

Handling and Processing Section

Proc. Fla. State Hort. Soc. 91:102-103. 1978.

THE EFFECTS OF VARYING SPRAY CONCENTRATIONS AND GALLONAGE ON ABSCISSION PERFORMANCE OF PIK-OFF (GLYOXIME) ON ORANGES FOR PROCESSING

W. C. WILSON
Florida Department of Citrus
P.O. Box 1088, Lake Alfred, FL 33850

Additional index words. abscission chemicals, glyoxime, citrus fruits, growth regulators, *C. sinensis* Osbeck.

Abstract. PIK-OFF (ethanedial dioxime), a CIBA-GEIGY Corp. product, was evaluated during the 1977-78 Florida citrus fruit season. Results of a series of gallonage versus concn field tests showed increased amounts of chemical per acre substantially improved abscission performance. Particular improvement was noted on large trees where 500 gal (1892.7 l) of spray per acre (0.4 ha) did not appear to give adequate coverage with the maximum label recommendation of 5 qts (18.9 l) PIK-OFF (1 lb (0.454 Kg) active per gal or 3.78 l) per acre. Adverse weather conditions greatly reduced the effectiveness of PIK-OFF.

PIK-OFF has been undergoing experimental testing for several seasons (2, 3). Advantages of using PIK-OFF include its probable low cost, simple chemical structure, compatibility with the late season or 'Valencia' orange, and minimum residues. At times it has given erratic fruit loosening and has generally not reduced fruit removal force (FRF) to desired levels for efficient air shaker harvesting. Fruit loosening problems appeared to be more prevalent with large trees (18 ft (5.5 m) or taller). The purpose of these field tests was to evaluate spray coverage, as affected by gallonage and concn, on fruit loosening.

Materials and Methods

PIK-OFF was applied to 'Hamlin', 'Pineapple' and 'Valencia' oranges using the Florida Department of Citrus (FDOC) modified AG-TEC (airblast) sprayer or with a standard FMC hand sprayer. All groves were located near Lake Alfred. Trees were rather large and were estimated to be 20 ft (6.1 m) in height. Measurements of FRF were recorded on 15 fruit per tree using a hand-held Hunter spring mechanical force gauge 4-7 days following the sprays. Fruit drop was also recorded at that time. Treatments consisted of 5 or more trees with 2 or more replications. Tree spacings were 25 x 25 ft (7.6 x 7.6 m) (70 trees per acre or 175 per ha) producing spray gallonage requirements per tree of 7.14, 10.7 and 14.28 (27, 40 and 54 l), respectively, at 500, 750 and 1,000 (1892, 2839 and 3785 l) per acre (0.4 ha).

Results and Discussion

The tests on 'Hamlin' oranges were generally negated by

cold weather and rains. (All currently used abscission agents suffer reduced effectiveness when subject to adverse climatic conditions). Low temperatures also negatively affected the tests on 'Pineapple' oranges. However, an overall trend of reduced FRF was noted with increased gallonage and concentration (Table 1). Observed fruit drop was variable, but generally increased with increasing concentration and gallonages.

Table 1. The effect of varying spray concn and gallonages of PIK-OFF on abscission performance of 'Pineapple' oranges. Sprays were applied February 20, 1978 and FRF readings were taken February 27, 1978.

Qts/tank*	Gal/acre	FRF (lb) & SD ^w	Fruit drop (avg)	Rank
3	500	6.36 ± 4.16	28	8
3	750	6.24 ± 3.44	50	7
3	1000*	4.87 ± 3.49	87	2
4	500	5.18 ± 2.47	24	5
4	750*	5.33 ± 3.49	58	6
4	1000*	4.93 ± 2.42	95	3
5	500 ^v	6.60 ± 3.70	36	9
5	750*	5.04 ± 2.09	61	4
5	1000*	3.14 ± 2.00	160	1
Control	—	7.74 ± 4.24	25	10

*Tank contains 500 gal.

