Proc. Fla. State Hort. Soc. 102:374-379. 1989.

SUPPRESSION OF THE SWEETPOTATO WHITEFLY ON COMMERCIAL FRESH MARKET TOMATOES

D. J. Schuster
Gulf Coast Research & Education Center
5007 60th Street East
Bradenton, FL 34203

P. H. Everett
Pacific Land Co.
Rte. 2, Box 421
Immokalee, FL 33934

J. F. Price & J. B. Kring
Gulf Coast Research & Education Center
5007 60th Street East
Bradenton, FL 34203

Additional index words. Bemisia tabaci, Lycopersicon esculentum, aphid, leafminer, *Liriomyza,* integrated pest management, insecticidal control, irregular ripening.

Abstract. **Esfenvalerate (Asana XL), permethrin (Ambush), abamectin (Agri-Mek), endosulfan (Thiodan), oxamyl (Vydate L) and insecticidal soap (Safer Insecticidal Soap) were applied either alone or combined or alternated with each other on commercial, fresh market tomatoes (*Lycopersicon esculentum* Mill.) in southwest Florida for control of the sweetpotato whitefly, *Bemisia tabaci* (Genn.). Applications were made in 1 experiment with a hand-held CO_2 sprayer on 3 row, 20 ft long plots. Applications in 2 other experiments were made with a commercial, tractor-pulled sprayer on 6 row, 560 ft long plots. Foliar samples were collected periodically and the numbers of immature lifestages were counted on the undersides of leaflets. In the larger plot experiments, 2 yellow sticky traps were placed for 24 hr in each plot every 3 to 4 days and the numbers of trapped adult whiteflies were counted. Fruit harvested from treated plots were evaluated for the development of symptoms of irregular ripening, characterized by inhibited or incomplete ripening of longitudinal sections of fruit.**

All insecticides applied alone (with the exception of abamectin), and all insecticides applied in combinations or alternations resulted in fewer immature stages of the whitefly relative to the check on at least one sampling date. Fewer whitefly adults were captured on yellow sticky traps in the larger treated plots on at least 1 trapping date compared to the check. In the smaller plots, no treatment resulted in less irregular ripening compared to the check. In the larger plots, all treatment combinations or alternations resulted in less irregular ripening compared to the check although no treatment eliminated the disorder.

Florida Agricultural Experiment Station Journal Series No. N-00087. The authors wish to express their gratitude to ABC Farms and Pacific Land Co. for their assistance and support in the conduct of these experiments. Appreciation is also expressed to Ken Kiger, Tracy Mahoney, Curt Nagle, Sue Trammell, Emily Vasquez and Preston Young, our technical staff at the Gulf Coast Research and Education Center, for their dedication and invaluable assistance.

Commercial products are mentioned in this publication solely for the purpose of providing specific information. Mention of a product does not constitute a guarantee or warranty of the products by the Agricultural Experiment Station or an endorsement over products not mentioned.

This publication also reports research involving pesticides. It does not contain recommendations for their use, nor does it imply that the uses discussed here have been registered. All uses of pesticides must be registered by appropriate state and federal agencies before they can be recommended.

The sweetpotato whitefly, *Bemisia tabaci* (Genn.), was first recorded in Florida in 1900 (Hamon and Salguero 1987) but only recently has become a pest of tomatoes in the state. Populations were noted in all tomato growing areas of Florida in late 1987 (Schuster, unpublished data) but didn't become damaging until 1988 (Price et al. 1988. Univ. Fla., IFAS, Bradenton GCREC Res. Rept. BRA1988-15). In the spring of that year, high populations in south and southwest Florida were associated with a new disorder on tomato fruit that has been called irregular ripening. This disorder is characterized by inhibited or incomplete ripening of longitudinal sections of fruit. Losses due to this disorder in southwest Florida were estimated to be at least $15 million in the spring of 1988 (Schuster et al. 1989. Univ. Fla., IFAS, Bradenton GCREC Res. Rept. (BRA1989-12). Current annual direct losses due to the disorder and indirect losses due to increased insecticide costs are conservatively estimated at $25 million.

