Fenoxycarb, Pymetrozine (C G A-215944), and Fenpropathrin / Acephate: Rotations for Silverleaf Whitefly Control in Upland Cotton in Central Arizona

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ABSTRACT

Trials (0.01 ac plots) with fenoxycarb (Fenoxycarb 40 W P, 0.062 lb. ai/ac), pymetrozine (CGA 215944, Fulfill™50 W P, 0.094 lb. ai/ac), pymetrozine /fenoxycarb, (Sterling™), and fenpropathrin (Danitol™ 2.4 E C, 0.20 lb. or 0.10 lb. ai/ac)/acephate (Orthene™ 90 S, 0.5 or 0.25 lb. ai/ac) were made against silverleaf whitefly, Bemisia argentifolii Bellows and Perring, at UA, Maricopa Agric. Ctr. Six applications (plus adjuvant Kinetic) were applied on 9 treatments. Ten treatments (embedded control included) were in a double tier complete random block design and there was 1 adjacent, 1.5 ac control block (treatment 11). Eggs and large nymphs were sampled weekly post application to determine efficacy; reported as % reduction from block control. Rotation schemes were: 1) 3 pymetrozine /fenoxycarb, then 3 fenpropathrin/acephate applications, 2) 3 pymetrozine 2/3rate /fenoxycarb full rate, then 3 fenpropathrin /acephate applications, 3) fenoxycarb 6 applications, 4) pymetrozine 6 applications, 5) 3 fenpropathrin /acephate, then 3 pymetrozine /fenoxycarb applications, 6) 3 fenpropathrin /acephate, then 3 pymetrozine /fenoxycarb, 7) fenpropathrin /acephate at full , ½, full, then 3-½ rate applications, 8) 2 pymetrozine /fenoxycarb, 2 fenpropathrin /acephate, 1 pymetrozine /fenoxycarb, and 1 last fenpropathrin /acephate application, 9) 2 fenpropathrin /acephate, 2 pymetrozine/ fenoxycarb, 1 fenpropathrin/acephate, and 1 last pymetrozine/fenoxycarb application, 10) embedded control, and 11) block control. Egg % reductions for season means ranged from 93-99% for combinations and rotations of them. Last ½ season analyses showed reductions from 95-99%. Pymetrozine had a 98% reduction and fenpropathrin /acephate had 98 % egg reduction. Nymphal % reduction for season means ranged from 80-95% for combinations and rotations of them. Last ½ season analyses, showed % reductions from 91-98%. Pymetrozine had 92% reduction and fenpropathrin /acephate had 92% reduction of nymphs (season). These studies showed that pymetrozine, pymetrozine/fenoxycarb, fenpropathrin/acephate combinations and rotations provided excellent control of silverleaf whitefly immatures.

Introduction

Successful use of IPM against the silverleaf whitefly, *Bemisia argentifolii* Bellows and Perring requires chemical agents that include biorational agents in addition to conventional insecticides. Rotational regimes that alternate different insecticide classes need to be tested to determine which regimes are most appropriate for particular circumstances.

In this study, we report the efficacy of pymetrozine and fenoxycarb, alone and in combination, (known together as Sterling™, and pymetrozine alone as Fulfill™) in rotation with the combination fenpropathrin (Danitol™)/acephate (Orthene™) against immatures of the silverleaf whitefly. A specific objective was to generate data for using pymetrozine/fenoxycarb in an insecticide resistance management (I R M) program in cotton.

Materials and Methods

DP 5415 cotton was planted on DOY 095 (4/5/1995). Germination occurred quickly with cotyledons breaking the surface and opening by DOY 097. It was planted in 40-in rows, 4 rows per plot, that were 34 ft in length (0.01 ac each). Plots were partially isolated from each other by corridors of four unplanted rows between each 4-row plot and by 20 ft fallow alleys that separated plots. Plots were arranged in a 2-tiered random block design with 10 treatments (including an untreated control) with 5 replicates. An eleventh treatment consisted of an untreated control block (UTCB) of 1.5 acres of cotton adjacent to the isolated plots but separated by 4 fallow rows. The row pattern for the UTCB was 12 planted then 2 fallow (skip) rows.

Agents tested included pymetrozine, fenoxycarb, the combination, pymetrozine/fenoxycarb) and the combination fenpropathrin/acephate applied at various formulations, rates, and rotation regimes (Table 1).