^vMaximum allowable chemical per acre according to label recommendations.

^wExceeds label recommendations.

*1 lb = 0.454 kg; 1 acre = 0.4 ha; 1 gal = 3.78 l; 1 qt = 0.946 l.

Trends on early and midseason oranges were confirmed with tests on 'Valencia' oranges (Table 2). Substantial reduction in FRF and avg fruit drop were observed with increasing gallonage and concn. This experiment was conducted under weather conditions where low temperatures were not a factor.

Table 2. The effect of varying concentrations and gallonage on abscission performance of PIK-OFF with 'Valencia' oranges. Sprays were applied April 21, 1978 and FRF readings were taken April 25, 1978.

Qts/tank*	Gal/acre	FRF (lb) & SD	Fruit drop (avg)	Rank
3	500	8.84 ± 3.91	43	9
3	750	7.69 ± 4.58	65	8
3	1000*	5.51 ± 3.55	95	5
4	500	7.09 ± 4.46	62	7
4	750*	5.49 ± 3.66	108	3
4	1000*	5.58 ± 3.74	206	5
5	500 ^v	6.12 ± 3.68	93	6
5	750*	3.71 ± 2.65	218	2
5	1000*	3.22 ± 2.28	259	1
Control	—	16.78 ± 4.20	7	10

*Tank contains 500 gal.

^vMaximum allowable chemical per acre according to label recommendations.

^wExceeds label recommendations.

¹Florida Agricultural Experiment Stations Journal Series No. 1429. Experiments were conducted in cooperation with CIBA-GEIGY Corp., Deland, FL and Greensboro, NC. Technical assistance of Mr. Jerry Eley and Mr. Earl Rowland is hereby acknowledged.

To differentiate between the effects of gallonage versus concentration, an additional test was conducted (Table 3). This test strongly indicated that most of the improved response from the sprays was a function of increased concentration rather than increased gallonage, although increasing gallonage of a given concn of PIK-OFF does reduce FRF and increase fruit drop somewhat (Table 2). Attempts to split applications (one-half applied one day, the second one-half the following day) proved not beneficial.

Table 3. The effect of varying spray gallonages and split application sprays on the performance of PIK-OFF with 'Valencia' oranges. Split application sprays were applied May 25, 1978. Single sprays were applied May 26, 1978. FRF was taken May 30, 1978.

Qts/acre	Gal/acre	FRF (lb) & SD	Fruit drop (avg)	Rank
3	500	9.90 ± 5.00	57	5
3	1000	13.49 ± 4.35	25	7
5*	500	7.20 ± 5.10	159	2
5*	1000	9.63 ± 4.37	89	4
10 [†]	1000	3.74 ± 3.46	412	1
1.5 + 1.5	500 + 500	12.06 ± 5.68	26	6
2.5 + 2.5 [‡]	500 + 500	8.31 ± 4.81	93	3
Control	—	14.40 ± 3.78	0	8

*Maximum allowable chemical per acre according to label recommendations.

[†]Exceeds label recommendations. Applied by hand sprayer.

In the central citrus producing area of Florida, many older citrus groves have trees ranging upwards from 18 ft (5.5 m) in height unless hedging and topping are practiced. The growth habit of orange trees also is such that these trees

develop expansive canopies. Field experience with abscission chemicals has demonstrated that adequate spray coverage of these trees is often not accomplished with present machinery.

PIK-OFF is currently labeled for use with a maximum of 5 qts (18.9 l) (1 lb (0.454 Kg) active glyoxime per gal) per acre (1). With large trees, it is difficult to obtain adequate spray coverage at a rate of 500 gal (1892 l) per acre. Results of these tests strongly indicate that increasing gallonages to 750 (2839 l) or 1,000 (3785 l) with corresponding concn of 7.5 (7.1 l) and 10 (9.46 l) qts might reduce the poor performance of PIK-OFF on these larger trees. However, increasing the amount of material applied is impossible without state or federally allowed label changes.