The objective of the present investigation was to evaluate selected insecticides under commercial conditions for control of the sweetpotato whitefly and irregular ripening on tomatoes.

Materials and Methods

Three experiments were conducted on commercially-grown tomatoes in southwest Florida. The plants were grown according to the cultural practices of the grower which included raised beds of Immokalee fine sand that had been fumigated and covered with polyethylene plastic mulch. Plants were grown staked and were sprayed at least weekly for control of fungal and bacterial pathogens attacking foliage, stems and fruit.

The first experiment was conducted in the spring of 1988 during the initial outbreak of the sweetpotato whitefly on tomatoes. The experiment was initiated on 28 Apr. when the plants had fruit about 1.5 inches in diameter. Plots consisted of three, 20 ft long rows spaced 5 ft and replicated 4 times in a randomized complete block design. Insecticidal treatments were applied twice weekly for 5 weeks with a hand-held, CO_2 sprayer that delivered 125 gpa.

Twenty terminals leaflets were collected weekly from the middle strata of 10 plants (10 leaflets from the outside of each plant and 10 leaflets from the inside of each plant) from the middle row of each plot. The numbers of unhatched eggs, nymphs, pupae and emerged pupae were counted on a 0.8 inch diameter disk from each leaflet. On 31 May the relative numbers of whitefly adults were estimated by rating each plot on a scale of 1 to 5 for increasing abundance. On 1 June, all of the fruit that were showing color were harvested from 2 plants from the middle row of each plot and the percent exhibiting external symptoms of irregular ripening was determined.

The second and third experiments were conducted during the fall of 1988 and spring of 1989. Transplants were set 9 Sept. and 24 Jan. for the respective experiments. Plots consisted of six, 560 ft long rows spaced 6 ft and replicated 3 times in randomized complete block designs in both experiments. Insecticidal treatments were applied with a 1,200 gal commercial, 6-row sprayer which delivered 40-100 gpa. The gallonage was increased as the plants grew by increasing the number of nozzles per row and the application pressure. Thus, in the fall 1988 trial, the sprayer delivered 40 gpa on 27 Sept. and 4 Oct. (4 nozzles/row, 160 psi); 70 gpa on 11 and 18 oct. (6 nozzles, 160 psi); 100 gpa on 25 Oct. (8 nozzles, 180 psi); and 100 gpa on 1, 8, 15, 22, 30 Nov., 2, 6, 9, 13, 16, 20, 23 and 27 Dec. (10 nozzles, 200 psi). In the spring 1989 trial, the sprayer delivered 40 gpa on 27, 30 Jan., 3, 7, 10, 14, 17, 21 and 28 Feb. (4 nozzles/row, 160 psi); 80 gpa on 3, 8, 11, 14, 17, 21, 28 and 31 Mar. (8 nozzles, 180 psi); and 100 gpa on 4, 7, 11, 19, 25 and 28 Apr. (10 nozzles, 180 psi). Each nozzle was fitted with D-3 disks and #25 cores.

In the fall 1988 trial, methomyl (Lannate L) was applied at 2 pts/100 gal on 30 Nov. for control of lepidopterous larvae. Prior to initiation of the fall trial, all plots were sprayed with permethrin (Ambush 2EC) on 12 Sept. at 8 ozs/100 gal, esfenvalerate (Asana XL 0.66EC) on 22 Sept. at 5.3 oz/100 gal and with parathion plus endosulfan (Endocide Plus) on 26 Sept. at 27 oz/100 gal. In the spring 1989 trial, methomyl (Lannate L) was applied at 2 pts/100 gal on 21 Mar., 5 and 12 Apr. for control of lepidopterous larvae.