Six spray applications were made at approximately weekly intervals, DOY 206-207 (7/24--25/1992), 222-223, 230, 237, 245. Applications were made with a John Deere 600 Hi Cycle Sprayer modified to apply at 400 psi, 30 GPA, with 3 nozzles per each side of the row by drops and 1 overhead nozzle for a total of 7 nozzles per row (Akey and Henneberry 1995)

Pre-application baseline samples were taken on DOY 200 (7/19/1995). Seven post application samples were taken on DOY 213 (8/1/1995), 221, 227, 235, 240, 250, and 257. For samples of immatures, five leaves were picked from each of 5 plants in each of the 5 replicate plots per treatment. Leaves were chosen from the fifth main leaf from the terminal leaf. The leaves were harvested, stored in coolers, brought back to the laboratory, put in cool storage, and examined by microscope (6-12x). Immatures were sampled by whole leaf counts early in the season and throughout the season with 2.54 mm diam. leaf disk samples (1-disk / leaf). Large 3rd instars, young 4th instars, and "red-eye" 4ths (pupae) were counted and for the purposes of the paper, data presented here include these instars as a single group of "large" immature SPW and are for leaf-disk samples. Sampling methods for eggs were conducted similarly but without any grouping techniques. In the sample unit, all eggs that appeared to be viable were counted. All immature counts are presented in numbers per cm square (for more sampling details, see Akey 1995, 1994). Adult baseline numbers were determined by the leaf-turn method and reported as percentage of fifth leaves (from the terminal) that were infested with 3 or more SLWF adults (Ellsworth et. al.1995, Naranjo and Henneberry 1996).

Results and Discussion

Percent reduction of eggs for season means ranged from 93-99% for combinations and rotations of combinations. Analyses of last half of season applications, showed percent reductions from 95-99%; pymetrozine alone had a 98% reduction and fenpropathrin / acephate had 98 % egg reduction (Table 2). Percent reduction for season means of large nymphs ranged from 80-95% for combinations and rotations of combinations. Analyses of last half of season applications, showed percent reductions from 91-98%; pymetrozine alone had 92% reduction and fenpropathrin / acephate had 92% reduction of nymphs (Table 3). These studies showed that pymetrozine, fenoxycarb/pymetrozine, fenpropathrin / acephate combinations and rotations provided excellent control of silverleaf whitefly immatures.

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Table 1 Use of pymetrozine, fenoxycarb, pymetrozine/fenoxycarb, and fenpropathrin / acephate against silverleaf whitefly, *Bemisia argentifolii*: formulations, rates , regimes, and six applications for eleven[1] treatments.

Application→ Treatment ↓	**1**	**2**	**3**	**4**	**5**	**6**
1	P1/[2] F[3]	P1/ F	P1/ F	FE1/ A1[4]	FE1/ A1	FE1/ A1
2	P2/[5] F	P2/ F	P2/ F	FE1/ A1	FE1/ A1	FE1/ A1
3	F	F	F	F	F	F
4	P1	P1	P1	P1	P1	P1
5	FE1/ A1	FE1/ A1	FE1/ A1	P1/ F	P1/ F	P1/ F
6	FE1/ A1	FE1/ A1	FE1/ A1	P2/ F	P2/ F	P2/ F
7	FE1/ A1	FE2/ A2[6]	FE1/ A1	FE2/ A2	FE2/ A2	FE2/ A2
8	P1/ F	P1/ F	FE1/ A1	FE1/ A1	P1/ F	FE1/ A1
9	FE1/ A1	FE1/ A1	P1/ F	P1/ F	FE1/ A1	P1/ F

[1] Treatment 10 = embedded control, no sprays; treatment 11 = block control of 1.5 ac, no sprays.

[2] P 1 = Pymetrozine 50 WP at 0.09 lb. ai/ac.

[3] F = Fenoxycarb 40 WP at 0.06 lb. ai/ac.

[4] FE1 = Fenpropathrin 2.4 EC full rate, at 0.20 lb. ai/ac; A1 = Acephate 90 S full rate, 0.5 lb. ai/ac.

[5] P 2 = Pymetrozine 50 WP at 0.06 lb. ai/ac.

[6] FE2 =Fenpropathrin 2.4 EC 1/2 rate, at 0.10 lb. ai/ac; A2 = Acephate 90 S 1/2 rate, 0.25 lb. ai/ac.

