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SUBSEQUENT YIELDS OF 'VALENCIA' ORANGE TREES SPRAYED WITH ABSCISSION CHEMICALS[1,2]

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Abstract. **Four abscission chemical treatments were evaluated over two harvest seasons to determine their effect on subsequent fruit yields of hand harvested 'Valencia' orange trees. Subsequent fruit yields were reduced by abscission chemical treatments, especially when concentrations used exceeded those recommended on the manufacturer's label. Curves of cumulative post-harvest young fruit drop also indicated that more fruit had dropped from chemically treated trees during a 15-day period after treatment than from the nonsprayed trees.**

Satisfactory performance of shakers to remove citrus by mechanical harvesting may depend on the effectiveness of an abscission chemical in reducing the fruit removal force. Shakers that remove mature 'Valencia' fruit also remove the young 'Valencia' fruit from the tree at harvest time. If no abscission chemicals are used, removal of mature fruit with limb shakers may have negligible effect on subsequent yields when young fruit are less than 0.5 in. (1.3 cm) in diameter; however, as the season progresses, young fruit removal by shaking can be appreciable and subsequent yields have been reduced 50% (1). Furthermore, without the aid of abscission chemicals, the limbs must be shaken harder and for a longer period of time than oranges treated with abscission chemicals, and such aggressive shaking is more likely to cause tree damage and reduced shaker life.

Abscission chemicals that would reduce the pull force of the mature 'Valencia' fruit without affecting the pull force or the natural development of the young fruit have been sought. RELEASE (5-chloro-3-methyl-4-nitro- 1H-pyrazole) and PIK-OFF (glyoxime) have been used in Florida citrus groves to loosen mature 'Valencia' fruit and, thus, facilitate shaker removal of oranges. Both chemicals have been cleared for experimental use on citrus by the Environmental Protection Agency.

Limb-shaker harvesting tests resulted in subsequent 'Valencia' yield reduction when RELEASE was applied at a concentration of 275 ppm (2). Results of air shaker tests also indicated a yield reduction with 250 and 375 ppm concentrations of RELEASE (3,4). Subsequent yields with the 375 ppm concentration were significantly less than those with the recommended concentration of 250 ppm for air-shaker and hand harvesting treatments. The 375-ppm concentration also resulted in more defoliation than did the 250-ppm concentration.

The objective of the research reported in this paper was to determine the effect of selected concentrations of abscission chemicals on the subsequent yields of hand-harvested 'Valencia' orange trees.

Materials and Methods

The experiment was established in a mature 'Valencia' orange grove near the Agricultural Research and Education Center (AREC) at Lake Alfred. The trees were on rough lemon rootstock, spaced 25 ft x 25 ft (7.6 m x 7.6 m) and ranging in height from 20 to 25 ft (6.1 to 7.6 m). In 1975, they were hedged to a 7-ft (2.1-m) wide middle, and undesirable limbs were removed. The yields in 1977 ranged from 8 to 11 boxes (327 to 450 kg) per tree.

The experiment consisted of four abscission chemical treatments plus one check treatment (Table 1) evaluated on two harvest dates (two tests) during the 1978 and 1979 harvest seasons. Tests 1 and 2 were conducted on two separate 30-tree plots, with each plot divided into 6-blocks of 5 trees each. The trees used in Test 1 for the 1978 harvest were used again in Test 1 for the 1979 harvest. The same applied for the Test 2 trees. Treatments were randomly assigned to the five trees in each block. The abscission chemicals were applied with a hand sprayer at a rate of

Table 1. Performance of chemicals.

Treatment[z]	Rate[y] ppm	FRF[x] lb	FRF[x] (N)	Preharvest fruit drop (Percent)	PYR[w, u]
		Test 1, May 30—1978			
RH	400[v]	2.5	(11.1)	40	82 b
RL	250	3.7	(16.5)	17	95 b
R+A	250+1	2.4	(10.8)	24	99 ab
PO	300[v]	3.7	(16.5)	23	93 b
CK	—	18.6	(82.5)	2	122 a
		Test 2, June 13—1978			
RH	400[v]	6.3	(28.1)	13	85 b
RL	250	8.1	(35.9)	7	107 a
R+A	250+1	7.3	(32.7)	5	79 b
PO	300[v]	7.6	(33.9)	17	94 ab
CK	—	17.0	(75.6)	1	108 a
		Test 1, May 22—1979			
RH	400[v]	3.7	(16.5)	12	106 a
RL	250	3.8	(16.9)	7	88 a
R+A	250+1	2.8	(12.5)	7	84 a
PO	300[v]	3.1	(13.8)	8	93 a
CK	—	10.7	(47.6)	1	116 a
		Test 2, June 4—1979			
RH	400[v]	3.8	(16.9)	24	
RL	250	6.0	(26.7)	9	
R+A	250+1	2.5	(11.1)	16	
PO	300[v]	2.5	(11.1)	11	
CK	—	16.1	(71.6)	2	

