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Abscission Chemical Effects on Shaker-catchframe Harvest System Performance and Subsequent 'Hamlin' and 'Pineapple' Orange Yield[1]

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Abstract. **Four abscission chemical treatments (Acti-Aid, 20 ppm cycloheximide) (Release, 125 ppm 5-chloro-3-methyl-4-nitro-1H-pyrazole) (Acti-Aid, 5 ppm + Sweep, 250 ppm chlorothalonil + Release, 125 ppm) and (Pik-Off, 300 ppm glyoxal dioxime) were applied to the same orange trees (*Citrus sinensis* (L.) Osbeck, cv. Hamlin and Pineapple) for 3 consecutive years to aid harvest with a shaker-catchframe system. The treatments had no significant effect on subsequent fruit yield for years not influenced by freezing temperatures.**

The strong force required to detach citrus fruits from the tree has been a deterrent to the successful use of mechanical harvesting systems (2). However, limb shakers (with or without catchframes) are capable of removing close to 100% of the fruit on a citrus tree, provided the operator is willing to spend the necessary shaking time. Abscission chemicals function to facilitate fruit removal so that 95% or more of the fruit can be achieved in a shorter time period and with less energy expenditure and mechanical wear to the shaker. Several abscission chemicals for loosening the fruit have been identified; however, they are dependent on favorable weather conditions for satisfactory loosening of the fruit (3). Leaf drop associated with the use of some of these chemicals and with shaker-type harvest systems has caused concern about the long-term effect of their repeated use on tree vigor and subsequent fruit yield. An experiment was conducted over 3 consecutive seasons to determine if 4 abscission chemical treatments used with a shaker-catchframe harvest system affected the bearing capacity of trees as measured by subsequent fruit yields.

Treatments are listed in Table 1. Harvesting tests were conducted with 'Hamlin' oranges beginning on January 7, 1976, January 6, 1977, and January 4, 1978. With 'Pineapple' harvest, the tests were initiated on Jaunary 8, 1976, January 24, 1977, and January 20, 1977. All harvests were concluded within 2 days.

Three-tree plots were used to facilitate the harvest operation. Treatments were replicated 3 times in a randomized block design for a total of 9 trees per treatment. Each plot received the same treatment for 3 consecutive years.

Thirty-eight liters (10 gal) of spray were applied to each tree with a modified AgTec sprayer. Ortho X-77 surfactant (0.1%) was used with Acti-Aid, Release, and a combination of Acti-Aid + Sweep + Release (ASR). As recommended by the manufacturer, no surfactant was used with Pik-Off. Control trees were not sprayed. Treatment plots were harvested 4 days following application of chemical treatments with an experimental shaker-catchframe harvest system described by Coppock (1). Control plots were also harvested at this time. The shaker operators were experienced and applied shaking action to each tree so that, in their judgment, at least 95% of the fruit was removed. Fruit not caught by the catchframes and that dropped before harvest were manually gleaned during the harvest operation and were included in the total fruit recovered with the system. Any fruit remaining on the trees following harvest with the shakers were gleaned by hand. Fruit recovered and that gleaned from the trees were weighed for each plot as a measure of yield and to determine the percentage of fruit recovered. Fruit removal force (FRF) and preharvest drop from each tree were measured immediately before harvest. Fifteen measurements of FRF were made per plot for each harvest.

The performance data for the treatments and harvest system are shown in Table 1. FRF for 'Hamlin' and 'Pineapple' oranges averaged 54% less for all chemically-treated fruit than for the control. On the average, Acti-Aid and the ASR combination reduced FRF more than the other chemical treatments. Preharvest drop for both cultivars ranged from 0.0 to 3.2% of fruit yield. Abscission chemical treated plots required less shaking time for 95% fruit removal as noted in other experiments (1).

The subsequent fruit yield of the 'Hamlin' and 'Pineapple' orange plots for 1976, 1977, and 1978 tests is shown graphically in Fig. 1. The subsequent plot yields are compared to the initial 1975 plot yield for each treatment. The initial plot yield is considered to represent the relative bearing capacity of the plots before treatments were applied. The devia-

Table 1. The performance obtained from 4 abscission chemical treatments and no chemical control when used in a shaker-catchframe harvest system, (average over 3-year period.)

Treatments	Cultivar	FRF ± SD[z]	Preharvest drop (%)	Fruit recovery (%)
Chemical concn.		Newtons		
No chemical (control)	Hamlin	58.7 ± 4.2	0.3	96
No chemical	Pineapple	81.4 ± 13.8	0.0	95
Acti-Aid	Hamlin	21.8 ± 7.6	1.2	98
20 ppm	Pineapple	31.6 ± 9.3	3.2	98
Release	Hamlin	32.5 ± 14.2	1.6	98
125 ppm	Pineapple	42.7 ± 12.0	1.5	98
ASR Comb[y]	Hamlin	21.8 ± 8.1	2.8	98
5-250-100 ppm	Pineapple	32.5 ± 10.2	1.5	98
Pik-Off	Hamlin	32.5 ± 8.0	0.5	97
300 ppm	Pineapple	43.6 ± 10.7	1.3	98

[z]FRF = Fruit Removal Force. (1.0 Newton = 0.225 ft-lb.)
[y]ASR = Acti-Aid + Sweep + Release.

