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Insecticide Control of Sweetpotato Whitefly in South Texas

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ABSTRACT

Three field experiments (one in cabbage and two in cantaloupe) were conducted at the Texas Agricultural Experiment Station at Weslaco, Texas in 1992 to evaluate chemical control of the b-strain sweet potato whitefly (SPWF), *Bemisia tabaci* Gennadius (Homoptera: Aleyrodidae). The field tests were designed according to a protocol for the 1992 USDA nationwide standardized chemical tests for SPWF control. Fosetyl-al 4.5 kg ai/ha, imidacloprid 0.10 kg ai/ha, fenpropathrin 0.28 kg ai/ha plus acephate 0.57 kg ai/ha amitraz 0.28 kg ai/ha, endosulfan 0.57 kg ai/ha, azadiractin 2% v/v, buprofezin 0.43 kg ai/ha, bifenthrin 0.09 kg ai/ha plus acephate 0.57 kg ai/ha, and an untreated check were evaluated in all tests. Imidacloprid and fenpropathrin plus acephate provided exceptionally good control of SPWF in all tests. In the fall cantaloupe test, a single application of imidacloprid applied in-furrow at planting provided SPWF control comparable to weekly foliar treatments and resulted in a significant increase in yield.

RESUMEN

En 1992 se dondujeron tres experimentos de campo (uno en repollo y dos en melón) en la Estación Agrícola Experimental de Texas en Weslaco, para evaluar el control químico de la cepa-b de la mosca blanca del camote (MBC), *Bemisia tabaci* Gennadius (Homoptera: Aleyrodidae). Las parcelas experimentales fueron diseñadas de acuerdo al protocola estandarizado para la realización de pruebas con productos químicas del Departamento de Agricultura de Estados Unidos. En todos los experimentos se evaluaron los siguientes tratamientos: Fosetyl-al con 4.5 kg de ia/ha, imidacloprid con 0.10 kg de ia/ha, fenpropatrina con 0.28 kg de ia/ha más ecefato con 0.57 kg ia/ha, amitraz 0.28 kg de ia/ha, bifentrina con 0.09 kg de ia/ha más acefato con 0.57 kg de ia/ha y el testigo que no recibió tratamiento. Imidacloprid y fenpropatrina más acefato brindaron un control excepcionalmente bueno de la mbc en todas las pruebas. En el muestreo del melón en otoño, una aplicación única de imidacloprid aplicado en el canal de riego, al momento de la siembra, proporcionó n control de la mbc comparable a los tratamientos foliares semanales y provocó un incremento significativo del rendimiento.

The main objective of these tests was to evaluate insecticide efficacy of eight chemical treatments against various stages of the b-strain Sweetpotato Whitefly, *Bemisia tabaci* Gennadius (SPWF) on cabbage and cantaloupe. Whiteflies in the Lower Rio Grande Valley of Texas have been shown to be controlled to various degrees by a number of insecticide combinations under greenhouse conditions (Riley 1991,1992 a-e). Also, there is a considerable amount of literature on chemical control of whiteflies world-wide (Dittrich et al. 1991), but the frequency and extensiveness of insecticide resistance with this pest (Dittrich et al. 1991, Wolfenbarger et al. 1994) necessitates the testing of products under field conditions in specific areas where they are to be used to adequately evaluate whitefly response. In 1992, a USDA protocol was developed for nation-wide standardized chemical tests to control sweetpotato whitefly (Akey 1993). The protocol outlined evaluation of chemical treatment effects on SPWF adults, SPWF nymphs, damage to the crop and crop yield. The following summarizes field tests done in south Texas in 1992. Also, evaluations of additional insecticide treatments in cantaloupe and observations on other pest damage in cabbage are included.