[z]RH—RELEASE high concn; RL—RELEASE low concn; R+A—RELEASE low concn, plus ACTI-AID-(Cycloheximide); PO—PIK-OFF; CK—check (no chemical).
[y]Chemical applied at 15 gal (56.8 *l*) per tree of mixture. Ortho X-77 surfactant was applied with RELEASE treatments at the rate of 2.5 ml/gal (0.66 ml/*l*) of mixture.
[x]FRF—fruit removal force. Data taken on 3 trees/treatment, 15 readings/tree.
[w]PYR—percent yield ratio, (subsequent yield ÷ 1978 yield) x 100.
[v]Chemical application rate exceeds label recommendation.
[u]Means within a column followed by the same letter are not significantly different at the 5% level according to Duncan's multiple range test.

[1]Cooperative research by USDA, Science and Education Administration, Agricultural Research, Florida Department of Citrus, and University of Florida.

[2]Trade names and company names are used in this publication solely for the purpose of providing specific information. Their mention does not constitute a guarantee or warranty of a product by the U. S. Department of Agriculture or an implication of product registration under FIFRA as amended.

15 gal. 56.8 *l*) per tree, 4 to 5 days before harvest. Orth. X-77 surfactant was applied with RELEASE treatments at the rate of 2.5 ml/gal (0.66 ml/*l*) of mixture.

The average weight and droppage of young fruit were determined during the 1978 and 1979 harvest season from four nonsprayed check trees in the grove. Figure 1 gives the dates of abscission chemical application and weight of the young fruit. The young fruit droppage from trees in test 2 was recorded for 4 weeks after harvest in 1979.

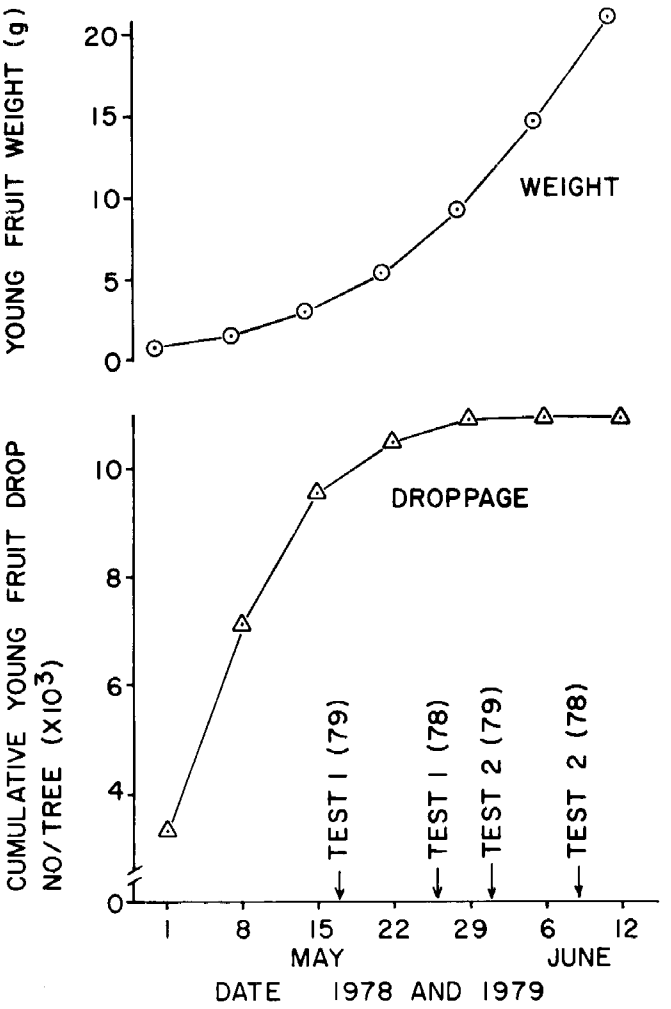

Fig. 1. Average young fruit weight and droppage per nonsprayed tree during the 'Valencia' harvest season for 1978 and 1979 harvest season. Dates of tests 1 and 2 are the days of application for the abscission chemical treatments.