In the original request for temporary tolerance to the federal Environmental Protection Agency (EPA), it would appear that total tree area was not adequately considered when computing maximum allowable chemical per acre. Since chemical residue on fruit appears to be a function of total tree area covered rather than ground area, increasing concn and gallonages for citrus groves with large trees should not produce excessive fruit residues.

Literature Cited

1. Technical Release. 1977. Experimental plant growth regulator PIK-OFF™ (CGA-22911). Agr. Div., CIBA-GEIGY Corp., Greensboro, NC 27409.
2. Wilcox, M., J. B. Taylor, W. C. Wilson and I. Y. Chen. 1974. Chemical abscission of 'Valencia' oranges by glyoxime (CGA-22911). *Proc. Fla. State Hort. Soc.* 87:22-24.
3. Wilson, W. C., R. E. Holm and R. K. Clark. 1977. Abscission chemicals-aid to citrus fruit removal. *Proc. 1977 Inter. Citrus Congress*. Vol. 3. (In press).

Proc. Fla. State Hort. Soc. 91:103-106. 1978.

INCREASING THE EFFECTIVENESS OF RELEASE^{®1} AS A HARVEST AID FOR CITRUS FRUITS²

R. H. BIGGS, S. V. KOSSUTH AND F. G. MARTIN³

Fruit Crops Department, Univ. Fl, Gainesville, FL 32611,

SE Forest Experiment Station, P.O. Box 70,

Olustee, FL 32072,

and Statistics Department, Univ. Fl., 32611

Additional index words. *Citrus sinensis* (L.) Osbeck, abscission, growth regulators, regreening, cuticle, cycloheximide, surfactants, adjuvants, harvesting, uptake, absorption.

Abstract. Uptake of Release[®] in 2- and 3-way combinations with Sweep^{®4}, Acti-aid^{®5} and other adjuvants were tested on 'Valencia' orange (*Citrus sinensis* (L.) Osbeck). Immature, green oranges had the highest levels (65-84%) of uptake with decreasing amounts of ¹⁴C recovered from December to May (43 to 49%), irrespective of additives. Ad-

juvants may be beneficial in causing spray retention on the orange under conditions of field application but did not increase uptake compared to the water control when runoff was eliminated, demonstrating that the critical parameter is surface retention. The data indicated that 1 ppm Acti-aid results in sufficient tissue changes to stimulate active uptake by as much as 34 percent, whereas 20 ppm inhibited uptake. Sweep combined with Release significantly increased uptake of Release by 20 percent on "regreened" or non-responsive oranges, and also significantly increased uptake of Release in the 3-way combination with Acti-aid. The patterns of uptake can be used to increase field reliability in using chemicals to aid in fruit harvest.

The use of abscission chemicals as aids to mechanical and hand harvest of citrus was limited at first to early- and mid-season fruit such as 'Hamlin', 'Parson Brown' and 'Pineapple' oranges (7, 8, 16, 28, 21). The difficulties with 'Valencia' orange, a late-season cultivar whose production makes up 45% of the Florida crop, were that Acti-aid (cycloheximide) and other abscission chemicals were erratic in performance or damaged young fruit, flowers or leaves at the time of harvest (19, 20). Release (5-chloro-3-methyl-4-nitro-1H-pyrazole) is an abscission chemical which can be used on 'Valencia' but it can give poor results in loosening the fruit at certain times of the year.

¹Release is a trademark registered by Abbott Laboratories.

²IFAS Journal Series No. 1538.

³A portion of this work was done under a contract from the Florida Department of Citrus, Harvesting Research and Development Committee, to Drs. R. H. Biggs and S. V. Kossuth and was also supported by National Science Foundation Grant #DEB 76-04150 to Dr. Hellmers for the Duke University Phytotron.

⁴Chlorothalonil and Sweep are trade names for formulations registered by Diamond Shamrock Corporation.

⁵Acti-aid (cycloheximide) is registered by Upjohn Company.