

Insecticidal Control of the Sweet Potato Whitefly in Cotton

T. F. Watson

Abstract

Four field experiments were conducted to evaluate efficacy of a number of registered or experimental insecticides against the sweet potato whitefly. Several materials gave encouraging results under unusually high population densities. Among the more effective treatments in one or more tests were: Capture, Danitol, NTN 33893, pyriproxyfen and SN 85292, and combinations of Capture+endosulfan, Capture+Ovasyn and Danitol+Orthene.

Introduction

Insecticidal control of the sweet potato whitefly, *Bemisia tabaci* (Gennad.), has been difficult to achieve. Two factors usually associated with poor control are ineffective insecticides and poor coverage. Several experiments were conducted during 1991 at the Yuma Valley Agricultural Center in an effort to achieve satisfactory control of this pest with insecticides. Four of these experiments are reported herein.

Efficacy of NTN 33893 and Temik against the sweet potato whitefly in cotton.

Methods

A test was conducted at the University of Arizona, Yuma Valley Agricultural Center, to determine the relative efficacy of NTN33893 and Temik against the sweet potato whitefly (SPWF) when applied at planting or later as a side-dress. Applications were made at planting, March 15, 1991, and at layby on July 2, 1991.

Two rates of NTN33893 (0.32 oz. and 0.55 oz a.i. per 1000 row ft.) and one of Temik (1.0 lb/A), were utilized at each application date. The formulations used were 2.5 g for NTN33893 and 15g for Temik. Plots were 4 rows wide by 280 ft. long and treatments were replicated 4 times.

Sampling for the SPWF consisted of pulling 5 leaves at random from each plot on approximately weekly intervals and examining a 1"-diameter leaf disc for the presence of eggs and immature whiteflies.

Results

Table 1 presents the sampling data for SPWF egg populations from June 3, the early square stage of cotton growth, until August 13, the time when the cotton was maturing out and whitefly populations had become quite heavy and general.

Seasonal means (Table 2) are used as the basis for comparing treatment effectiveness. Treatments 1, 5, 6 and 7 have two seasonal means, one in parenthesis. The mean in parenthesis represents the mean of counts taken after the side-dress application was made.

Both rates of NTN33893 reduced SPWF egg populations when compared with the untreated check and with Temik. However, there appeared to be little effect of rates as counts in both treatments were too close and irregular to give a clear indication of rate influence. Temik appeared to be relatively ineffective. This is contrary to results from previous years.

Table 2 shows the seasonal picture of the buildup of immature populations. The same general picture as with egg populations is illustrated with the immature counts. The differences between treatments and the check were not as great as it should be for effective control. Again, the Temik appeared to exhibit little, if any, control.

Efficacy of various insecticides against the sweet potato whitefly in cotton.

Methods

The experiment was conducted at Yuma, AZ on DPL-5164 cotton. The cotton was planted on May 29, 1991, in order to have vigorous, succulent cotton during the latter part of the growing season. Heavy whitefly infestations had developed by mid-August and the test was initiated on August 14, 1991.

The experiment was a randomized complete block with 4 replications. Plots were 4 rows wide and 60 ft. long with a 10 ft. alley between the ends of plots, and 2 rows were skipped between adjacent plots (4x2 planting pattern).

Applications were made with a tractor-mounted, CO₂-powered sprayer, using 3 nozzles per row and 40 psi pressure to deliver 20 gal. total spray per acre. A total of 7 applications was made with sampling occurring between applications.

Sampling consisted of randomly pulling 5 fully-expanded leaves near the terminal from each plot. These were returned to the laboratory where a 1" diameter leaf disc was cut from each leaf for the microscopic counting of eggs and immature whiteflies. Adult sampling was done in an entirely different manner. A small rectangular pan (Ca 6" x 9") was marked near both ends with a 50cm² area. The entire bottom of the pan was coated with a light vegetable oil and a plant terminal was slapped across the pan to constitute a sample. Therefore, each sample consisted of the 2, 50cm² areas where adult whiteflies were trapped.

Results

When this test was initiated the cotton was growing well and in excellent condition. However, whitefly populations had developed to exceedingly high levels and treatments were initiated at levels where the bottoms of the terminal leaves were white with the adult whiteflies. Therefore, after the first application, a 0.5lb./A. rate of Ovasyn was added to the treatment of SN85292 since it was not an adulticide. That was the only time the combination was used.

The number of eggs per leaf disc in the check treatment (Table 3) reveals the general level of the whitefly infestation at the start of this experiment. All treatments resulted in an eventual lowering of the egg populations. However, certain treatments were considerably more effective than some of the others. Those more effective in reducing egg numbers were: Capture + endosulfan, Capture, Capture + Ovasyn, and NTN33893 (at both rates). The treatment of SN85292 was beginning to bring

the egg populations down to a much lower level by the time the test was terminated.

