

4. French, J. V. and L. W. Timmer. 1979. Control of rust mite and reduction of citrus nematode populations on Texas oranges with Temik. *J. Rio Grande Valley Hort. Soc.* 33:55-62.
5. French, J. V. and L. W. Timmer. 1981. Suppression of citrus rust mite and citrus nematode on Texas grapefruit with aldicarb. *Proc. Int. Soc. Citriculture* 2:672-74.
6. Knapp, J. L., T. R. Fasulo, D. P. H. Tucker, and R. P. Muraro. 1982. Comparison of yield, quality and dollar return on fruit produced on Temik and non-Temik treated citrus trees. *Proc. Fla. State Hort. Soc.* 95:59-60.
7. Simanton, W. A. 1976. Population of insects and mites in Florida citrus groves. *Fla. Agric. Exp. Sta. Monogr. Ser. No. 7.* p 1-141.
8. Timmer, L. W., R. F. Lee, and D. P. H. Tucker. 1982. Effect of aldicarb treatment of citrus trees on sharpshooters. *Proc. Fla. State Hort. Soc.* 95:56-59.
9. Wheaton, T. A., C. C. Childers, L. W. Timer, L. W. Duncan, and S. Nikdel. 1985. Effects of aldicarb on yield, fruit quality, and tree condition of Florida citrus. *Proc. Fla. State Hort. Soc.* 98:6-10.

Proc. Fla. State Hort. Soc. 102:44-46. 1989.

DICOFOL: THE INFLUENCE OF APPLICATION METHOD ON SNOW SCALE POPULATION AND SEX RATIO

A. C. WHITE

*Consulting Entomologist
817 W. Fairbanks Ave.
Orlando, FL 32804*

T. J. STELTER

*Rohm & Haas Company (Retired)
224 DeSota Road
West Palm Beach, FL 33405*

Abstract. Post-bloom and summer sprays of dicofol were made to mature grapefruit trees infested with citrus snow scale, *Unaspis citri* (Comst.) in 1986 to compare the effects of hand gun sprays with typical speed sprayer applications on the citrus snow scale population. The hand gun sprays, where the foliage, tree trunks, and scaffold limbs were directly sprayed to run-off resulted in increased citrus snow scale population. The influence of dosage rates on the population increase was not statistically significant. The typical speed sprayer applications, using 220 gallons per acre in the post-bloom spray and 777 gallons per acre in the summer spray, did not result in a significant increase in the citrus snow scale population. Neither the hand gun sprays nor the speed sprayer applications resulted in a statistically significant increase in the female to male ratio of the citrus snow scale population in this study.

This study was initiated by Rohm & Haas Company to determine the influence of the miticide difocol (Kelthane MF) and the relation of application methods on the citrus snow scale population in a snow scale infested citrus grove in Florida.

Studies conducted at the Citrus Experiment Station, Lake Alfred, Florida by Brooks and Whitney (2) showed that the use of dicofol in citrus snow scale infested groves resulted in increased snow scale population. It was later publicized that the population increases were the result of a shift in the sex ratio induced by dicofol, resulting in more females in the population.

The original studies were conducted with hand gun sprays. Spray practices have since changed to speed sprayer applications, and some field observations now indicate that the citrus snow scale population increases do not occur following speed spray applications. The present study was designed to determine whether or not the current spray methods would result in population increases and an alteration of the sex ratio.

Materials and Methods

Following the inspection and evaluation of several groves on the Florida east coast, a grapefruit grove in good condition on Merritt Island was selected as the site for this study.

The selection was made based on the high populations of the citrus snow scale, and the relative uniformity in the infestation as compared to the other groves inspected. The test plots were marked, mapped and the treatments were randomly selected within each of eight replicates. Evaluation trees within each plot were selected on the basis of citrus snow scale population and tagged for easy reference.

The test was set up in a randomized complete block design with eight replicates per treatment. The treatments are shown in Table 1.

Two application methods were used. In one, a hand gun spray was used to thoroughly wet the tree, including the inside branches, to run-off using about 750 gallons per acre (11 gallons/tree) in both the post-bloom spray on 22 April and the summer spray on 20 July. In the other, a speed sprayer application was used with 220 gallons per acre in the post-bloom spray on 29 April, and 777 gallons per acre in the summer spray on 15 July.

The method described by Brooks in 1964 (1) was used in the evaluation of this trial. On each of the eight trees used in the evaluations, four one square inch bark patches were brushed clean of all scale insects, and other debris leaving a clean bark patch for reinfestation by the citrus

Table 1. Treatments reported in this study.