MATERIALS AND METHOD

Treatments and Sampling Procedure. Three insecticide efficacy tests (one in cabbage and two in cantaloupe) had certain common features that are outlined here; other information is described by individual test. All three tests evaluated a minimum of eight chemical treatments including: (1) fosetyl-al (Aliette® 80WP) 4.5 kg ai/ha; (2) imidacloprid (Admire 240S®) 0.10 kg ai/ha; (3) fenpropathrin (Danitol® 2.4EC) 0.28 kg ai/ha plus acephate (Orthene® 90S) 0.57 kg ai/ha; (4) amitraz (Mitac® 50WP) 0.28 kg ai/ha; (5) endosulfan (Thiodan® 3EC) 1.13 kg ai/ha; (6) azadiractin (Margosan-O®) 2% v/v; (7) buprofezin (Applaud® 440F) 0.43 kg ai/ha; (8) bifenthrin (Capture® 2EC) 0.09 kg/ ai/ha plus acephate 0.57 kg ai/ha; and (9) an untreated check.

Foliar spray applications were made using one overhead plus two drop hollow cone nozzles or three TX-SS10 nozzles per 102 cm cabbage or bed and three TX-SS18 nozzles per 203 cm cantaloupe bed with 3.2 and 3.5 kg/cm^2 pressure, respectively, at the spray boom and tractor speed of 4.6 km per hour. The average pH of the spray solutions in the cantaloupe and cabbage tests using a CO_2 pressurized sprayer was 6.2±0.8 (S) after application and all spray solutions were applied within 2 h of mixing. Treatments were arranged in a randomized complete block design with four replicates in the cabbage and cantaloupe tests. Individual plot sizes, application methods, and cultural practices are described by test.

Sampling for SPWF in all tests included counts of eggs, small nymphs (first and second instar), large nymphs (third and fourth instar), and empty pupal cases per cm^2 of leaf

Table 1. The average number of SPWF adults per leaf, large nymphs numbers per 10 cm^2 of leaf area, adults per 10 cm^2 of yellow sticky trap during the growing season and disease rating, cabbage yield (average head weight) and a damage rating for lepidopterous larvae in a spring cabbage test at Weslaco, Texas, 1992.

		12 May	Seasonal average			18 June		Harvest	
Treatment	Rate	Adults per leaf	Large nymphs per 10 cm^2 leaf area	Adults per leaf	Adults per 10 cm^2 trap area	Adults per leaf	Plant Disease rating[a]	Kg/head	Leaf Damage[b]
fosetyl-al	4.5 kg ai/ha	3.00 a[c]	0.21 abcd	15.4 ab	18.3 a	35.0 a	1.50 c	2.70 ef	3.6 ab
imidacloprid	0.10kg ai/ha	0.00 b	0.01 e	10.8 d	11.3 abcd	1.0 c	2.55 ab	3.08 bc	3.7 a
fenpropathrin plus	0.28kg ai/ha								
acephate	0.57kg ai/ha	0.25 b	0.12 cde	11.9 bcd	3.8 d	2.0 bc	1.75 bc	3.38 a	2.5 cd
amitraz	0.28kg ai/ha	2.25 ab	0.16 bcde	14.2 abcd	17.8 a	20.8 abc	2.25 bc	2.79 def	2.1 cde
endosulfan	1.13kg ai/ha	0.25 b	0.05 de	11.5 cd	5.5 cd	2.2 bc	2.50 abc	2.68 ef	2.4 cd
azadiractin	2% v/v	2.00 ab	0.34 a	16.7 a	14.7 ab	34.0 a	3.15 a	2.93 cde	3.6 ab
buprofezin	0.43kg ai/ha	3.00 a	0.07 de	15.9 a	11.1 abcd	19.8 abc	1.45 c	3.22 ab	3.9 a
bifenthrin plus	0.09kg ai/ha								
acephate	0.57kg ai/ha	0.00 b	0.04 e	10.3 d	7.8 bcd	0.5 c	2.15 bc	2.68 cdef	2.7 bc
untreated check	-	2.25 ab	0.21 abcd	16.1 a	16.6 a	26.3 abc	2.55 ab	2.59 f	4.5 a