In the fall 1988 and spring 1989 trials, the densities of immature sweetpotato whitefly lifestages (crawlers, sessile nymphs and pupae) were estimated weekly or biweekly by counting the numbers of crawlers, sessile nymphs and pupae on the terminal leaflet from the 7th or 8th leaf (counting from the top) of each of 10 stems from the middle rows of each plot. The numbers of apterous (unwinged) aphids and large (>0.5 inch in length) and small (≤0.5 inch) leafmines caused by *Liriomyza* spp. were also counted on these leaflets. The densities of adult whiteflies were estimated by placing 6 X 12 inches yellow sticky traps (Olsen Products, Medina, Ohio) in each plot for 24 hr every 3 to 4 days and counting the number of entrapped adults. Traps were placed flat on the bed surface with the long side parallel to the direction of the row.

Two, 25 pound samples of mature green fruit were harvested from each plot on 3 Nov., 12 and 30 Dec. in 1988 and on 18 April and 2 May in 1989. Fruit were exposed to ca. 100 ppm ethylene at 70 F and 90% RH for 4 to 5 days. After about another week, fruit were rated 1 to 4 for increasing severity of external symptoms *of irregular* ripening. Fruit rated 1 had no visible symptoms. Fruit rated 2 had a faint, yellow criscross ("star") pattern on the blossom end. Fruit rated 3 and 4 had ≤30% and >30%, respectively, of the fruit surface showing symptoms. In 1989 each fruit was cut transversely and rated 1 to 5 for increasing severity of internal white tissue. White tissue is normally present in certain commercially-grown tomato cultivars but is more severe when large populations of the sweetpotato whitefly are present.

Insecticides selected for evaluation in all 3 experiments had previously demonstrated efficacy against 1 or more lifestages of the whitefly in laboratory and greenhouse investigations (Schuster et al. 1989. Univ. Fla., IFAS, Bradenton GCREC Res. Rept. BRA1989-12) and included abamectin (Agrimek 0.15EC), azinphosmethyl (Guthion 2L), endosulfan (Thiodan 3EC or 50WP), esfenvalerate (Asana XL 0.66EC), insecticidal soap (Safer Insecticidal Concentrate), oxamyl (Vydate 2L), and permethrin (Ambush 2EC). The synergist, piperonyl butoxide (Butacide 8EC), was combined with esfenvalerate in the spring 1988 trial to determine if efficacy of esfenvalerate could be increased. The adjuvant Blendex was tank-mixed with the combination of permethrin, endosulfan and insecticidal soap in the fall 1988 trial to improve compatibility of the combination.

In the spring 1988 trial, insecticidal treatments were not alternated. Price et al. (1988. Univ. Fla., IFAS, Bradenton GCREC Res. Rept. BRA1988-15) suggested that insecticides of different chemical classes be alternated to avoid the development of resistance in the sweetpotato whitefly to the chemicals applied for its control. Consequently, in the fall 1988 and spring 1989 experiments, insecticidal treatments consisted of different classes of insecticides or insecticide combinations that were rotated on alternate spray days.

Results and Discussion

In the spring 1988 trial, esfenvalerate (applied either alone or combined with the synergist, piperonyl butoxide) and the combination of endosulfan and insecticidal soap consistently resulted in fewer unhatched eggs, nymphs, pupae, and emerged pupae and lower ratings for adult

Table 1. Impact of twice weekly applications of selected insecticides or insecticide combinations on populations of immature lifestages of the sweetpotato whitefly on commercially-grown tomatoes. Immokalee, Spring 1988.

