

Reprinted from Volume 84 of the Proceedings of the  
FLORIDA STATE HORTICULTURAL SOCIETY  
Miami, November 9-11, 1971

## COMPARATIVE HARVEST TRIALS OF FOLIAGE AND LIMB SHAKERS IN 'VALENCIA' ORANGES<sup>1</sup>

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### ABSTRACT

Harvesting trials were made on 'Valencia' oranges in 1970 and 1971 using the ITF Leasing Corporation<sup>2</sup> foliage shaker and the Experiment Station limb shaker. Mature fruit removal averaged 88% with the limb shaker and 85% with the foliage shaker over the two seasons. Fruit removal

with both machines averaged 92% with the use of abscission chemicals in the June, 1970, trial. Removal of young fruit (next year's crop) was less with the foliage shaker than with the limb shaker. Approximately 30% of the mature 'Valencia' fruit harvested with the limb shaker had stems attached which was 5% more than fruit harvested by the foliage shaker.

Harvest time in the June, 1970, test averaged 11 minutes per tree with the limb shaker versus 6 minutes for the foliage shaker; but time spent actually shaking the trees was almost the same for both machines when checked in 1971 trials. Tree shapes and density are important factors in the use of either harvest method.

### INTRODUCTION

Tree shaker concepts for mass fruit removal appear to offer an efficient method of mechanical harvesting in terms of future needs of the Florida citrus industry. Several shaking methods, including limb and foliage type shakers, have been investigated over the past 10 years (1, 2).

The long stroke, inertia type limb shaker, and several foliage shakers which impart low frequency,

Florida Agricultural Experiment Stations Journal Series No 4215.

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

<sup>2</sup>Trade names are used in this publication solely for the purpose of providing specific information. Mention of a trade name does not constitute a guarantee or warranty of the product by the U.S. Department of Agriculture or an endorsement by the Department over other products not mentioned.



large amplitude energy to the tree have been effective in removal of early and mid-season varieties of oranges and grapefruit (3).

Valencia oranges, however, are held more tightly on the tree than early and mid-season varieties (4) and have two crops of fruit on the tree at harvest. It is desirable that mature fruit be removed with a minimum removal of young fruit. Since the 'Valencia' variety constitutes approximately one-half of the Florida orange crop (47% in 1969-70) (5), it is imperative that effective means of harvesting this portion of the citrus crop be developed before complete mechanization throughout the harvest season can be accomplished.

Under certain grove conditions in previous tests, a foliage shaker demonstrated better selection between young and mature 'Valencia' oranges than did an inertia limb shaker. Therefore, two formal harvest tests were set up to evaluate both shaker concepts under different field conditions and to compare selectivity between mature and young fruit, effect on subsequent yields, efficiency of mature fruit removal, and actual shaking time per tree. Results of harvest trials presented here

were obtained during the 1970 and 1971 'Valencia' orange harvest seasons.

#### EXPERIMENTAL METHODS

##### *1970 Harvest Test*

The limb shaker used in this test (Fig. 1) was developed on the cooperative harvesting project at the Agricultural Research and Education Center, Lake Alfred. The displacement of its unbalanced weight (250 lb.) was 6 inches. The effective displacement transmitted to the limb and its direction varied depending upon frequency, attachment angle, and limb size. Maximum shaker frequency was set at 400 cpm. In operation, the machine was shuttled back and forth along one side of a tree making from 8 to 12 clamps per tree. Operation of the shaker was governed by the judgment of an experienced operator in regard to fruit selectivity, clamp placement, etc.

The foliage shaker (Fig. 2) was furnished by its manufacturer, ITF Leasing Corporation, Longwood, Florida. It was operated without its catching frame so that the two shakers would be performing



Figure 1.—The low frequency, large amplitude inertia type limb shaker used in these harvest tests.