On the day of harvest, pull force measurements on mature fruit were recorded along with counts of mature-fruit preharvest drop for each of the five treatments. The mature fruit yield was determined from each tree by weighing the fruit harvested. All trees in the experiment were hand harvested.

In 1978 the dates of chemical application were May 26 and June 9, (young-fruit average weight—6.5 and 18 g. respectively), and in 1979 they were May 17 and 31 (young-fruit average weight—4.5 and 12.5 g, respectively). Fruit were hand harvested 4 to 6 days later and on June 17, 1980. The effect of the chemical treatments on fruit yield were determined as measured by differences in the subsequent fruit yields harvested in 1979 and 1980.

The deviations of the fruit yields subsequent to 1978 and 1979 treatment dates were compared with the initial yields (1978). Yield data were statistically evaluated by analysis of variance and by Duncan's multiple range test.

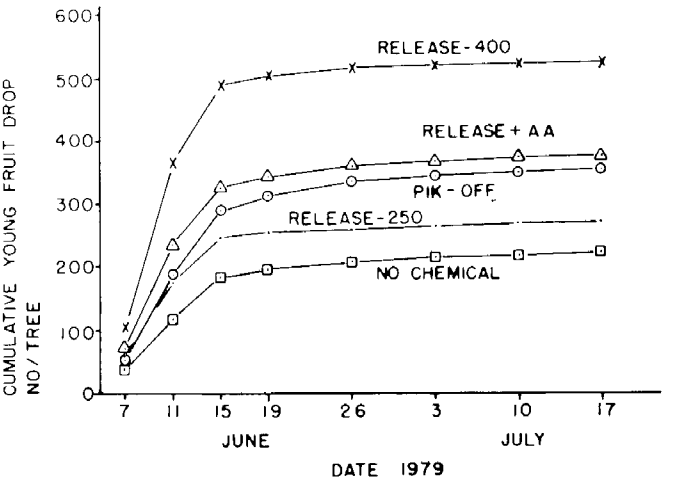

Fig. 2. Cumulative young fruit droppage per tree after application of abscission chemicals and mature fruit harvest for the 1979 season (Test 2).

Results and Discussion

The performance of each of the chemical treatments is given in Table 1. All chemical treatments provided good fruit loosening. The RH treatment resulted in the highest percentage of preharvest fruit drop, except in test 2—1978, in which the PO treatment resulted in the highest percentage. The RL treatment required the greatest amount of fruit removal force in all tests; however, this force was considered within an acceptable range for a mechanical harvesting system.

Figure 2 illustrates the average cumulative young fruit droppage per tree for test 2 after harvest (June 4, 1979). All treatments had a high droppage rate until June 15th, when they decreased to a low droppage rate with little or no droppage. The cumulative young fruit droppage within the 15-day period after harvest was greatest with the RH treatment and least with the CK treatment. The curve for the RL-treatment droppage was only slightly above that for the CK treatment. The R+A and PO treatments resulted in approximately the same young-fruit droppage.

Leaf droppage was minor from RL-treatment trees, but was excessive from the RH-treatment trees. Leaf droppage from treatments PO and R+A were between that from RL and RH; the PO treatment removed more leaves than the R+A treatment.

Figures 3 and 4 show the average tree yields and deviation from the initial yield (1978). Yields from the check treatment for 1979 and 1980 were greater than the initial yields. The deviations were 21 and 14 percent respectively, for test 1 and 6 percent for test 2 in 1979. The deviations between the initial and subsequent yields for the chemical treatments for test 1 and 2 ranged from −18 percent to +5 percent. The yield data for test 2 in 1980 was not considered in the evaluation because part of the data was lost and several of the trees had to be removed from the test because they showed signs of tree decline.

To reduce yield variability caused by tree size, we assumed that the yield potential of each tree was assumed to be the 1978 base yield. For statistical comparison, values of percentage yield ratio (PYR) were determined for each tree as (subsequent yield ÷ 1978 yield) × 100.

