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ABSCISSION CHEMICALS EFFECT ON THE PERFORMANCE OF A LIMB SHAKER-CATCHING FRAME CITRUS HARVEST SYSTEM¹

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Abstract. The effects of Release and Acti-Aid abscission chemicals on certain performance factors of a limb shaker-catching frame harvest system were studied in oranges. Compared to non-treated controls abscission chemicals applied to 'Hamlin' oranges had only a small effect on total fruit recovered except when a large preharvest drop occurred and then it was reduced proportionally to the drop. Also, in early season tests fruit removed with stems was reduced 70% and total fruit removal was increased about 2%. The harvest rate was increased in all tests, the increase ranging from one to 40% with the largest occurring in the late season tests. In some tests Release applied to 'Valencia' oranges reduced young fruit removal 45% and increased mature fruit removal.

Limb shaker-catching frame harvest systems have been used to a limited extent for harvesting the citrus crop in Florida. Fruit removal is achieved by shaking the limbs at varying degrees of intensity, depending on the shaker attachment position on the limb and the tightness of the fruit. Obviously, loosening the fruit would influence the performance of the harvest system. Several abscission chemicals have exhibited good fruit loosening characteristics on oranges (2, 3, 4). Information on the effects that two of these abscission chemicals (Release and Acti-Aid) have on certain performance factors of a limb shaker-catching frame harvest system in oranges is provided in this paper.

Materials and Methods

Tests were conducted in 'Hamlin' and 'Valencia' oranges on rough lemon rootstock using either Release or Acti-Aid. A harvest system

developed at the Agricultural Research and Education Center, Lake Alfred, was used to harvest the fruit (1). The same operators, who had no prior knowledge of the treatments, were employed in all tests. Trees were 18 ft tall and planted on a 25 x 25 ft spacing. They had been hedged on opposite sides in one direction and the lower limbs pruned the previous year to accommodate the harvest system.

'Hamlin' oranges. Four harvest tests were conducted at different dates during the 'Hamlin' orange season. Preharvest treatments included abscission chemical application at a high and low rate (ppm) (see Table 1) and non-treated controls. In a single row of trees, 3-tree plots were replicated 3 times. The abscission chemical was mixed with water to give the desired concentration and a surfactant (Ortho X-77) was added at 120 mls per 50 gallon of spray mixture. The mixture was applied at 10 gallons per tree to the plots with a hand sprayer and the plots were harvested 5 days later.

The harvest system was operated continuously except for a brief stop between plots to empty the fruit bins. Immediately before harvest the fruit attachment force and preharvest drop were determined for each treatment, and after the harvest the fruit left on tree, lost over frames, recovered in containers and removed with stems attached, were determined. The harvest rate in trees per hour was found by standard time and motion study procedures.

'Valencia' oranges. Three harvest tests were conducted at different dates during the 'Valencia' orange season to determine the abscission chemical (Release) effects at various stages of young fruit development. Preharvest treatments were, abscission chemical applied at a high and low rate (ppm) and non-treated controls. One-tree plots were replicated 4 times in a single row. The abscission chemical was mixed and applied in the same manner as described for the 'Hamlin' orange test.

One tree was harvested at a time and the following factors determined either before or after harvest: mature fruit attachment force, preharvest mature fruit drop, young fruit diameter, mature and young fruit removed.

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Table 1. Abscission chemical effects on limb shaker harvest system in 'Hamlin' oranges ^z.

Chem	Conc ppm	Attach force lb	Preharv drop % ^y	Catch		Fruit re- covered % ^y	Removed w/stem % ^x	Harv rate trees/hr
				frame loss % ^y	Left on tree % ^y			
Dec. 12, 1974 - Brix-acid ratio ^v 10.00								
C ^w	000	15.09	0.9	5.5	6.1	87.7	12.7	12.2
Rel ^w	100	5.64	5.8	7.6	4.0	82.6	3.3	14.9
Rel	125	7.50	8.7	8.2	4.1	78.9	4.7	12.3
Jan. 2, 1975 - Brix-acid ratio 10.39								
C	00	19.00	0.2	4.8	5.1	89.9	16.0	12.8
AA ^w	7.5	10.10	0.4	5.1	4.5	89.9	4.6	13.6
AA	15	6.90	1.6	6.3	2.6	89.5	3.7	15.2
Jan. 21, 1975 - Brix-acid ratio 13.09								
C	00	14.93	0.0	3.0	3.0	91.0	7.7	10.8
AA	7.5	11.78	0.0	3.7	7.0	89.1	7.7	11.9
AA	15	10.32	0.0	4.1	4.5	91.2	5.0	14.1
Feb. 7, 1975 - Brix-acid ratio 13.87								
C	00	10.41	0.0	5.0	3.0	89.5	5.7	11.6
AA	7.5	7.55	0.0	5.0	3.9	90.2	5.7	14.9
AA	15	4.54	2.3	5.3	2.2	90.0	4.3	15.1
Rel	75	9.48	0.0	6.9	3.4	89.6	8.6	11.8
Rel	100	6.88	0.0	4.5	2.9	92.2	3.6	16.2