Table 3 also shows the mean number of immature whiteflies per leaf disc. Again, all treatments had some effect in reducing the immature stages and, in general, the treatments resulting in the lower egg counts also had the lowest number of immatures.

Table 4 shows the results of the adult sampling. A note of particular interest in this table is the much reduced adult counts on Sept. 6. A rain fell the evening before this sample was taken. Again the more effective treatments shown in Table 3 were the more effective ones in lowering adult counts. The exception was the treatment with SN85292.

Effect of Danitol against the sweet potato whitefly

Methods

The experiment was conducted at Yuma, AZ on DPL cotton, variety 5164. The cotton was planted on March 20, 1991 and the test initiated at a low level of pink bollworm in squares and just prior to the presence of infestable bolls.

Applications were made with a tractor-mounted, CO₂-powered sprayer, using 3 nozzles per row and 40 psi pressure to deliver 20 gal. total spray per acre. Plots were 4 rows wide and 60 ft. long with a 10 ft. alley between the ends of plots and 2 rows skipped between adjacent plots (4x2 planting pattern).

Results

The sweet potato whitefly became a severe problem in this experiment. Only those treatments showing considerable efficacy against this pest were intensely sampled. Excellent control was achieved with Danitol or Danitol + acephate combinations. All other treatments became heavily infested and foliage and lint became heavily coated with honeydew. Table 5 shows detailed whitefly counts for those treatments giving whitefly control.

Control of the sweet potato whitefly

Methods

The experiment was conducted at Yuma, AZ on DPL-5164 cotton. The cotton was planted on May 29, 1991, in order to insure vigorous, succulent cotton during the latter part of the growing season. Heavy whitefly populations had developed by mid-August. Since the experimental material, pyriproxyfen, was yet unavailable with which to initiate the test, blanket applications of either Danitol and orthene or Danitol alone were made in order to save the cotton for the ensuing test. The test was initiated with all treatments on September 5, 1991.

The experiment was a randomized complete block with three replications. Plots consisted of three sets of 4-row plots, each separated by two unplanted rows, i.e., plots were 12 rows wide plus the unplanted rows, and 60 ft. long. Sampling was conducted in the center 4-row plot.

Applications were made with a tractor-mounted, CO₂-powered sprayer, using 3 nozzles per row and 40 psi pressure to deliver 20 gal. total spray per acre. The application schedule is shown in Table 1.

Sampling consisted of randomly pulling 5 fully-expanded leaves near the terminal from each plot.

These were returned to the laboratory where a 1" diameter leaf disc was cut from each leaf for the microscopic counting of eggs and immature whiteflies. Adult sampling was done in an entirely different manner. A small rectangular pan (Ca 6" x 9") was marked near both ends with a 50cm² area. The entire bottom of the pan was coated with light vegetable oil and a plant terminal was slapped across the pan to constitute a sample. Therefore, each sample consisted of the 2,50cm² areas where adult whiteflies were trapped.

Results

The blanket applications made to the test area prior to initiation of the test undoubtedly had some effect overall in evaluating later treatments. However, this was unavoidable in order to prevent excessive whitefly damage prior to initiating the test. The combination of Danitol and Orthene resulted in outstanding control, followed by Danitol alone and then, the IGR, pyriproxyfen. All were superior to the untreated check (untreated after the initial blanket applications).

Pyriproxyfen showed considerable promise. However, because of complicating factors involved in the experiment, results were inconclusive.

Tables 6, 7 and 8 show SPWF populations of eggs, immatures and adults, respectively. The relative efficacy of each treatment is the same for each life stage of SPWF. A visual rating of all treatments, based upon appearance of leaves and honeydew accumulation, resulted in a ranking of treatments from best to poorest as follows: Danitol + Orthene, Danitol, pyriproxyfen, and the untreated check, exactly as the numerical data in the tables show.

Acknowledgement

The author wishes to acknowledge the outstanding assistance of Antonio Tellez, Luis Lastra and Francisco Reyes in the conduct of these experiments.

Table 1. Effect of various systemic insecticide treatments on SPWF egg populations in cotton.

Treatment ¹	No. SPWF eggs/1" leaf disc										Seasonal
	6/3	6/10	6/17	6/24	7/1	7/11	7/24	8/1	8/7	8/13	Mean ²
1 Check ³	2.8	1.1	2.6	3.6	7.9	26.1	17.4	5.7	33.4	62.8	16.3 (29.1)
2 NTN33893	0.6	1.8	1.7	2.2	5.1	16.1	5.8	5.7	14.9	15.2	6.9
3 NTN33893	0.3	1.2	2.4	1.7	3.4	9.9	3.3	18.1	24.2	35.4	10.0
4 Temik	0.4	1.7	2.4	3.0	3.8	23.1	4.0	9.3	59.1	143.7	25.1
5 NTN33893	0.4	1.7	3.3	3.9	5.9	12.4	12.6	6.4	23.7	21.8	9.2 (15.4)
6 NTN33893	1.0	2.3	2.5	2.3	6.7	9.9	14.1	8.0	24.1	46.5	11.7 (10.3)
7 Temik	0.3	1.6	3.8	1.3	4.1	41.0	17.1	19.9	34.2	86.0	36.3 (39.6)

¹Treatments 2, 3 and 4 were applied in-furrow at planting on March 15, 1991; treatments 5, 6 and 7 were applied as a side-dress application on July 2, 1991.