Yields for 1979 in tests 1 and 2 were significantly different between treatments and the check yields were the highest for both tests (Table 1). The R+A treatment reduced subsequent yields more when applied late than when applied early in 1978, even though the abscission effective-

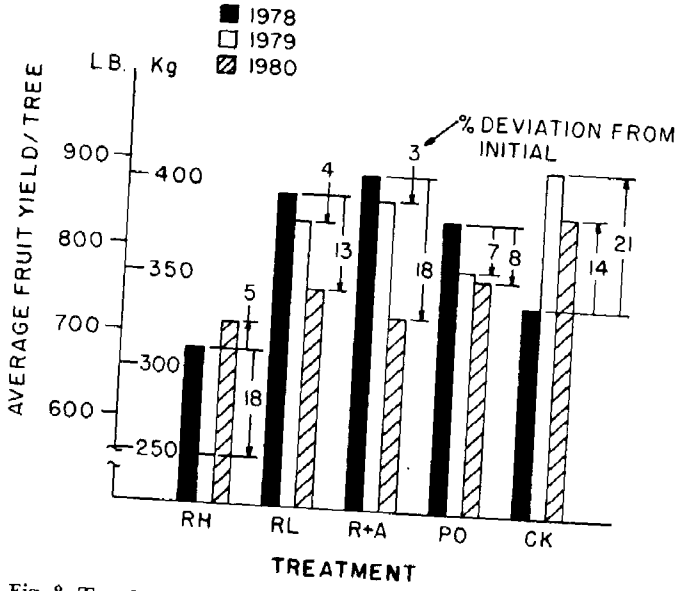

Fig. 3. Test 1—The initial and subsequent treatment yields and the deviation of the subsequent yields from the initial yields. The treatment codes are: RH—400 ppm RELEASE; RL—250 ppm RELEASE; R+A—250 ppm RELEASE plus 1 ppm ACTI-AID; PO—300 ppm PIK-OFF; CK—CHECK (No Chemical).

ness was less for test 2 (preharvest fruit drop decreased and fruit removal force increased). This result may have been caused by more leaf drop late in the harvest season, an established characteristic effect of the ACTI-AID abscission component. For both tests the RH treatment resulted in lower subsequent PYR values than the RL treatment; however, they were not significantly different for test 1. PYR for 1979, Test 1, indicated no significant differences between treatments; however, the check PYR was higher than that for any chemical treatment.

Because of the alternate-bearing characteristics of the 'Valencia' orange variety, measurement of small differences in subsequent fruit yields or reaching specific conclusions about chemical treatment levels was difficult. However,

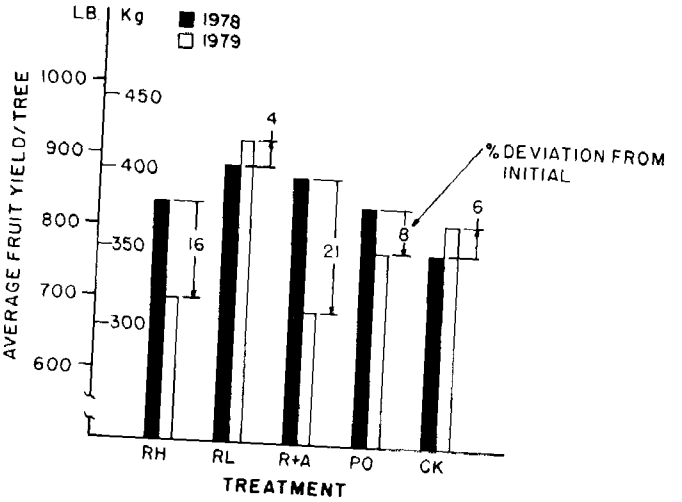

Fig. 4. Test 2—The initial and subsequent treatment yields and the deviation of the subsequent yield from the initial yields. The treatment codes are: RH—400 ppm RELEASE; RL—250 ppm RELEASE; R+A—250 ppm RELEASE plus 1 ppm ACTI-AID; PO—300 ppm PIK-OFF; CK—CHECK (No Chemical).

cumulative postharvest droppage of young fruit indicated that application of abscission chemicals at rates above those recommended by manufacturer's label reduced subsequent yields of hand-picked 'Valencia' orange trees when compared with check (no chemical) treatments.

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