		No. immatures/20, 0.8 inch leaf disks							
		Unhatched eggs				Nymphs			
Treatment	Amount /100 gal	12 May	19 May	26 May	31 May	12 May	19 May	26 May	31 May
Abamectin 0.15EC	8 oz	51.1bc[z]	83.4c	128.6d	294.3c	21.6ab	55.3cd	116.5c	147.5c
Esfenvalerate 0.66EC	7 oz	40.7b	82.1c	56.3c	64.0b	19.0a	34.5bc	34.1b	30.0b
Esfenvalerate 0.66EC	7oz								
+ Piperonyl butoxide 8EC	6 oz	20.3a	13.6a	12.5a	15.0a	15.6a	14.3a	8.8a	5.3a
Azinphosmethyl 2L	2 pt	61.3bc	152.6d	228.4ed	352.3c	25.6ab	50.3cd	143.0c	243.8cd
Endosulfan 50WP	1 lb								
+ Insecticidal soap	2 gal	15.5a	26.1b	27.5b	57.3a	14.5a	22.5ab	26.0b	29.8b
Check		67.8c	141.1d	277.8e	378.8c	31.4b	63.7d	183.1c	322.8d

[z]Mean separation within columns by Duncan's multiple range test, 5% level.

Table 2. Impact of twice weekly applications of selected insecticides or insecticide combinations on populations of pupae and adults of the sweetpotato whitefly and on irregular ripening (IRR) on commercially-grown tomatoes. Immokalee, Spring 1988.

		No. pupae/20, 0.8 inch leaf disks					
		Pupae		Emerged pupae			
Treatment	Amount/100 gal	26 May	31 May	26 May	31 May	Adult Rating[z]	% IRR
Abamectin 0.15EC	8 oz	12.1b[y]	16.8b	12.3b	28.3c	4.3bc	76.0a
Esfenvalerate 0.66EC	7 oz	4.6a	2.8a	7.6ab	9.3ab	1.5a	—
Esfenvalerate 0.66EC	7 oz						
+ Piperonyl butoxide 8EC	6 oz	1.6a	2.5a	6.8ab	9.0ab	1.1a	67.1a
Azinphosmethyl 2L	2 pt	13.7b	18.0b	9.9ab	20.3bc	3.6b	77.2a
Endosulfan 50WP	1 lb						
+ Insecticidal soap	2 gal	2.8a	7.0a	6.3a	5.8a	1.4a	81.2a
Check		17.3b	39.0c	10.9ab	30.3c	4.5c	72.8a

[z]The number of adults present at harvest were rated 1-5 for increasing abundance.
[y]Mean separation within columns by Duncan's multiple range test, 5% level.

abundance relative to the check (Tables 1 & 2). Abamectin resulted in fewer nymphs and pupae compared to the check only on the last sampling date. Azinphosmethyl resulted in fewer immatures only for pupae on the last sampling date. Nevertheless, the adult density rating of plots sprayed with azinphosmethyl was lower than that of the check plots. Combining piperonyl butoxide with esfenvalerate resulted in significantly fewer unhatched eggs on all sampling dates and fewer nymphs on 3 of 4 sampling dates compared to esfenvalerate alone. No treatment reduced the percent of fruit with external irregular ripening symptoms relative to the check.

In the fall 1988 trial, significant differences in the numbers of adults captured on yellow sticky traps occurred beginning on the first sampling date (Fig. 1). Consistently fewer were captured in treated plots than in untreated plots beginning on 31 Oct. Traps placed in plots treated with alternations of permethrin/endosulfan tended to capture fewer adults than traps placed in plots sprayed with the esfenvalerate/oxamyl alternation although differences were significant only on 19 Oct., 2, 16, 21 Nov., 1, 5 and 12 Dec.