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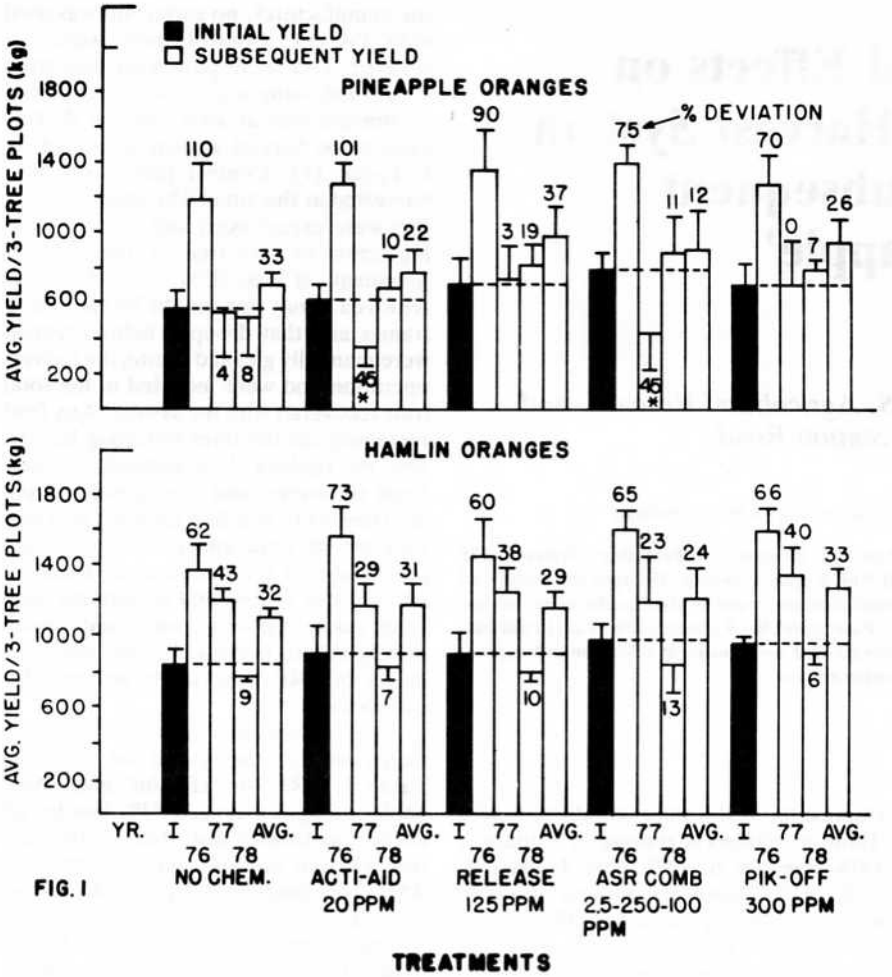

FIG. 1

Fig. 1. Plot yields and percent deviation from initial plot yield for chemical treatments in 'Hamlin' and 'Pineapple' oranges. Standard deviation of treatment means is shown by a bar. Significance at 5% level is indicated by *.

tion of subsequent plot yield from initial yield represents treatment effect plus seasonal yield differences. Comparison of the control deviation from initial yield with treatments provided a measure of treatment effect. The chemical treatments on 'Hamlin' oranges had no significant effect on subsequent fruit yields.

The 1977 'Pineapple' orange yields were significantly reduced only in the Acti-Aid and ASR plots. A freeze during the 1977 harvest, 2 days after plots were sprayed, probably caused the reduction since substantially increased fruit loosening and defoliation (75% or more) were observed in these plots. The freeze had no significant effect on subsequent yields for the Release and Pik-Off plots, neither of which had observed defoliation different from the control. The data for this freeze year confirms observations from commercial harvesting operations in other seasons that Acti-Aid applications a few days prior to a freeze can substantially increase freeze damage to a citrus tree.

The abscission chemical treatments used in these experiments were equal to or near the maximum concentrations reported as being feasible for early and midseason oranges (3). Therefore, these results should be comparable to those from commercial practice. Harvesting with catchframes was accomplished within 4 days of the sprayed treatment to avoid the heavy fruit drop and additional hand gleaning which could be expected following the use of these concentrations.

This study indicates that these abscission chemical treatments can be safely used as an aid to a shaker-catchframe harvest system without reduction in subsequent early and midseason orange yields. However, if weather forecasts indicate a strong probability of freezing weather, Acti-Aid should not be used in the abscission sprays.

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