[a]Rating 0=no symptoms, 1=one leaf spot,..., 5=leaves severely spotted, [b]Lepidoptera damage rating (Hoy et al 1990), [c]LSD tests ($P<0.05$),

area. Also, the number of adults per leaf and the number of adults per cm^2 of yellow sticky trap were recorded. In cantaloupe, the immature SPWF stages were sampled at the sixth leaf node from the apical meristem and in cabbage, they were sampled on the second oldest leaf. In cantaloupe, the SPWF adults were sampled at the third leaf node from the apical meristem and in cabbage, they were sampled on the fourth oldest leaf. A minimum of forty leaves were sampled per treatment 48 h after each application and held at freezing temperatures until evaluated. A yellow sticky trap (Olson® Products, Medina, Ohio), measuring 7.6 cm x 7.6 cm, was positioned in the middle of each plot, oriented perpendicular to the row in a vertical position with plant and approximately 10 cm above the soil surface, was exposed for a 24-h period, within 48 h of each application in all tests. Whitefly nymphs and adults per trap were recorded and analyzed on a cm^2 basis. Whitefly numbers and harvest quality data were analyzed using ANOVA procedures (SAS 1987) and LSD tests were used for separation of treatment means.

Cabbage Test (spring 1992) Cabbage var 'GrandSlam', was direct seeded on 17 March. Normal cultural practices were used in all tests. This included pre-plant applications of 12-24-12 (N-P-K) at 340 kg/ha and bensulide (Prefar 4E®) at 9.5 l/ha, three cultivations and periodic applications of metalaxyl-chlorothalonil (Ridomil® Bravo® 81W) 1.7 kg/ha for disease control. Also, three applications of *Bacillus thuringiensis* var. *kurstaki* (Biobit®) at 1.13 kg/ha were made for the suppression of lepidopterous pests. The treatment plot size was 4.1 m (4 rows) by 10.7 m. Treatments were initiated at a 1-2 true leaf stage and continued weekly with the exception of 18-22 May due to excessive rain. The nine previously listed treatments were evaluated. Data collected in this test included the previously described weekly SPWF measurements, harvest quality measurements and damage on the five best heads per plot in all replicates, and total yield weight per 50 heads per plot in three replicates.

Cantaloupe Test (spring 1992) Variety 'Perlita' was direct seeded on 19 March. The treatment plot size was 4.1 m (2 rows) by 10.7 m. Normal cultural practices were maintained with the exception that fields had to be drained frequently and weekly fungicide applications (metalaxyl-chlorothalonil 1.7 kg/ha) were made due to unusually high amounts of rainfall and the presence of downy mildew. Treatments were initiated at a 1-2 true leaf stage for both crops and continued weekly with the exception of 18-22 May due to excessive rain. In addition to the nine previously described treatments, treatments of: (1) imidacloprid 0.05 kg ai/ha + imidacloprid 0.12 g ai/m (side dress); (2) RH 0345 0.142 kg ai/ha + Latron B® 0.1% v/v; (3) RH 0345 0.28 kg ai/ha + Latron B® 0.1% v/v; (4) RH 0345 0.57 kg ai/ha + Latron B® 0.1% v/v; (5) buprofezin 0.43 kg ai/ha + endosulfan 1.13 kg ai/ha (once every two weeks); (6) buprofezin 0.43 la ai/a + amitraz 0.28 kg ai/ha (once every two weeks); (7) endosulfan 1.13 kg ai/ha + amitraz 0.28 kg ai/ha (once every two weeks); and (8) imidacloprid 0.14 kg ai/ha (applied in side dress at cotyledon stage) were evaluated. Data collected in this test included the previously described weekly SPWF measurements, and yield data from three harvests with evaluations of cantaloupe size by categories.