All treatment alternations in the fall 1988 trial resulted in fewer crawlers compared with the control on the third and last sampling date and fewer older nymphs on the last sampling date (Table 3). Fewer pupae were observed only with the treatment of permethrin alternated with a combination of endosulfan, insecticidal soap and Blendex and

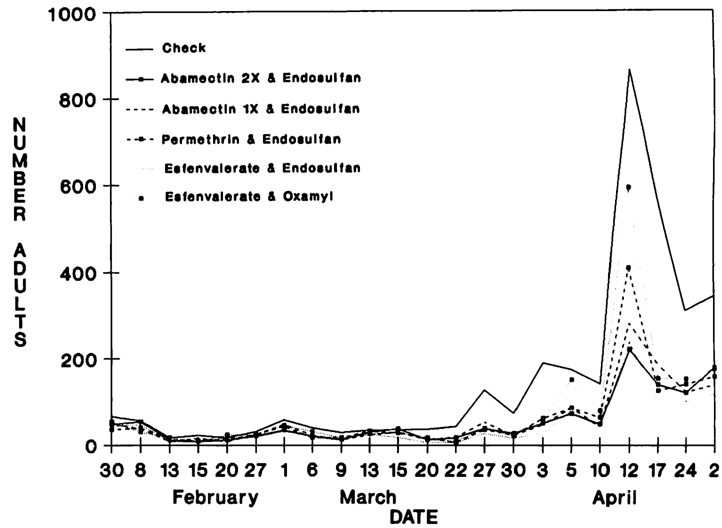

Fig. 1. The number of sweetpotato whitefly adults captured per yellow sticky trap placed 24 hr in tomato plots sprayed with insecticides. Immokalee, FL, 1988.

Table 3. Effect of selected insecticides or insecticide combinations alternated at least weekly on populations of immature lifestages of the sweetpotato whitefly on commercially-grown tomatoes. Immokalee, Fall 1988.

		Number nymphs/10 leaflets									
		Crawlers					Sessile nymphs				
Treatment alternation[z]	Amount /100 gal	16 Nov	23 Nov	30 Nov	7 Dec	14 Dec	16 Nov	23 Nov	30 Nov	7 Dec	14 Dec
Permethrin 2EC	8 oz										
& Endosulfan 3EC	2.5 pts	6.3a[y]	25.3a	16.7a	2.7a	44.3a	5.0a	2.3a	15.3a	9.3a	4.3a
Permethrin 2EC	8 oz										
& Endosulfan 3EC	1.5 pts										
+ Insecticidal Soap	1 gal										
+ Blendex	1 pt	4.3a	20.7a	26.3a	15.0a	52.3a	2.0a	6.7a	25.7a	24.3ab	2.0a
Esfenvalerate 0.66EC	6 oz										
& Oxamyl 2L[x]	2 pts	11.3ab	29.3a	27.3a	27.0ab	50.3a	11.0a	10.3ab	16.3a	34.3ab	4.0a
Control	—	17.3b	33.7a	53.0b	64.0b	91.3b	12.0a	24.3b	44.0a	97.7b	12.7b

[z]An "&" indicates an alternation of treatments and a "+" indicates a tank mix combination.
[y]Mean separation within columns by Duncan's multiple range test, 5% level.
[x]The rate of Oxamyl 2L was increased to 3 pts for the last six sprays.

Table 4. Effect of selected insecticides or insecticide combinations alternated at least weekly on populations of pupae of the sweetpotato whitefly and on irregular ripening (IRR) on commercially-grown tomatoes. Immokalee, Fall 1988.

Treatment alternation[z]	Rate form/100 gal	No. pupae/10 leaflets					Average IRR rating			
		16 Nov	23 Nov	30 Nov	7 Dec	14 Dec	First harvest	Second harvest	Third harvest	Season average
Permethrin 2EC & Endosulfan 3EC	8 oz 2.5 pts	0.3a[y]	1.3a	0.3a	4.0a	9.3ab	1.1a	1.6a	2.0a	1.6a
Permethrin 2EC & Endosulfan 3EC + Insecticidal Soap + Blendex	8 oz 1.5 pts 1 gal 1 pt	0.7 a	1.0a	2.0a	3.7a	1.3a	1.1a	1.1a	2.0a	1.6a
Esfenvalerate 0.66EC & Oxamyl 2L[x]	6 oz 2 pts	1.3a	2.0a	0.7a	4.0a	7.7ab	1.0a	1.0a	2.3b	1.6a
Control	—	8.3a	4.3a	3.0a	7.7a	20.0b	1.4b	2.2b	2.6c	2.1a