²Seasonal means are means of all counts or those taken only after the side-dress application shown in parenthesis.

³Treatment rates (a.i./A): treatments 2 and 3, and 5 and 6 were 4.4 and 7.5 oz./A, respectively; treatments 4 and 7 were 1.0 a.i./A.

Table 2. Effect of various systemic insecticide treatments on SPWF immature populations in cotton.

Treatment ¹	No. SPWF immatures/1" leaf disc										Seasonal
	6/3	6/10	6/17	6/24	7/1	7/11	7/24	8/1	8/7	8/13	Mean ²
1 Check ³	0.3	0.4	0.8	4.0	7.7	12.4	9.8	8.5	7.3	32.4	8.4 (14.1)
2 NTN33893	0.2	0.0	0.9	2.4	1.4	9.1	4.1	7.1	3.0	9.9	3.8
3 NTN 33893	0.4	0.8	0.4	2.6	2.2	5.2	4.6	14.9	5.2	15.3	5.2
4 Temik	0.4	0.8	1.4	3.4	4.0	4.4	5.6	15.9	12.4	36.1	8.4
5 NTN33893	0.1	0.1	1.4	4.0	4.3	9.3	9.3	8.5	6.2	24.1	6.7 (11.5)
6 NTN33893	0.8	0.3	0.8	3.6	6.0	7.0	5.9	5.9	5.4	26.2	6.2 (10.1)
7 Temik	0.1	0.4	0.8	2.7	6.1	7.6	13.1	22.6	11.9	28.5	9.4 (16.7)

^{1,2,3}See footnotes in Table 1.

Table 3. Populations of sweetpotato whitefly eggs and immatures on cotton following treatment with various insecticides. Yuma, AZ. 1991.

Treatment ¹	Rate a.i./A	Mean No. SPWF eggs/1" leaf disc:							
		August				September			
		20	26	3	9	16	20	27	x
Check	---	1579	2245	812	478	170	225	331	834
Orion	0.5	1139	552	367	87	65	98	161	353
Orion	1.0	1159	1478	529	146	77	184	142	531
NTN33893	0.7oz	283	325	183	59	30	43	44	138
NTN33893	1.4oz	232	307	213	43	23	71	48	134
SN85292	0.375	1550 ²	384	394	223	68	146	138	226
Capture	0.06	334	286	77	59	31	36	48	124
Capture + Endosulfan	0.06 0.5	277	198	73	34	19	26	21	93
Capture + Ovasyn	0.06 0.25	375	187	183	57	31	60	36	133

Mean No. Immature SPWF/1" leaf disc:									
Check		11.8	11.6	46.4	17.6	28.4	12.2	18.9	21.0
Orion		0.0	3.4	4.6	3.8	0.9	9.3	5.5	3.9
Orion		9.4	156.3 ³	24.4	20.2	1.4	16.0	6.3	13.0
NTN33893		0.6	3.6	3.3	3.7	1.2	4.3	2.3	2.7
NTN33893		1.9	2.5	5.6	1.1	0.5	8.2	2.1	3.1
SN85292		0.6	187.4 ³	24.5	6.8	1.3	8.4	6.7	8.1
Capture		0.0	7.3	0.5	4.9	0.6	1.5	2.2	2.4
Capture + Endosulfan		0.0	1.7	2.4	2.6	1.4	2.1	4.1	2.0
Capture + Ovasyn		0.6	3.0	2.1	4.9	0.7	11.0	1.0	3.3

¹ Application dates: 8/14, 8/21, 8/28, 9/5, 9/11, 9/18 and 9/25.

² The egg count in the SN85292 treatment, taken on 8/20, was not included in the seasonal mean.

³ Counts considered anomolies and not included in mean.

Table 4. Populations of adult sweetpotato whiteflies on cotton following treatment with various insecticides. Yuma, AZ. 1991.