Cantaloupe Test (fall 1992) Variety 'Perlita' was direct seeded on 5 August 1992. The treatment plot size was 4.1 m (2 rows) by 10.7 m and there were four replicates of each plot. Normal cultural practices were maintained including a single application of dacthal (Dacthal 75W®) at 6.8 kg/ha was made for weed control at the five true leaf stage. Treatments were initiated at a 1-2 true leaf stage for both crops and continued weekly. In addition to the nine previously described treatments, treatments of: (1) imidacloprid 0.06 g ai/m (a single in-furrow spray at planting); (2) imidacloprid 0.12 g ai/m (a single in-furrow spray at planting); (3) imidacloprid 0.05 kg ai/ha; and (4) imidacloprid 0.13 kg ai/ha were evaluated. Data collected in this test included the previously described weekly SPWF measurements, and

Table 2. Average number of SPWF eggs and large nymphs 10 cm² of leaf area, adults per leaf, and adults per 10 cm² of yellow sticky trap in a sping cantaloupe test at Weslaco, Texas, 1992.

		26 May		Seasonal average		
Treatment	Rate	Eggs (per 10cm²)	Large nymphs	Large nymphs	Adults per leaf	Adults per trap
fosetyl-al	4.5kg ai/ha	7.6 abcde[a]	4.9 bcde	18.3 abc	5.6 abcde	8.0 abcdef
imidacloprid plus	0.05kg ai/ha					
imidacloprid	0.12g ai/m[b]	3.0 ef	7.4 bcd	3.1 bc	4.6 abcde	8.1 abcdef
imidacloprid	0.10kg ai/ha	5.1 cdef	0.1 e	1.2 c	2.6 e	7.0 bcde
fenpropathrin plus	0.28kg ai/ha					
acephate	0.57kg ai/ha	1.4 f	0.0 e	1.4 c	2.5 e	6.8 cdef
amitraz	0.28kg ai/ha	9.3 abcd	2.7 cde	5.1 bc	5.6 abcde	8.7 abcd
endosulfan	1.13kg ai/ha	4.5 cdef	0.6 e	9.6 abc	3.1 de	4.9 f
azadiractin	2% v/v	5.4 bcdef	7.4 bcd	5.1 bc	3.9 cde	6.3 cdef
buprofezin	0.43kg ai/ha	9.9 abc	0.3 e	23.3 abc	7.2 ab	7.9 abcdef
bifenthrin plus	0.09kg ai/ha					
acephate	0.57kh ai/ha	4.1 def	0.2 e	10.9 abc	4.4 bcde	7.5 abcdef
RH 0345	0.14kg ai/ha	11.1 ab	6.4 bcde	21.7 abc	5.5 abcde	9.0 abc
RH 0345	0.28kg ai/ha	7.1 abcdef	14.8 a	10.7 abc	7.6 a	9.2 abc
RH 0345	0.57kg ai/ha	4.2 cdef	9.9 ab	14.7 abc	4.8 abcde	10.4 ab
buprofezin plus	0.43kg ai/ha					
endosulfan	1.13kg ai/ha[c]	6.2 abcdef	1.5 de	2.8 c	3.2 de	5.2 ef
buprofezin plus	0.43lb ai/ha					
amitraz	0.28kg ai/ha[c]	11.3 a	2.1cde	5.5 bc	5.7 abcde	6.5 cdef
endosulfan plus	1.13kg ai/ha					
amitraz	0.28kg ai/ha[c]	6.4 abcdef	6.1 cde	4.4 bc	6.4 abc	10.3 ab
imidacloprid	0.14kg ai/ha	3.6 def	0.3 e	4.0 bc	4.8 abcde	6.4 cdef
untreated check	–	6.8 abcdef	8.5 abc	25.5 a	85.9 abcd	10.8 a

[a]LSD tests (P<0.05), [b]soil applied as side dress, [c]applied once per two weeks.

yield data from three harvests with evaluations of cantaloupe size by categories, and percent soluble sugars.

