

## AIR SHAKER HARVEST TRIALS IN 'VALENCIA' ORANGES WITH TWO RATES OF ABSCISSION CHEMICAL<sup>1,2</sup>

J. D. WHITNEY  
*University of Florida,  
Institute of Food and Agricultural Sciences,  
Agricultural Research and Education Center,  
P. O. Box 1088, Lake Alfred, FL 33850*

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**Abstract.** During May and June of 1975 when the young fruit diam averaged 1.2 inches, 4 harvest experiments were conducted in 'Valencia' oranges with the AREC air shaker at 2 mph ground speed and 2 concns (250 and 375 ppm) of the abscission chemical, Release (5-chloro-3-methyl-4-nitro-1H-pyrazole). The trees were shaken 5 days after spraying. Pre-harvest mature fruit drop at the low and high concns of chemical averaged 13 and 31%, respectively. Mature fruit removal with the air shaker averaged 88 and 96%, respectively. In 1976, subsequent yields of trees sprayed with 250 ppm of Release were not significantly reduced, whereas 375 ppm did cause a significant reduction. Harvest efficiency of the air shaker was 80% with 250 ppm and 78% with 375 ppm Release.

Mechanical harvesting systems have not been totally accepted for Florida citrus. A significant deterrent has been the low harvesting efficiency in 'Valencia' oranges due to the poor efficiency of the fruit removal device. Harvesting efficiency of a fruit removal device as discussed in this paper is defined as the product of its percentage mature fruit removal from trees in season 1 and the subsequent fruit yield of the same trees in season 2 divided by the fruit yield of check trees in season 2.

A report (1) was made to this Society last year relating the results of air and trunk shaker tests in 'Valencia' with a promising new abscission chemical, Release. With the air shaker operating at 1 mph ground speed following an application of 250 ppm of Release, the harvesting efficiency averaged 70%. The objective of the research reported in this paper was to determine if harvesting efficiency could be increased in 'Valencia' oranges by providing better mature fruit loosening with higher concentrations of Release and by decreasing air shaking energy transmitted to the tree.

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<sup>2</sup>Cooperative research by the University of Florida, Agricultural Research and Education Center, the U. S. Department of Agriculture, and the State of Florida, Department of Citrus, at Lake Alfred, Florida.

### Materials and Methods

Four experiments were conducted in 'Valencia' oranges during May and June of 1975 (See Table 1). Five harvesting treatments (Table 2) were replicated 5 times in each experiment in a randomized block design. The AREC air shaker was operated at 2 mph ground speed and Release was applied at 250 and 375 ppm. Handpicking with and without Release was included in the harvesting treatments to determine the effects of the air shaker and Release on subsequent yields.

Table 1. Dates in 1975 that Release was applied, trees were shaken, and young fruit diam in Experiments I through IV.

| Exp. No. | Spray applied       | Trees shaken | Young fruit diam, inches |
|----------|---------------------|--------------|--------------------------|
| I        | May 8               | May 13       | 0.9                      |
| II       | May 23              | May 29       | 1.4                      |
| III      | May 22 <sup>a</sup> | May 27       | 1.2                      |
| IV       | May 30 <sup>b</sup> | June 4       | 1.5                      |

<sup>a</sup>Trees were originally sprayed on May 16. Rained 1/2-inch 4 hr after application; reapplied May 22.

<sup>b</sup>Rained 1/2-inch 6 hr after application, not reapplied.

Table 2. Treatment descriptions in 'Valencia' experiments.

| Treatment No. | Treatment description                                |
|---------------|--|
| 1             | 375 ppm Release <sup>a</sup> and air shaker at 2 mph |
| 2             | 375 ppm Release and handpick                         |
| 3             | 250 ppm Release and air shaker at 2 mph              |
| 4             | 250 ppm Release and handpick                         |
| 5             | No chemical, handpick                                |

<sup>a</sup>2.4 ml of Ortho X-77 added to each gal of spray mixture.

Experiments I and II were conducted on 2-tree plots. The trees were spaced 16 x 26 ft and were 20 ft high. Five to 6 days prior to air shaking, Release was applied with an FMC 900 series airblast sprayer at 900 gpa.

