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SHAKER-PICKUP HARVEST SYSTEM FOR EARLY AND MIDSEASON ORANGES[A]

W. C. Wilson----Abscission chemical

G. E. Coppock---Shakers

H. R. Sumner

S. L. Hedden----Rake-pickup machine and fruit transport equipment

J. G. Blair-----Fruit damage determination

D. L. Deason

C. L. Anderson--System evaluation

The shaker-pickup harvest system is one of several systems proposed for the mechanical harvesting of citrus fruit. Within the system, the fruit is (a) loosened with an abscission chemical, (b) detached with a shaker and allowed to drop to the ground, (c) picked up with a rake-pickup machine, (d) hauled to a roadside semitrailer in a hi-lift grove truck, and (e) transported to processing plant in a semitrailer. One man follows the shaker to detach any fruit left on the trees and to rake fruit away from the tree trunks. The system is referred to in this report as ASPT, (A)bscission chemical, (S)haker, (P)ickup machine, (T)ruck.

Components of the system have been under development at the AREC-LA for several years. Their development has progressed to a level where they will function acceptably in an integrated harvesting system. In the past, it has been difficult to make meaningful evaluations independently because the components are dependent on each other.

The purpose of this study was to evaluate the ASPT system and its separate components while operating under varied grove, fruit, and climatic conditions during the early and midseason orange season. The criteria for evaluation were performance and compatibility of components, harvesting costs and effect on fruit and tree conditions.

HARVEST TESTS

A test of the system was conducted at 3 dates, 3 to 4 weeks apart, over the December to March harvest season. Detailed descriptions of the components are given under separate headings in this report. They are listed below:

Abscission chemical--Acti-Aid at 2 concentrations.

Shakers--2 AREC-LA self-propelled limb shakers.

Rake-pickup machine--USDA.

Grove truck--Conventional hi-lift truck, 60-box capacity.

Semi trailer--Conventional, 500-box capacity.

[A] University of Florida, Florida Department of Citrus, and the U. S. Department of Agriculture cooperating.

Arrangements were made for 3 grove areas (1-'Hamlin' and 2-'Pineapple' suitable for harvesting with limb shakers and for operating a pickup-machine. No extensive land preparation or tree pruning was necessary. The grove areas are described below:

Lynchburg 'Hamlin'--20 X 24-foot square spacing, 18 to 20-foot high trees, hedged both middles in one direction, hedged every other middle in the other direction, fairly level terrain, 3-foot tree skirts, Figure 1.

Florida Gold 'Pineapple'--25 X 25-foot square spacing, 16 to 20-foot high trees, hedged both middles in both directions, fairly level terrain, 3-foot tree skirts, Figure 2.

Winter Garden 'Pineapple'--25 X 25-foot diagonal spacing, 20 to 25-foot high trees, foliage canopied over in top, fairly level terrain, 8-foot tree skirts, Figure 3.

Each test consisted of 3 plots, with enough trees to produce approximately 400 boxes per plot. The number of trees varied with fruit yield. Two plots were sprayed with Acti-Aid, one with a maximum and the other with a minimum concentration required for loosening the fruit. The concentratic were determined by the harvest conditions. The third plot was left unspray for a control.

When it was thought the Acti-Aid had caused peak loosening of the frui the plots were harvested. Usually, one plot was harvested each day for 3 consecutive days. The fruit was delivered to the roadside trailer the same day it was removed from the tree. In the Lynchburg 'Hamlin' and the Florida Gold 'Pineapple' tests, the fruit was held on the semitrailer about 24 hour after loading before it was delivered to the processing plant. In the Wint Garden 'Pineapple' test, it was delivered about 3 hours after loading.

$$\text{Average yield per tree} = \frac{Fd + Fg + Ft}{\text{No trees in plot}}$$

where,

Fd = Fruit delivered to processing plant, lbs.

Fg = Fruit left on ground, lbs.

Ft = Fruit left on tree, lbs.

$$\text{Fruit removal efficiency, \%} = \frac{Fd + Fg \times 100}{\text{Yield}}$$

The fruit delivered (Fd) to the processing plant was determined by weighing at the plant. Fruit left on the ground (Fg) and on the tree (Ft) were determined by weighing the fruit collected in these locations after harvest from 6 randomly selected trees for each preharvest treatment.

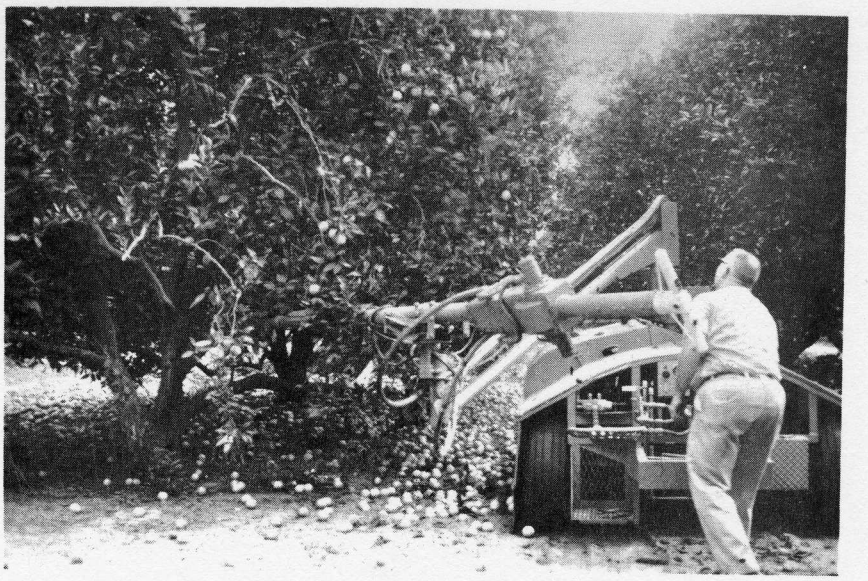

Figure 1. Lynchburg 'Hamlin' grove with AREC-LA limb shaker in operation.

Figure 2. Florida Gold 'Pineapple' grove with USDA rake--pickup machine in operation.