Treatment ¹	Mean No. Adult SPWF/1" leaf disc:									
	September								October	
	3	6 ²	9	13	16	19	24	27	2	x
Check	51.1	6.6	40.0	26.8	37.4	24.8	35.4	31.8	41.5	32.8
Orion	24.4	2.9	18.9	5.6	10.9	11.3	17.9	17.5	4.6	12.7
Orion	35.8	5.3	25.5	7.5	25.0	26.0	6.0	18.4	11.4	17.9
NTN33893	21.4	2.1	17.5	3.0	8.5	7.8	9.6	20.4	9.9	11.1
NTN33893	13.1	1.8	15.6	2.8	7.5	6.1	6.9	22.4	9.8	9.6
SN85292	86.8	4.5	28.9	4.4	7.1	8.3	13.1	25.9	7.5	20.7
Capture	25.1	1.0	13.5	1.8	5.4	2.3	9.4	11.6	9.3	8.8
Capture + Endosulfan	15.4	1.4	12.9	0.8	5.5	0.9	2.4	9.8	8.9	6.4
Capture + Ovasyn	14.0	1.0	15.3	1.3	4.3	2.0	9.3	19.5	8.6	8.4

¹ Application dates and rates shown in Table 1.

² Rain fell on the evening prior to this sample on 9/6.

Table 5. Effect of selected treatments on egg and immature sweet potato whitefly populations in cotton (means per 1" diam./leaf disc).

Treatment ¹	7/25		7/31		8/6		8/15		Mean	
	E ²	Imm	E	Imm	E	Imm	E	Imm	E	Imm
Check	8.4	6.0	2.2	7.0	10.9	2.9	80.7	20.6	25.6	9.1
Acephate	7.5	2.3	5.1	3.4	19.9	4.7	20.1	6.5	13.2	4.2
Danitol+Acephate	1.0	0.2	0.8	0.2	2.5	0.2	17.6	1.5	5.5	0.6
Danitol+Acephate	1.1	0.3	0.7	0.5	2.0	0.7	19.7	1.6	5.9	0.8
Dantiol	3.5	1.9	1.0	2.4	4.8	1.2	40.5	9.2	12.5	3.7
Dantiol	2.6	1.2	1.8	1.0	9.2	2.1	42.7	3.2	14.1	1.9
Danitol	2.1	1.6	0.5	1.3	4.9	0.9	45.5	6.8	13.3	2.7

¹Application dates: 6/19, 6/25, 7/3, 7/9, 7/18, 7/25, 7/31, 8/7, 8/19.

²E=Whitefly eggs and Imm.=Immatures.

Table 6. Effect of various treatments on sweet potato whitelfy egg populations in cotton.

Treatment ¹	Rate a.i./A	Mean No. SPWF Eggs / 1" Leaf Disc							Mean
		9/9	9/16	9/20	9/27	10/7	10/14	10/23	
Check	---	37a	58a	83a	54a	58a	55a	10a	50.7
Danitol	0.3	21b	30a	45b	27ab	30ab	24ab	6ab	26.1
Danitol + Orthene	0.3 0.5	25b	34a	28b	15b	23b	10b	4b	19.9
Pyriproxyfen	20.24g	22b	28a	55b	38ab	39ab	41ab	6ab	32.7

¹Treatment schedule:

August 14: Blanket application of Danitol+Orthene (0.2+0.5lbs.) since all materials were not on hand for start of test.
 August 21: Second blanket application of Danitol @ 0.2 lb.
 August 28: Third blanket application of Danitol @ 0.2 lb.
 Sept. 5: All treatments
 Sept. 11: All treatments except pyriproxyfen
 Sept. 18: All treatments

Table 7. Effect of various treatments on immature populations of sweet potato whitefly.

Treatment ¹	Rate a.i./A	Mean No. SPWF Immatures / 1" Leaf Disc							Mean
		9/9	9/16	9/20	9/27	10/7	10/14	10/23	
Check	---	1.6	0.5	2.3	6.2	3.1	12.3	6.7	4.67
Danitol	0.3	0.2	0.7	3.0	1.9	1.6	5.5	4.3	2.46
Danitol + Orthene	0.3 0.5	0.6	0.9	2.5	0.3	0.3	5.1	3.6	1.90
Pyriproxyfen	20.24g	0.5	0.3	5.5	2.5	1.9	8.7	3.2	3.23

¹See Table 6 for treatment schedules.

Table 8. Effect of various treatments on adult populations of the sweet potato whitefly.

Treatment ¹	Mean No. SPWF Adults / 50 ^{cm} ²											
	September						October					Mean
	9	13	16	19	24	27	2	7	14	23		
Check	43.8	9.4	10.0	12.8	9.8	20.8	13.0	3.8	4.3	0.5	12.8	
Danitol	12.3	1.1	5.8	2.5	2.7	7.7	8.7	1.3	1.3	0.7	4.4	
Danitol + Orthene	13.0	1.1	2.0	1.2	1.3	2.8	6.8	0.5	0.5	0.4	3.0	
Pyriproxyfen	9.8	3.4	5.5	6.5	4.5	19.0	7.3	2.3	1.3	0.4	6.0	

¹See Table 6 for treatment schedule.