[z]An "&" indicates an alternation of treatments and a "+" indicates a tank mix combination.
[y]Mean separation within columns by Duncan's multiple range test, 5% level.
[x]The rate of Oxamyl 2L was increased to 3 pts for the last six sprays.

only on the last sampling date (Table 4). All treatments produced fruit with lower average irregular ripening ratings than the check when considering each harvest individually, although no treatment alternation completely eliminated symptoms (Table 4). In the third harvest, lower ratings were observed with permethrin alternations than with the esfenvalerate-oxamyl alternation or the control.

In the spring 1989 trial, the numbers of apterous aphids were reduced only by alternations including esfenvalerate and only on the first sampling date compared to the check (Table 5). Fewer large leafmines were observed on 3 of 4 sampling dates in plots sprayed with abamectin at the high rate relative to the check. An alternation with permethrin resulted in fewer large leafmines on 2 of the 3 first sampling dates but by the last sampling date resulted in more leafmines than the check. Alternations including esfenvalerate either did not reduce the number of large leafmines or resulted in more than the check. Differences gard to small leafmines were not often as great although fewer such mines were observed in plots sprayed with an

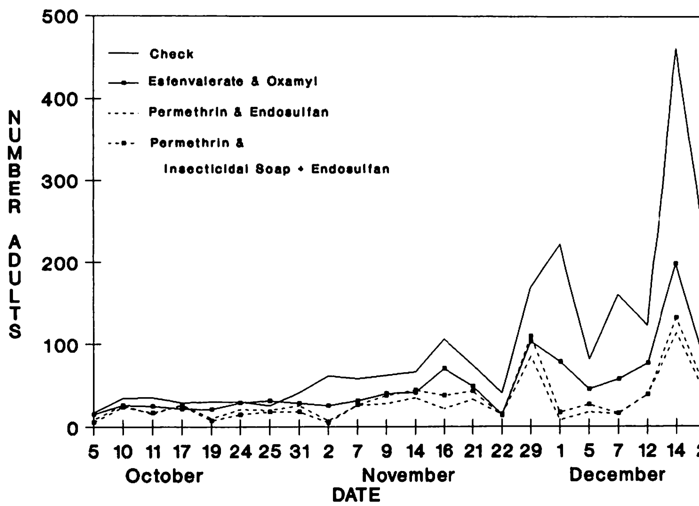

Fig. 2. The number of sweetpotato whitefly adults captured per yellow sticky traps placed 24 hr in tomato plots sprayed with insecticides. Immokalee, FL 1989.

Table 5. Densities of aphids and *Liriomyza* spp. leafmines on commercially-grown tomatoes sprayed twice weekly with alternations of insecticides. Immokalee, Spring 1989..

Treatment Alternation[z]	Amount /100 gal	No./10 leaflets: Apterous aphids			Large leafmines					Small leafmines				
		21 Feb	7 Mar	21 Mar	21 Feb	7 Mar	21 Mar	4 Apr	2 May	12 Feb	7 Mar	21 Mar	4 Apr	2 May
Abamectin 0.15EC & Endosulfan 3EC	8 oz 2.5 pts	15.3ab[y]	2.7a	14.7b	0.7a	0.0a	0.3a	2.0a	1.7a	3.0a	0.0a	0.3a	0.3a	3.7a
Abamectin 0.15EC & Endosulfan 3EC	4 oz 2.5 pts	19.7ab	3.0a	5.0a	6.0a	0.0a	8.0ab	12.0ab	7.0ab	10.0ab	0.7a	5.3a	6.0ab	13.7ab
Permethrin 2EC & Endosulfan 3EC	8 oz 2.5 pts	25.7ab	3.3a	3.0a	11.7a	0.0a	15.7ab	21.0b	21.7cd	14.7ab	0.3a	9.0ab	11.0abc	16.0ab
Esfenvalerate 0.66EC & Endosulfan 3EC	6 oz 2.5 pts	8.0a	0.3a	6.3a	46.0c	0.7a	75.7c	53.7c	34.3d	21.7b	5.3a	29.3b	23.7c	22.3b
Esfenvalerate 0.66EC & Oxamyl 2L	6 oz 3 pts	5.3a	0.3a	2.0a	31.3bc	0.7a	45.7bc	46.7c	29.0cd	7.3ab	6.7a	13.0ab	17.0bc	15.7ab
Check		36.0b	4.0a	7.7ab	27.7b	2.7a	66.7c	25.0b	17.7b	22.3b	18.0a	17.7ab	17.7bc	12.0ab