RESULTS

Cabbage Test (spring 1992) The number of SPWF adults and nymphs were low through 12 May (Table 1) due to heavy rains and a low initial infestation in March and April. The insecticide combinations and endosulfan significantly reduced adult numbers per trap compared to the untreated check when averaged over all sampling dates and imidacloprid was one of the best treatments for reducing nymph numbers (Table 1). By the end of the season, large differences were noted in SPWF adults per leaf, as well as the incidence of secondary foliar diseases (Table 1). Yield was significantly greater in several of the treatments that provided good SPWF control, but effects due to disease and damage by lepidopterous larvae confounded the measurement of the effect of SPWF control on cabbage yield (Table 1). The total weight from 50 heads per plot indicated that only fenpropathrin plus acephate, endosulfan, and amitraz was significantly different from the untreated check ($F=3.2$, $df=11, 33$, $P>0.05$), which are treatments that also reduced lepidopterous damage (Table 1). In this test, it appeared that SPWF damage was not the most significant factor affecting yield because lepidopterous damage and foliar disease symptoms were severe.

Cantaloupe Test (spring 1992) Heavy rains affected the cantaloupe crop in terms of greater incidence of downy mildew and decreased plant stand and, consequently, treatment effects on yield were too variable to be representative. However, treatment effects on SPWF numbers were significant and are summarized here. By 26 May SPWF numbers were moderate and treatments with low adulticide activity experienced greater levels of oviposition, such as in the buprofezin and amitraz plots, than the untreated check (Table 2). Most insecticide combinations, amitraz, azadiractin, endosulfan, and the high rate of imidacloprid significantly reduced adult numbers per trap over the entire season. Foliar applications of imidacloprid, fenpropathrin plus acephate, and buprofezin plus endosulfan resulted in the lowest number of nymphs overall (Table 2). Yield was not significantly affected (total number of fruit, $F=0.8$, $df = 19, 79$, ns, total weight $F=0.52$, $df=19, 79$, ns), and this was attributed to the excessive rainy weather conditions resulting in poor stands.

Cantaloupe Test (fall 1992) SPWF numbers were greater in the fall than in the spring during the early vegetative growth of the cantaloupe crop (Table 3). Again, treatments with low adulticide activity, buprofezin and amitraz, tended to have greater oviposition than other treatments, but were still significantly lower than the untreated check. The bifenthrin treatment did not perform as well as in the

Table 3. Average numbers of SPWF eggs and large nymphs per (3.8 cm^2) leaf area, adults per leaf, and adults per 10cm^2 of yellow sticky trap during early vegetative growth (18 Sept), eggs, nymphs and adults per (10cm^2) yellow sticky trap on maturing plants (8 Oct), and a season-long average of SPWF eggs and large nymphs adults per trap in a fall cantaloupe test at Weslaco, Texas, 1992.

		18 September		8 October			Overall		
Treatment	Rate	Eggs	Large Nymphs	Eggs	Large nymphs	Trapped adults	Eggs	Large Nymphs	Trapped adults
fosetyl-al	4.5 kg ai/ha	29.4 ab[a]	7.3 bcde	156 ab	42.2 a	12.4 a	114 ab[1]	29.3 a	17.5 bcde
fenpropathrin	0.28kg ai/ha								
plus acephate	0.57kg ai/ha	8.5 cd	2.7 e	5 c	2.3 d	1.1 c	74 bcd	17.7 abc	11.4 e
amitraz	0.28kg ai/ha	20.3 bcd	10.3 abc	73 bc	51.3 a	9.3 ab	103 abcd	21.0 abc	19.9 abcd
endosulfan	1.13kg ai/ha	7.9 cd	4.0 de	15 c	7.0 c	1.7 c	93 bcd	15.0 bc	13.1 de
azadiractin	2% v/v	15.7 bcd	6.5 bcde	30 c	24.3 b	5.0 bc	107 abc	21.4 abc	15.2 cde
buprofezin	0.43kg ai/ha	25.3 abc	3.7 de	54 c	0.2 d	7.7 abc	113 ab	13.6 bc	15.0 cde
bifenthrin	0.09kg ai/ha								
plus acephate	0.57kg ai/ha	14.4 bcd	2.6 e	17 c	14.3 bcd	2.3 bc	84 bcd	24.5 ab	19.9 abcd
imidacloprid	0.06g ai/m[b]	4.5 d	11.5 ab	24 c	4.9 d	12.8 a	69 cd	21.8 abc	22.9 abcd
imidacloprid	0.12g ai/m[b]	8.1 cd	14.9 a	21 c	4.1 d	13.6 a	69 cd	10.6 c	25.6 a
imidacloprid	0.05kg ai/ha	12.9 bcd	3.0 de	6 c	1.5 d	4.8 bc	73 bcd	15.0 bc	13.7 de
imidacloprid	0.13kg ai/ha	8.5 cd	5.1 cde	6 c	0.6 d	1.9 c	66 d	15.6 bc	15.8 bcde
untreated check	–	43.1 a	9.0 abcd	190 a	21.0 bc	12.7a	138 a	24.2 ab	21.4 abc

