CALIFORNIA MELON RESEARCH BOARD
2012 Final Report

January 1, 2012 to December 31, 2012

PROJECT TITLE:

New Insecticide Alternatives for Insect Management in Melons

PRINCIPLE INVESTIGATOR:

John C. Palumbo
Yuma Agricultural Center
Dept. of Entomology
University of Arizona,
Yuma, Arizona

Objective 1. To continue to evaluate the efficacy of insecticide alternatives and develop alternatives to endosulfan for whitefly adults and CYSDV in spring and fall melons.

Objective 2. To continue to evaluate new insecticide alternatives on spring and fall melons in an attempt to develop *alternatives for diazinon* and other older chemistry for seed corn maggot and Lepidopterous larvae.

SUMMARY OF RESEARCH RESULTS:

- Spring and fall cantaloupe trials further documented the activity of several new experimental foliar insecticides with adult whitefly activity that may provide suppressive activity against CYSDV. Among these included Pyrifluquinazon (PFQ), Closer (sulfoxaflor), Exirel/Verimark (cyazypyr) and Sivanto (*flupyradifurone)*. These novel compounds controlled adult whiteflies comparable to industry standards such as endosulfan, Assail and Venom. They also provided excellent control of whitefly nymphs. In most cases, we were not able to measure suppression of Cucurbit Yellows Stunting Disorder Virus (CYSDV) with these compounds due to low virus incidence in the spring, and premature termination of studies in the fall due to high temperatures and vine decline.

- For a second year studies showed that the use of Venom and Sivanto, applied in a management program that included at-planting applications followed by a side-dress application, significantly reduced whiteflies and delayed CYSDV incidence when followed by experimental foliar sprays.

- A number of experimental seed treatments were shown to be effective alternatives to for protection of seedling melons from seed corn maggot. In addition, a study demonstrated that in-furrow applications of bifenthrin and Cyazypyr provided significantly better control of SCM than when these same compounds were applied as soi-surface band treatments over the seedline

- A fall study examined the residual efficacy of several new insecticide products against cabbage looper. Radiant, Intrepid and several Diamides (Coragen, Voliam Xpress and Belt) significantluy control loopers fro 7-8 days following application and prevented feeding damahe to leaves.

RESEARCH PROCEDURES AND RESULTS

Objective 1. Whitefly Control and CYSDV Management

I. Spring Cantaloupes

A. *Conventional Foliar Alternatives for Whitefly Adults / CYSDV*

Research procedures: With the loss of the endosulfan on melons, this trial was designed to evaluate the efficacy of several foliar insecticide alternatives (combined with Brigade) against adult whiteflies and the associated incidence of Cucurbit Yellows Stunting Disorder Virus (CYSDV) in melons. Cantaloupe plots planted with 'Gold Express' were established at the Yuma Agricultural Center on 25 Apr, 2012 and managed similarly to local growing practices. Plots consisted of a single 84-inch bed, 45 ft long with a 7 buffer between each plot. The study was designed as a RCB design with 4 replicates / treatment. The treatment combinations and rates are shown in the table below. The treatments and rates are shown in the table below. Three foliar spray treatments were applied on 24 and 31 May, and 12 June with a CO_2 backpack sprayer that delivered 21 GPA at 40 psi, using 4 – TX18 ConeJet nozzles per bed as a broadcast spray. All spray treatments included an adjuvant, DyneAmic at 0.25% v/v.

Populations of whitefly adults were evaluated at 1, 3 and 7 day intervals following each application (DAA). Adult populations were estimated using a modified vacuum method that employed a DeWALT DC500 2-gallon portable vacuum fitted with 5 oz cloth-screened containers to capture and retain vacuumed adults. On each sample date, 5 separate plants from each replicate were sampled by vacuuming the terminal area of the plants for 3 seconds. Containers with adults were taken into the laboratory, placed in a freezer for 24 hours after which the number of adults/ plant was recorded. Immature densities were estimated at 14 days following the 3rd application, where 3 leaves were collected from each plant on the 10th, 15th and 20th nodes from the terminal on the primary vine. Leaves were taken into the laboratory where densities of eggs, and nymphs were counted on two, 2-cm^2 leaf discs of each leaf using a dissecting microscope. CYSDV incidence was estimated on 25 Jun and 5 Jul by counting the number of leaves in 30 row ft within each plot that expressed yellow interveinal chlorosis (YIVC) symptoms.

Research Summary: Adult pressure was light during this trial, but differences among the Brigade tank-mixtures in control of whitefly adults were observed. Following the 1st spray, all treatments provided knockdown activity at 1 day after application (1 DAA) (Table 1). We did observe significant phtyotoxicity to melons leaves in the Dibrom treatment at this time (Figure 2). No other treatments caused phyto in this trial. However, only the Diazinon and Assail provide significant residual activity (7 DAA). Following the 2nd spray, a similar trend was observed except that only the Assail +Brigade treatment provided significant residual control of adults. Following the 3rd application, adult numbers began to increase in the untreated plots. Again, all treatments provided significant knockdown activity, and most treatments showed significant activity at 7 DAA except the Dibrom and Vydate treatments. Further, these products did not provide significant control of whitefly immatures (Figure 1). Only Assail and Agri-Mek provide control of nymphs comparable to the standard (Thionex). Overall, the most consistently performing products in this trial were Assail and Diazinon, when compared to the standard. Both treatments provided control of adults that was as good as, or better than Thionex (endosulfan). Unfortunately very little CYSDV was present in the experimental plots and differences among treatments was not detected.