Treatments	Timing and Rates	Application Method
Nontreated		
Dicofol	post-bloom — 4.5 pts./acre	hand gun
	summer spray — 4.5 pts./acre	hand gun
Dicofol	post-bloom — 9 pts./acre	hand gun
	summer spray — 9 pts./acre	hand gun
Aldicarb	post-bloom — 33 lbs./acre	granular
Dicofol	summer spray — 4.65 pts./acre	speed sprayer
Dicofol	post-bloom — 3.96 pts./acre	speed sprayer
	summer spray — 4.65 pts./acre	speed sprayer

NOTES:

1. Spray oil at 0.5% was added to all treatments in the summer spray.
2. Difocol formulation: Kelthane MF (9-7683) Form XF85018, Lot #3-1556R.
3. Aldicarb formulation used was Temik 15G.

snow scale. Counts were made using a 10X illuminated magnifier and a small lance tipped probe to remove the scale as they were counted. The probe was also used to determine whether the insect was alive or dead. All four one inch square bark patches on each tree were used in each evaluation. The counts determined the number of crawlers, the number of live and dead females, and the number of live and dead males. The results were recorded by tree number and square number at each evaluation. The figures used are the results of counts on four bark patches on eight trees, giving a total of 32 square inches for each treatment at each evaluation.

For statistical handling a two-way analysis of variance was run for each observation date and each category of scale counts recorded. An analysis was also run on the cumulative post-treatment totals (sum of 8, 16 and 26 week counts) for the hand gun treatments. The ratio of live males to live females was also analyzed for each evaluation time, and on the cumulative total for the hand gun treatments.

The raw data for scale counts was converted to log-values for the purpose of analysis. The ratio of live males to live females was transformed using the arcsine square root transformation. This transformation makes the data more acceptable for analysis of variance procedures because it stabilizes the variance, and improves the symmetry of the distribution.

The statistical analysis includes chemical treatments which are not used in this report due to lack of relevance to the main objective of this study. The deletion of these treatments does not diminish the confidence level of the data presented.

For ease of interpretation the summary tables show the means for the transformed data. Statistical separation of means was done using the Ryan-Einot-Gabriel-Welsch Multiple F test on the transformed data. This multiple comparison procedure controls the experiment wise error rate at the 95% confidence level, and is among the most powerful of the multiple comparison procedures available.

The statistical analysis and interpretation was conducted by S. M. Lokey of Rohm and Haas Company, Philadelphia, Pennsylvania. The authors extend this recognition and their thanks to Ms. Lokey.

Results and Discussion

Dicofol applied with a hand gun, thoroughly wetting the scaffold branches and foliage of each tree, resulted in an increase in both the live females (Table 2), live males

Table 2. Hand Gun—Number of Live Females.

Treatment	PreSpray -2	Weeks After Second Application			Cumulative Total
		8	16	26	
Control	26a	19 cd	39 b	4a	61 b
Dicofol, 1X	16 b	29 b	73a	4a	106a
Dicofol, 2X	37a	42a	65a	3ab	111a
Probability		0.0001	0.0001	0.0002	0.0001
c.v. (%)		33	29	130	15
N		32	32	32	96

Ryan-Einot-Gabriel-Welsch Multiple F test for log (count).
Means within columns with the same letter are not significantly different.

Table 3. Hand Gun—Number of Live Males.

Treatment	PreSpray -2	Weeks After Second Application			Cumulative Total
		8	16	26	
Control	51a	26 b	68 b	14 c	107 b
Dicofol, 1X	24ab	28 b	130a	31a	189a
Dicofol, 2X	45a	45a	118a	19 b	181a
Probability		0.0001	0.0001	0.0001	0.0001
c.v. (%)		28	21	25	6
N		32	32	32	96

Ryan-Einot-Gabriel-Welsch Multiple F test for log (count).
Means within columns with the same letter are not significantly different.

Table 4. Hand Gun—Number of Crawlers.

Treatment	PreSpray -2	Weeks After Second Application			Cumulative Total
		8	16	26	
Control	29 b	63 b	258 b	109 c	429 c
Dicofol, 1X	32 b	74a	403a	315a	791a
Dicofol, 2X	49a	103a	399a	193 b	694 b
Probability		0.0001	0.0001	0.0001	0.0001
c.v. (%)		28	21	25	6
N		32	32	32	96

Ryan-Einot-Gabriel-Welsch Multiple F test for log (count).
Means within columns with the same letter are not significantly different.

(Table 3), and crawlers (Table 4) in the citrus snow scale populations as compared to the populations on the non-treated trees.

The data showed no shift in the sex ratio following two hand gun applications of dicofol even at the high rate of 9 pints per acre, except at the 26 week evaluation where low populations diminish the strength of the statistics comparable to the other dates. The cumulative total for the three evaluation dates shows no significant increase in the ratio of females to males (Table 5).

Dicofol applied with a speed sprayer did not result in a significant increase in the live females (Table 6), live males (Table 7), or the crawlers (Table 8) in the citrus snow scale population as compared to the population on the non-treated trees.

The data showed no significant shift in the sex ratio following two speed sprayer applications of dicofol (Table 9).

Table 5. Hand Gun—Ratio of Live Males to Live Females.