[a]LSD test on log-transformed values (P<0.05), [b]A single in-furrow spray at planting.

spring test and there is evidence using a bioassay technique that the field population of SPWF was demonstrating higher levels of resistance to bifenthrin in this location (Wolfenbarger et al. 1994). By 8 October, greater than 90% reduction of eggs and nymphs was evident in several treatments (Table 3). The overall reduction of eggs, nymphs and adults based on a season long average was less dramatic (Table 3). Large difference in plant quality were noted by the first harvest and plant decline resulted in large numbers of small fruit (size 30) in the poorest treatments for SPWF control in the first harvest (Table 4). Although the quality of the plants decreased dramatically under heavy SPWF infestation, the plant compensated some what by producing a large number of small fruit earlier than in plots where the plants remained healthy. This is reflected in the effects on fruit size (kg/fruit in Table 4).

SUMMARY

The treatments which appeared to provide the best adult control were foliar applications of fenpropathrin plus acephate, bifenthrin plus acephate, and buprofezin plus endosulfan, and imidacloprid. Imidacloprid treatments to the soil also provide good control of SPWF nymphs and resulted in significant increases in yield and harvest quality in the fall cantaloupe test. The importance of sampling the right stage of SPWF and examining SPWF population dynamics over time were demonstrated in these tests. For example, the treatment of buprofezin alone protected the plant by reducing nymph development, but appeared to

Table 4. Cantaloupe yield data from the first and second harvests in terms of numbers of small (size 30) and medium (size 23) fruit and total yield averaged over all three harvests in the fall test at Weslaco, Texas, 1992.

		First Harvest	Second Harvest		Average over all harvests			
Treatment	Rate	Size 30	Size 30	Size 23	Kg per fruit	Kg overall	No. overall	% Sugars
fosetyl-al	4.5 kg ai/ha	69.3 a	1.5 d	0.5 d	0.28 d[a]	24.6 f	87.8 a	3.7 e
fenpropathrin plus	0.28 kg ai/ha							
acephate	0.57 kg ai/ha	4.3 c	12.0 abc	6.5 a	0.72 a	50.7 a	71.0 abcde	8.6 abc
amitraz	0.28 kg ai/ha	30.8 bc	8.0 abcd	1.0 cd	0.41 bc	32.8 cdef	84.0 abc	5.7 de
endosulfan	1.13 kg ai/ha	8.0 c	12.8 abc	3.0 cd	0.60 a	39.9 bc	66.3 abcde	8.2 abc
azadiractin	2% v/v	28.3 bc	14.5 ab	0.8 cd	0.36 bcd	23.0 f	66.5 abcde	6.8 cd
buprofezin	0.43 kg ai/ha	5.0 c	3.3 cd	4.8 ab	0.71 a	34.8 cde	50.3 e	9.5 ab
bifenthrin	0.09kg ai/ha							
plus acephate	0.57 kg ai/ha	9.3 c	17.3 a	6.0 ab	0.47 b	27.5 def	58.3 de	6.5 cd
imidacloprid	0.06 g ai/m[b]	2.3 c	12.0 abc	4.5 ab	0.64 a	38.9 bc	61.0 cde	6.3 cd
imidacloprid	0.12 g ai/m[b]	9.8 c	7.8 abcd	3.8 abc	0.65 a	47.9 ab	76.0 abcd	7.5 abcd
imidacloprid	0.05 kg ai/ha	8.8 c	7.5 abcd	4.8 ab	0.65 a	41.3 abc	63.8 bcde	9.9 a
imidacloprid	0.13 kg ai/ha	5.3 c	5.5 bcd	4.5 ab	0.68 a	37.2 cd	54.0 de	8.4 abc
untreated check	-	57.5 ab	4.5 bcd	0.0 d	0.33 cd	27.2 def	85.8 ab	7.3 bcd