[z]Insecticides were alternated for each spray.
[y]Mean separation within columns by Duncan's multiple range test, 5% level.

Table 6. Densities of immature lifestages of the sweetpotato whitefly on commercially-grown tomatoes sprayed twice weekly with alternations of insecticides. Immokalee, Spring 1989..

		No. sweetpotato whitefly immatures/10 leaflets											
		Crawlers						Sessile nymphs					
Treatment Alternation[z]	Amount /100 gal	21 Feb	7 Mar	21 Mar	4 Apr	18 Apr	2 May	21 Feb	7 Mar	21 Mar	4 Apr	18 Apr	2 May
Abamectin 0.15EC & Endosulfan 3EC	8 oz 2.5 pts	10.7a[y]	12.3a	17.3a	14.0a	73.3a	232.0a	9.0a	0.3a	35.7a	25.0a	29.7a	139.3a
Abamectin 0.15EC & Endosulfan 3EC	4 oz 2.5 pts	6.7a	7.0a	11.7a	18.3a	90.3a	159.3a	4.0a	1.3a	33.7a	22.7a	37.3a	137.3a
Permethrin 2EC & Endosulfan 3EC	8 oz 2.5 pts	15.7a	25.0ab	19.3a	11.3a	133.7a	125.0a	6.0a	5.0a	21.3a	22.3a	53.7a	116.7a
Esfenvalerate 0.66EC & Endosulfan 3EC	6 oz 2.5 pts	5.3a	7.0a	11.0a	14.3a	43.0a	67.0a	1.7a	0.0a	25.7a	15.7a	9.0a	40.3a
Esfenvalerate 0.66EC & Oxamyl 2L	6 oz 3 pts	4.0a	18.3ab	24.3a	17.7a	94.7a	247.7a	1.3a	0.7a	51.3a	31.0a	30.3a	162.3a
Check		61.0b	39.0b	46.0b	45.7b	243.3b	1160.7b	53.7b	12.0a	195.0b	95.0b	127.7b	954.3b

[z]Insecticides were alternated for each spray.
[y]Mean separation within columns by Duncan's multiple range test, 5% level.

alternation including abamectin at the 8 oz rate on two dates compared to the check.

Although significant differences in the numbers of adults captured on yellow sticky traps occurred on the first sampling date in the spring 1989 experiment, large differences were not apparent until 20 Mar. (Fig. 2). After that time, the numbers of trapped adults were consistently reduced by all treatments compared to the check. On 12 Apr., fewest adults were trapped in plots sprayed with alternations of abamectin/endosulfan or esfenvalerate/endosulfan. Plots sprayed with either esfenvalerate alternated with oxamyl or with permethrin alternated with endosulfan were intermediate in the numbers of adults trapped. Nevertheless, by the end of the experiment, the numbers trapped in treated plots were not different from each other.