Table 2. Efficacy as percent reduction from block control (treatment11) of silverleaf whitefly (SLWF) eggs by pymetrozine, fenoxycarb, pymetrozine/fenoxycarb; fenpropathrin/acephate; and by the 2 combinations in rotational application regimes in upland cotton in central Arizona, 1995.

	First Half Season[1]		Second Half Season[2]		Season Summary[3]	
Treatment	%	Mean[4] ± SE	%	Mean ± SE	%	Mean ± SE
1	78.91	0.66 ± 0.19a[5]	98.31	0.65 ± 0.20a	96.87	0.65 ± 0.13a
2	80.19	0.62 ± 0.18a	96.66	1.28 ± 0.58a	95.42	0.95 ± 0.31a
3	57.83	1.32 ± 0.34b	95.38	1.77 ± 0.68a	92.53	1.55 ± 0.38a
4	59.42	1.27 ± 0.46b	97.94	0.79 ± 0.23a	95.03	1.03 ± 0.26a
5	90.42	0.30 ± 0.09a	98.41	0.61 ± 0.25a	97.83	0.45 ± 0.13a
6	90.42	0.30 ± 0.08a	99.04	0.37 ± 0.13a	98.41	0.33 ± 0.07a
7	87.54	0.39 ± 0.11a	98.49	0.58 ± 0.28a	97.64	0.49 ± 0.15a
8	90.73	0.29 ± 0.07a	98.46	0.59 ± 0.22a	97.83	0.45 ± 0.12a
9	92.33	0.24 ± 0.06a	99.06	0.36 ± 0.08a	98.55	0.30 ± 0.05a
10	78.91	0.66 ± 0.16a	95.10	1.88 ± 0.74a	93.88	1.27 ± 0.39a
11	0.0	3.13 ± 0.76c	0.0	38.35 ± 12.38b	0.0	20.74 ± 6.92b

[1] 1st 3 post application samples 1, 2, and 3 (taken weekly).

[2] 2nd 3 post application samples 4, 5, and 6 (taken weekly).

[3] Post application samples 1-6.

[4] Mean no. SLWF eggs/sq. cm.

[5] Means followed by different letters are significant at $P \leq 0.05$ by Duncan's multiple range test (F value by ANOVA significant).

Table 3. Efficacy as percent reduction from block control (treatment 11) of silverleaf whitefly (SLWF) large nymphs by pymetrozine, fenoxycarb, pymetrozine/fenoxycarb; fenpropathrin/acephate; and by the 2 combinations in rotational application regimes in upland cotton in central Arizona, 1995.

	First Half Season[1]		Second Half Season[2]		Season Summary[3]	
Treatment	%	Mean[4] ± SE	%	Mean ± SE	%	Mean ± SE
1	6.67	0.14 ± 0.04ab[5]	96.15	0.08 ± 0.04a	90.09	0.11 ± 0.03a
2	46.67	0.08 ± 0.02ab	90.87	0.19 ± 0.09a	87.39	0.14 ± 0.05a
3	13.33	0.13 ± 0.03ab	90.87	0.19 ± 0.06a	85.59	0.16 ± 0.03a
4	0.0	0.26 ± 0.12c	91.83	0.17 ± 0.04a	80.18	0.22 ± 0.06a
5	40.00	0.09 ± 0.03ab	96.15	0.08 ± 0.03a	91.89	0.09 ± 0.02a
6	53.33	0.07 ± 0.02ab	98.08	0.04 ± 0.01a	94.59	0.06 ± 0.01a
7	86.67	0.02 ± 0.01a	91.83	0.17 ± 0.12a	91.89	0.09 ± 0.06a
8	53.33	0.07 ± 0.02ab	96.63	0.07 ± 0.02a	91.89	0.09 ± 0.01a
9	66.67	0.05 ± 0.01ab	93.27	0.14 ± 0.06a	91.89	0.09 ± 0.03a
10	26.67	0.11 ± 0.03ab	80.29	0.41 ± 0.12a	76.58	0.26 ± 0.07a
11	0.0	0.15 ± 0.03b	0.0	2.08 ± 0.79b	0.0	1.11 ± 0.43b

[1] 1st 3 post application samples 1, 2, and 3 (taken weekly).

[2] 2nd 3 post application samples 4, 5, and 6 (taken weekly).

[3] Post application samples 1-6.

[4] Mean no. SLWF large nymphs/sq. cm.

[5] Means followed by different letters are significant at $P \leq 0.05$ by Duncan's multiple range test (F value by ANOVA significant).