Experiments III and IV were conducted on 1-tree plots. The trees were spaced 15 x 30 ft and were 16 ft high. Release was applied with a handgun sprayer at 800 to 900 gpa. In Experiment III, a 1/2-inch rain fell within 4 hr after the initial application of Release on May 16. Because little or no mature fruit loosening was apparent, Release was reapplied on May 22 and the fruit was harvested on May 27.

In Experiment IV, a 1/2-inch rain fell within 6 hr after Release was applied on May 30. Since some mature fruit loosening was evident, the spray was not reapplied, and the fruit was harvested on June 4.

In 1975, yield data were collected on all treatments. On the air shaker treatments (1 and 3), data were also collected on (a) percentage preharvest fruit drop, (b) percentage mature fruit removal (includes preharvest drop), and (c) average diam and number of young fruit removed. Yield data were obtained for only 3 replications each in Experiments I and II and no yield data were obtained for Experiments III and IV in 1976.

### Results and Discussion

Fig. 1 gives the preharvest drop and removal for Treatments 1 and 3 in all 4 experiments. Release at the higher rate of 375 ppm provided superior loosening of the mature fruit as is evidenced by the higher magnitudes of preharvest drop and removal. In each experiment, Release at 375 ppm provided significantly higher (.05 level) preharvest drop than did Release at 250 ppm. The average preharvest drops at 375 and 250 ppm of Release were 30.8% and 13.2%, respectively. Mature fruit removals averaged 95.7% and 87.9% at 375 and 250 ppm Release, respectively, in all experiments, and were significantly (0.05 level) different in Experiments II and IV (See Fig. 1). The number of young fruit removed by the air shaker (not shown) was fairly constant for Treatments 1 and 3 in all experiments and averaged 76 fruit per tree. Differences in mature fruit loosening activity by the 2 concn of Release were least evident where the chemical was reapplied (Experiment III) after the rain and were most evident where the chemical was not reapplied after the rain (Experiment IV). The results in Experiment IV illustrate that the higher concn of Release may provide better mature fruit loosening when rain follows the chemical application within a few hr. This may have been either the result of increased activity of the higher concn between application and rain or greater residues remaining after the rain.

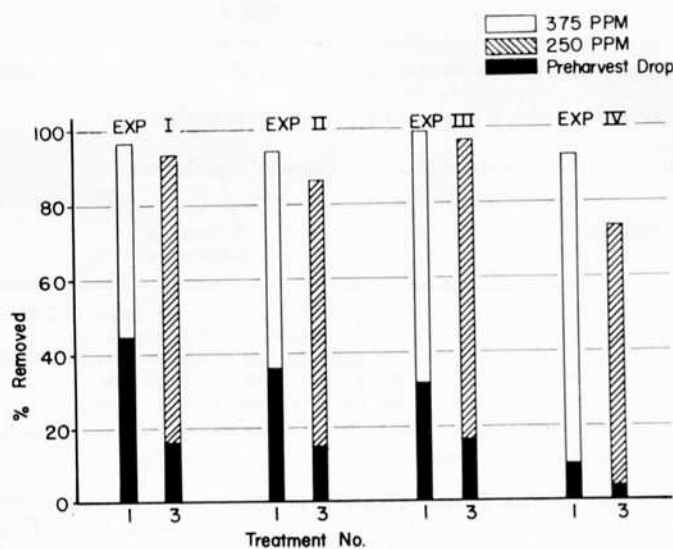


Fig. 1. Preharvest drop and percent mature fruit removal for Treatments 1 (375 ppm Release and air shaker) and 3 (250 ppm Release and air shaker) in Experiments I, II, III, and IV.

Yield data were only obtained for 3 replications in Experiments I and II in 1976. Data from both experiments were pooled and were analyzed as one experiment with 6 replications. These yield data are shown in Fig. 2 for 1975 and 1976 by individual treatments. By Duncan's multiple

range test, the 1976 yields associated with Treatment 1 were significantly less (0.05 level) than those of Treatments 4 and 5. These were the only significant differences between individual treatments.