[a]LSD test on log-transformed values (P<0.05), [b]a single in-furrow spray at planting.

attract more adults than the untreated check after plant quality in the check decreased as evidenced by increased oviposition. Also, significant treatment effects on whitefly numbers following applications appeared to be obscured when effects were averaged over the season. Crop yields do not always correspond with low seasonal averages of SPWF, due in part to confounding effects of other pests, but can be a better indicator of the effect of whitefly control treatments when combined with efficacy data. Based on the plant and insect response data presented here, effective treatments for the control of SPWF include fenpropathrin plus acephate, bifenthrin plus acephate, buprofezin plus endosulfan, and imidacloprid. A single soil application of imidacloprid at planting and weekly applications of fenpropathrin plus acephate provided the greatest yield in fall cantaloupes and significantly reduced whitefly numbers in all tests.

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REFERENCES

Akey, D. H. 1992. Protocols for ground application of chemical trials against the sweetpotato whitefly (SPWF) in the 1992 growing seasons, as established by the SPWF workshop at San Antonio, Texas, January 23-24, 1992. USDA Mimeograph February 14, 1992. Western Cotton Res. Lab, Phoenix, Arizona. 8 pp.

Dittrich, V., S. Uk, and G. H. Ernst 1991. Chemical control and insecticide resistance of whiteflies. pp. 263-286 In Whiteflies: Their Bionomics, Pest Status and Management. D. Gerling. ed., Intercept Ltd, Andover, United Kingdom.

Riley, D.G. 1992a. Control of the sweetpotato whitefly in cantaloupe with various insecticide treatments, 1991. Insecticide & Acaricide Tests 17: 94.

Riley, D.G. 1992b. Control of the sweetpotato whitefly in squash with various insecticide treatments, 1991. Insecticide & Acaricide Tests 17: 153.

Riley, D.G. 1992c. Control of the sweetpotato whitefly in cantaloupe with adjuvants, endosulfan, bifenthrin, and other treatments. Insecticide & Acaridice Tests 17: 94-95.

Riley, D.G. 1992d. Control of the sweetpotato whitefly in cantaloupe with endosulfan and amitraz, 1991. Insecticide & Acaricide Tests 17: 95.

Riley, D.G. 1992e. Control of the sweetpotato whitefly in cantaloupe with two pyrethroid and two organochlorine insecticides. Insecticide & Acaricide Tests 17: 95-96.

Riley, D.G. 1991. Control of the sweetpotato whitefly in cantaloupe in Texas, 1991. Insecticide and Acaricide Tests 17: 93.

SAS Institute. 1987. SAS/STAT Guide for personal computers, version 6 ed. SAS Institute, Inc., Cary, NC.

Wolfenbarger, D.A., D.G. Riley, G.L. Leibee, E.V. Gage, C.A. Staetz, G.A. Herzog. 1994. Response of sweetpotato whitefly to bifenthrin and endosulfan by vial bioassay in the southern United States. J. Econ. Entomol. Accepted.