

## MECHANICAL SYSTEMS TO HARVEST CITRUS FRUIT FOR JUICE PROCESSING PLANTS IN FLORIDA<sup>1</sup>

S. L. HEDDEN

*United States Department of Agriculture,  
Agricultural Research Service,  
Agricultural Research and Education Center,  
Lake Alfred, FL 33850*

J. D. WHITNEY

*University of Florida,  
Institute of Food and Agricultural Sciences,  
Agricultural Research and Education Center,  
Lake Alfred, FL 33850*

G. E. COPPOCK

*Florida Department of Citrus,  
Agricultural Research and Education Center,  
Lake Alfred, FL 33850*

*Additional index words.* Shakers, pickup, costs, oranges.

**Abstract.** Several mechanical harvesting systems have been developed for harvesting Florida citrus fruit destined for juice processing plants. Approximately 17.4 million kilograms of oranges for processing were mechanically harvested during the 1974-75 season. All systems use limb or tree shaking methods of fruit removal and the fruit is gathered by catching frames, mechanical windrow and pickup equipment, or by hand pickup crews and then loaded into grove trucks. Fruit loosening with abscission chemicals generally increases the efficiency of all harvesting systems, but especially those used in 'Valencia' oranges. However, the use of abscission chemicals requires careful timing with weather, labor and machinery, and at best, results are variable within and between groves. Commercially available machinery for mechanical harvesting has been generally limited in selection and not totally acceptable to the citrus industry. Harvest results are varied with these systems as are harvest capacity and initial cost. Total fruit recovery has been 85 to 95% under good conditions and fruit should be processed within 48 hours to prevent excessive losses from decay. Costs per box of fruit harvested have generally been higher than hand

**picking costs due to an adequate, if not over-supply of labor the past few years which has stabilized hand picking costs and reduced the immediate need for mechanization.**

Research and development of methods and equipment for mechanization of citrus harvesting has been covered in depth by previous speakers on this program (12, 14). Coppock (5) has pointed out the wide range of citrus grove conditions that a single commercial harvesting organization might encounter in Florida. Drake (8), suggested that future harvesting programs should simultaneously coordinate grove development, apparatus and methods development, and industry development. In other words, changes must occur in both the production of citrus fruit and in the receiving and processing of the fruit as well as in harvest mechanization in order for the entire process of producing a saleable product to be efficient and economical to all concerned.

Much of the current research program in Florida is directed toward putting together complete harvest systems and evaluating the various systems in terms of fruit recovered, labor required, capital investment, effects on subsequent fruit yields, and system economics.

The purpose of this paper is to discuss the combinations of equipment currently being used to make up a mechanical harvesting system and present some of the performance data to illustrate what results can be expected.

### Mechanical Harvest Systems

For reporting purposes, harvest systems are usually characterized by the methods used for fruit removal and gathering. Several systems have been used commercially in Florida, with slight variations, which account for about 16, 320 tonnes (400,000 boxes<sup>2</sup>) of citrus mechanically harvested each year for the past four seasons. This amounts to less than one percent of the total citrus crop in Florida.

#### *Handpick and Mechanical Pickup*

This is a semi-mechanical system in which handpickers remove the fruit and drop it on the ground. Using this

<sup>1</sup>Cooperative research by the U.S. Department of Agriculture, University of Florida, and the Florida Department of Citrus, Agricultural Research and Education Center, Lake Alfred, FL 33850.

<sup>2</sup>The Florida field box is defined under Sec. 601.15(3)(b) and (c) of the Florida Citrus Code as the equivalent of 90 pounds (40.8 kg) of oranges or 85 pounds (38.6 kg) of grapefruit.