Fewer sweetpotato whitefly crawlers were observed on all insecticide-sprayed plots compared to the check on all sampling dates except the second (Table 6). All insecticide treatments resulted in fewer sessile nymphs relative to the check. Whitefly pupae were present only on the last 4 sampling dates (Table 7). Of these, fewer pupae were observed on all insecticide-treated plots relative to the check on 3 sampling dates. Lower average irregular ripening ratings were produced on the second fruit harvest for all insecticide alternations compared to the check. The ratings for the combined harvests were also lower. Fruit rated either 3 or 4 for external irregular ripening are considered unmarketable. Using this criteria, all alternations of insecticides increased marketable yield compared to the check when considering individual harvests or the sum for both harvests. Ratings for the extent of internal white tissue

Table 7. Densities of pupae of the sweetpotato whitefly and severity of irregular ripening (IRR) on commercially-grown tomatoes sprayed twice weekly with alternations of insecticides. Immokalee, Spring 1989..

		No. whitefly pupae/ 10 leaflets				External fruit IRR						Internal fruit white tissue rating		
						Rating			% unmarketable fruit[y]					
Treatment Alternation[z]	Amount /100 gal	21 Mar	4 Apr	18 Apr	2 May	18 Apr	3 May	Total	18 Apr	3 May	Total	18 Apr	3 May	Total
Abamectin 0.15EC & Endosulfan 3EC	8 oz 2.5 pts	1.7a[x]	4.0a	3.0a	11.0a	2.0a	2.1ab	2.1a	0.6a	9.6ab	7.0b	3.1ab	3.8b	3.5a
Abamectin 0.15EC & Endosulfan 3EC	4 oz 2.5 pts	0.7a	9.0ab	6.7a	13.0a	2.0a	2.2b	2.1a	0.0a	13.1b	6.5b	2.9a	3.8b	3.3a
Permethrin 2EC & Endosulfan 3EC	8 oz 2.5 pts	1.7a	9.3ab	8.0a	7.0a	2.0a	2.1ab	2.1a	0.0a	7.5ab	5.1ab	3.1ab	3.8b	3.5a
Esfenvalerate 0.66EC & Endosulfan 3EC	6 oz 2.5 pts	0.0a	5.3ab	1.3a	3.3a	2.0a	2.0a	2.0a	0.0a	4.2a	2.4a	3.0ab	3.4a	3.5a
Esfenvalerate 0.66EC & Oxamyl 2L	6 oz 3 pts	0.3a	5.3ab	3.7a	10.0a	2.0a	2.1ab	2.1a	0.3a	9.8ab	5.4ab	3.0ab	3.8b	3.5a
Check		12.3b	26.7b	11.0a	95.3b	2.0a	2.8c	2.4b	2.7b	54.0c	31.2c	3.3b	4.3c	3.9b

[z]Insecticides were alternated for each spray.
[x]Mean separation within columns by Duncan's multiple range test, 5% level.
[y]Data are the percent of fruit rated 3 or 4. Data were transformed arcsin of the square root of the proportion prior to analyses but are presented in the original scale.

were lower for all insecticides on the second harvest and for the combined harvests relative to the check.

These studies clearly demonstrate that insecticides registered for use on tomatoes are available for controlling the sweetpotato whitefly. The large plot studies further suggest that alternating selected insecticides not only provides some degree of control of the whitefly but also results in a lower percentage of fruit being affected by irregular ripening. Field cage studies (Schuster et al., unpublished data) clearly link the whitefly with increased internal white tissue. Furthermore, those studies suggest a relationship between the density of the whitefly and the extent of development of symptoms of irregular ripening. The present experiments support these conclusions since treatments that resulted in reduced whitefly populations also resulted in reduced fruit loss due to irregular ripening.

Literature Cited

Hamon, A. B. and V. Salguero. 1987. *Bemisia tabaci*, sweetpotato whitefly, in Florida (Homoptera: Aleyrodidae: Aledyrodinae). Fla. Dept. Agr. and Consumer Services Div. of Plant Industry. Entomol. Cir. 292. 2pp.