^zAverage of 3 replications of 3-tree plots.

^yPercent of yield.

^xPercent of fruit recovered.

^wC = Control; Rel = Release; AA = Acti-Aid.

Results and Discussion

'Hamlin' oranges. The abscission chemicals effects on several system performance factors are presented in Table 1. All abscission chemical treatments reduced the fruit attachment force over that of the non-treated controls and the higher rates were more effective. However, in some treatments the higher rate caused a preharvest fruit drop which reduced the percentage of fruit yield recovered by the harvester. In most of the tests the percent of fruit lost over catching frames increased with a decrease in attachment force which may have been the results of increased fruit bouncing caused by faster removal. The

percent of the total fruit left on the tree and the percent of the fruit recovered with stems were reduced by the abscission chemical treatments in the December 12 and January 2 tests. However, these treatments had little effect in the January 21 and February 7 tests, which probably was due to the small differences between the attachment force of the non-treated and treated fruit in these late season tests. Harvest rate (trees per hr) was increased by the abscission chemicals in all tests with the largest occurring in the February 7 test which was a late season test.

Both abscission chemicals exhibited similar fruit loosening characteristics at the corresponding

high and low rates used, however, it was observed that Release treated fruit required a greater snapping force for removal than Acti-Aid treated fruit. Also, Release caused a smaller leaf drop than Acti-Aid in all tests.

Compared to non-treated fruit, the abscission chemical treated fruit had the following beneficial effects on the harvest system performance: 1) increased harvest rate ranging over season from one to 40%, and 2) increased fruit removal efficiency about 2%, and reduced fruit removed with stems about 70% at the early part of the season. The main nonbeneficial effect was the loss of fruit from preharvest drop which was dependant on the effective coordination of the chemical action with time of harvest.

'Valencia oranges. Only the abscission chemical, Release, was used in the 'Valencia' test. No young fruit loosening was observed that could be attributed to the abscission chemical. The effects of Release on certain performance factors of the harvest system are summarized in Table 2. The mature fruit loosening characteristics of Release was similar to that obtained in 'Hamlin' oranges, however, a higher rate was required. Preharvest drop ranged from zero to 22.6% and varied with the chemical concentration.

Young fruit removal was reduced by the chemical with the reduction varying inversely to the concentration in May 7 and June 10 tests. No explanation is offered for the lack of a reduction in young fruit removal that occurred at 300 ppm concentration in the May 31 test. The chemical increased mature fruit removal and the increase was larger in tests at the earlier dates when the control fruit attachment force was larger. These tests indicate that Release does aid in the selective harvest of 'Valencia' oranges but extreme care must be exercised to prevent shaking the trees hard enough to cause a young fruit removal large enough to reduce next year's crop.

Table 2. Abscission chemical (Release) effects on limb shaker harvest system in 'Valencia' oranges ^z.

Conc ppm	Attach force lb	Pre-harv drop % ^y	Young fruit removed No	Mature fruit removal % ^y
May 7, 1974 (Y fruit dia -0.32")				
C ^x	20.3	0.9	2052	87
175	7.8	6.8	1962	94
300	8.0	22.6	1291	96
May 31, 1974 (Y fruit dia -0.74")				
C	15.3	0	933	84
175	15.9	0	1207	96
300	3.8	7	933	96
June 10, 1974 (Y fruit dia -1.07")				
C	16.5	0	412	95
175	7.0	1	323	94
300	5.9	6	227	98

^zAverage of 4 replications of one-tree plot.

^yPercent of tree yield.

^xC = Control.

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