit samples stored at 70° F indicated that there was a considerable amount of concealed damage done during the mechanical harvesting process as indicated by accelerating decay after a 3-day period. This may not be a severe problem **if the fruit is processed within 36 hours after harvest.**

In-Plant Handling

Three semitrailer loads of fruit harvested with the Citrus Experiment Station's limb shaker and catching frame system were followed through Libby, McNeill, and Libby's processing plant at Ocala. Fruit with attached stems was the biggest problem. Samples were taken: 1) at the tailgate of the truck; 2) after passing over the first grading table; 3) after passing through the storage bins, but before the second grading table; and 4) after the second grading table, before going to the extractors. The percentage of fruit with stems at each of these positions is given in Table 3.

An average of 8% of the fruit still had stems attached when the fruit entered the In-line extractors. They cause some problems in delivering the fruit into the extractors.

(Continued on Page 9)

Table 1.--Condition of oranges harvested by different systems sampled at the roadside trailer.[1]

Harvest systems	Visible fruit damage					Stems	
	% split	% punctures	% plug	% bruised	% sound	% stems	Avg. length of stems
Mechanical shaker							
Catching frame (H)[2]	2.3	6.5	1.3	2.5	87.4	40.9	2.0"
Mechanical shaker							
Windrow and pickup (P)	4.9	0.6	0.4	0.4	93.7	16.9	--
Conventional							
Handpicked (H)	0	0.6	12.8	0	86.6	9.5	2.1"

[1]Harvest systems were operated under different harvest conditions.

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