Treatment	Weeks After Second Application			Cumulative Total
	8	16	26	
Control	3.2	6.1	4.9 b	3.3
Dicofol, 1X	1.4	3.2	9.3ab	1.9
Dicofol, 2X	1.3	2.1	10.0a	1.8
Probability	.0780 ns	.9204 ns	.0086	NS
c.v. (%)	83	70	54	43
N	32	32	32	96

Ryan-Einot-Gabriel-Welsch Multiple F test for log (count).
Means within columns with the same letter are not significantly different.

Table 6 Speed Sprayer—Number of Live Females.

Treatment	PreSpray -2	Weeks After Second Application		
		8	16	26
Control	26a	19a	39a	4ab
Aldicarb/Dicofol	20a	20a	41a	10a
Dicofol/Dicofol	27a	21a	69a	4ab
Probability		0.0001	0.0001	0.0001
c.v. (%)		66	68	400
N		32	32	32

Ryan-Einot-Gabriel-Welsch Multiple F test for log (count).
Means within columns with the same letter are not significantly different.

Table 7 Speed Sprayer—Number of Live Males

Treatment	PreSpray -2	Weeks After Second Application		
		8	16	26
Control	51a	26a	68a	14a
Aldicarb/Dicofol	67a	24a	51a	19a
Dicofol/Dicofol	89a	18a	82a	14a
Probability		0.0001	0.0001	0.0001
c.v. (%)		50	59	104
N		32	32	32

Ryan-Einot-Gabriel-Welsch Multiple F test for log (count).
Means within columns with the same letter are not significantly different.

The results of this trial demonstrates that typical speed sprayer applications to a citrus grove in good condition does not result in significant increases in the snow scale population. Snow scale population increases did result from through wetting of the scaffold branches with a hand gun spray, which indicates that more thorough coverage of the inside branches is required to induce the population

Proc. Fla. State Hort. Soc. 102:46-48. 1989.

ENHANCEMENT OF CITRUS RED MITE *PANONYCHUS CITRI* (MCGREGOR) CONTROL THROUGH THE USE OF TRITON CS-7

W. J. BOURGEOIS AND A. J. ADAMS
Citrus Research Station
Louisiana Agricultural Experiment Station
LSU Agricultural Center,
Rt. 1, Box 628, Port Sulphur, LA 70083

Additional index words. miticides, spreader binder

Abstract. Several miticides were applied to 'Washington' navel orange (*Citrus sinensis* (L.) Osb.) trees for the control of citrus red mites *Panonychus citri* (McGregor) during 1987 and 1988 at the Citrus Research Station, Port Sulphur, Louisiana. Miticides were applied alone and as a tank mix with the spreader binder Triton CS-7. Citrus red mite control was significantly enhanced with the addition of Triton CS-7 to the various miticide applications.

Florida Agricultural Experiment Stations Journal Series No. N-00069.

Table 8. Speed Sprayer—Number of Crawlers.

Treatment	PreSpray -2	Weeks After Second Application		
		8	16	26
Control	29ab	63a	258a	109a
Aldicarb/Dicofol	27ab	21 b	161a	89a
Dicofol/Dicofol	33a	47ab	321a	165a
Probability		0.0001	0.0001	0.0001
c.v. (%)		68	48	54
N		32	32	32

Ryan-Einot-Gabriel-Welsch Multiple F test for log (count).
Means within columns with the same letter are not significantly different.

Table 9. Speed Sprayer—Ratio of Live Males to Live Females.

Treatment	Weeks After Second Application		
	8	16	26
Control	3.2	6.1	4.9ac
Aldicarb/Dicofol	1.9	8.1	8.7a
Dicofol/Dicofol	1.4	2.6	4.6ab
Probability	.6505 ns	.2050 ns	.0044
c.v. (%)	55	97	76
N	32	32	32

Ryan-Einot-Gabriel-Welsch Multiple F test for log (count).
Means within columns with the same letter are not significantly different.

increases than is achieved with the typical speed sprayer application.

Literature Cited

1. Brooks, R. F. 1964. Control of citrus snow scale, *Unaspis citri* (Comst.), in Florida. *Proc. Fla. State Hort. Soc.* 77:66-70.
2. Brooks, R. F. and J. D. Whitney. 1973. Citrus snow scale control in Florida. *Proc. First World Congress of Citriculture*, Vol. 2:427-31.

The major pest of the Louisiana citrus industry is that of periodic infestations of the citrus red mite. Previous work (1-6) has identified several miticides and experimental pesticides that are effective in the control of the citrus red mite. In recent years there has been a decrease in effectiveness of some of these recommended miticides. Therefore, this study was undertaken to determine the effectiveness of Triton CS-7, a spreader binder added to the miticide spray on the control of citrus red mites in 'Washington' navel orange trees.

Materials and Methods

Various miticides alone and as a tank mix with Triton CS-7 were applied to 'Washington' navel orange trees with the use of a Solo backpack sprayer (Model 425). Miticide treatments consisted of single tree plots replicated four times in a randomized complete block design. Miticide treatments were applied to the tree foliage with complete

Proc. Fla. State Hort. Soc. 102: 1989.