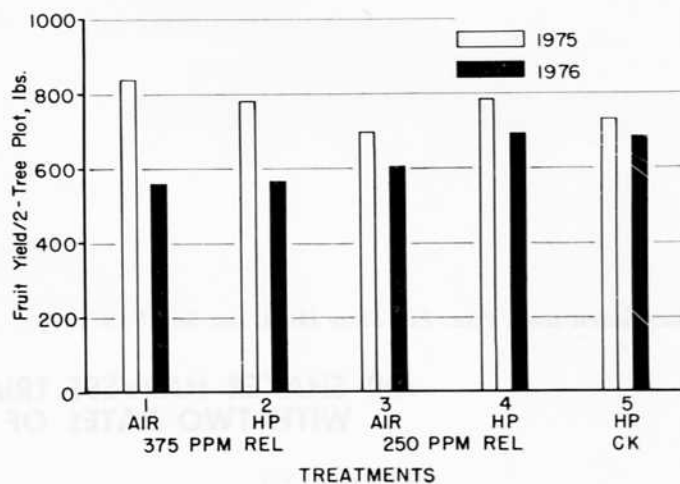


Fig. 2. Average 1975 and 1976 yield data for individual treatments in Experiments I and II.

Fig. 3 shows the 1975 and 1976 yields of (a) Release concn averaged over removal methods, (b) removal methods (air shaker vs. handpick) averaged over concn of Release and (c) the handpick checks. The 1976 yields associated with 375 ppm Release (Treatments 1 and 2) were significantly less (0.05 level) than those at 250 ppm (Treatments 3 and 4). The 1976 yields associated with the air shaker (Treatments 1 and 3) were not significantly less than those of handpicking with Release (Treatments 2 and 4).

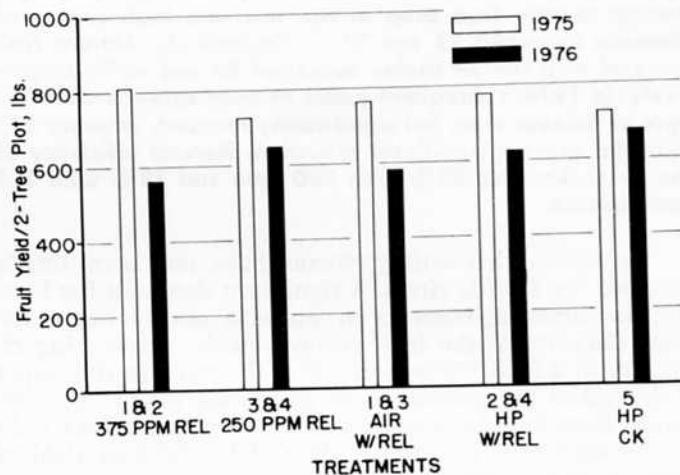


Fig. 3. Average 1975 and 1976 yield data for 375 and 250 ppm Release, the air shaker and handpick with Release, and the checks in Experiments I and II.

The harvesting efficiencies of the 2 air shaker treatments (1 and 3) can be calculated as the product of the percentage removal in 1975 (See Fig. 1) and the 1976 treatment yield and divided by the 1976 check yield (See Fig. 2) in Experiments I and II. For Treatment 1 (375 ppm Release), the harvesting efficiency was  $95.5 \times 559/680 = 78\%$ . Treatment 3 (250 ppm Release) had an efficiency of  $90.1 \times 603/680 = 80\%$ . Therefore, even though the higher concn of Release provided superior mature fruit removal, it did not result in higher harvesting efficiency because of lower subsequent yields.

The cause of the yield difference associated with the 2 ppm concn of Release was not apparent. The 375 ppm concn of Release did, however, cause noticeably more defoliation than did the 250 ppm concn. No chemical damage was noted on any of the young fruit of the sprayed trees for either concn.

In summary, the 375 ppm concn of Release resulted in more preharvest fruit drop and higher percentage fruit removal with the air shaker than did the 250 ppm concn, even when rain followed the spray application within 4 to 6 hr.

The 375 ppm concn of Release significantly reduced subsequent yields when compared to 250 ppm. The overall harvest efficiencies of the air shaker at 2 mph ground speed were 80% with 250 ppm and 78% with 375 ppm concn of Release.

#### **Literature Cited**

1. Whitney, J. D. 1975. Orange yield and removal studies with air and trunk shakers using two abscission chemicals. *Proc. Fla. State Hort. Soc.* 88:120-124.