Table 1. Knockdown and Residual Efficacy of Conventional Insecticides tank-mixed with Brigade Against Whitefly Adults in Spring Melons, 2012

Spray # 1 (24 May)

Treatment	Rate	Adult Whiteflies / Sample 1 DAA 25-May	3 DAA 28-May	7 DAA 31-May	Avg.
Dibrom 8EC + Brigade	1 pt + 6.4 oz	0.3 b	0.7 bc	2.8 a	1.3 b
Dimethoate E267 +Brigade	1.5 pt + 6.4 oz	0.3 b	1.3 abc	2.6 a	1.4 b
Diazinon A500 + Brigade	1.5 pts + 6.4 oz	0.3 b	0.3 cd	0.9 b	0.5 cd
Malathion 8F +Brigade	1.75 pts + 6.4 oz	0.3 b	1.0 ab	2.0 ab	1.1 b
Lannate SP + Brigade	1 lb + 6.4 oz	0.1 b	0.6 bc	3.0 a	1.2 b
Vydate L + Brigade	4 pts + 6.4 oz	0.1 b	0.9 abc	2.1 ab	1.0 bc
Thionex 3EC + Brigade	32 oz +6.4 oz	0.1 b	0.7 bc	1.8 ab	0.9 bcd
Agri-Mek SC + Brigade	3.5 oz + 6.4 oz	0.2 b	1.3 abc	3.1 a	1.5 b
Assail 30SG + Brigade	5.3 + 6.4 oz	0.2 b	0.2 d	1.1 b	0.5 d
Untreated		1.1 a	1.7 a	2.9 a	1.9 a

Spray # 2 (31 May)

Treatment	Rate	Adult Whiteflies / Sample 1 1-Jun	3 4-Jun	7 7-Jun	Avg.
Dibrom 8EC + Brigade	1 pt + 6.4 oz	0.7 bc	0.7 a	5.4 ab	2.3 b
Dimethoate E267 +Brigade	1.5 pt + 6.4 oz	1.3 ab	0.6 ab	6.6 ab	2.8 ab
Diazinon A500 + Brigade	1.5 pts + 6.4 oz	0.6 bcd	0.6 ab	3.8 b	1.6 bc
Malathion 8F +Brigade	1.75 pts + 6.4 oz	1.2 b	0.6 ab	5.5 ab	2.4 b
Lannate SP + Brigade	1 lb + 6.4 oz	0.9 bc	0.5 abc	5.6 ab	2.3 b
Vydate L + Brigade	4 pts + 6.4 oz	1.0 bc	0.7 a	5.4 ab	2.3 b
Thionex 3EC + Brigade	32 oz +6.4 oz	0.1 d	0.2 bc	3.8 b	1.4 cd
Agri-Mek SC + Brigade	3.5 oz + 6.4 oz	1.0 bc	0.6 ab	5.0 ab	2.2 b
Assail 30SG + Brigade	5.3 + 6.4 oz	0.3 cd	0.2 c	1.4 c	0.6 d
Untreated		3.1 a	1.1 a	8.3 a	4.2 a

Spray # 3 (12 June)

Treatment	Rate	Adult Whiteflies / Sample 1 13-Jun	3 15-Jun	7 19-Jun	Avg.
Dibrom 8EC + Brigade	1 pt + 6.4 oz	7.7 b	3.2 b	9.5 abc	6.8 bc
Dimethoate E267 +Brigade	1.5 pt + 6.4 oz	8.5 b	2.8 b	7.1 bcd	6.1 bc
Diazinon A500 + Brigade	1.5 pts + 6.4 oz	6.0 b	2.3 b	5.6 d	4.6 c
Malathion 8F +Brigade	1.75 pts + 6.4 oz	9.1 b	2.5 b	8.1 bcd	6.6 bc
Lannate SP + Brigade	1 lb + 6.4 oz	7.4 b	2.2 b	7.4 bcd	5.6 bc
Vydate L + Brigade	4 pts + 6.4 oz	9.6 b	3.2 b	13.2 a	8.7 b
Thionex 3EC + Brigade	32 oz +6.4 oz	0.6 c	0.5 c	2.3 e	1.1 d
Agri-Mek SC + Brigade	3.5 oz + 6.4 oz	7.2 b	2.3 b	6.5 cd	5.3 bc
Assail 30SG + Brigade	5.3 + 6.4 oz	1.0 c	0.4 c	2.2 e	1.2 d
Untreated		18.8 a	8.7 a	10.4 ab	12.6 a

Means in a column followed by the same letter are not significantly different (P>0.05)

Figure 1. Whitefly egg and nymph densites averaged across all spray applications of conventional insecticides tank-mixed with Brigade.

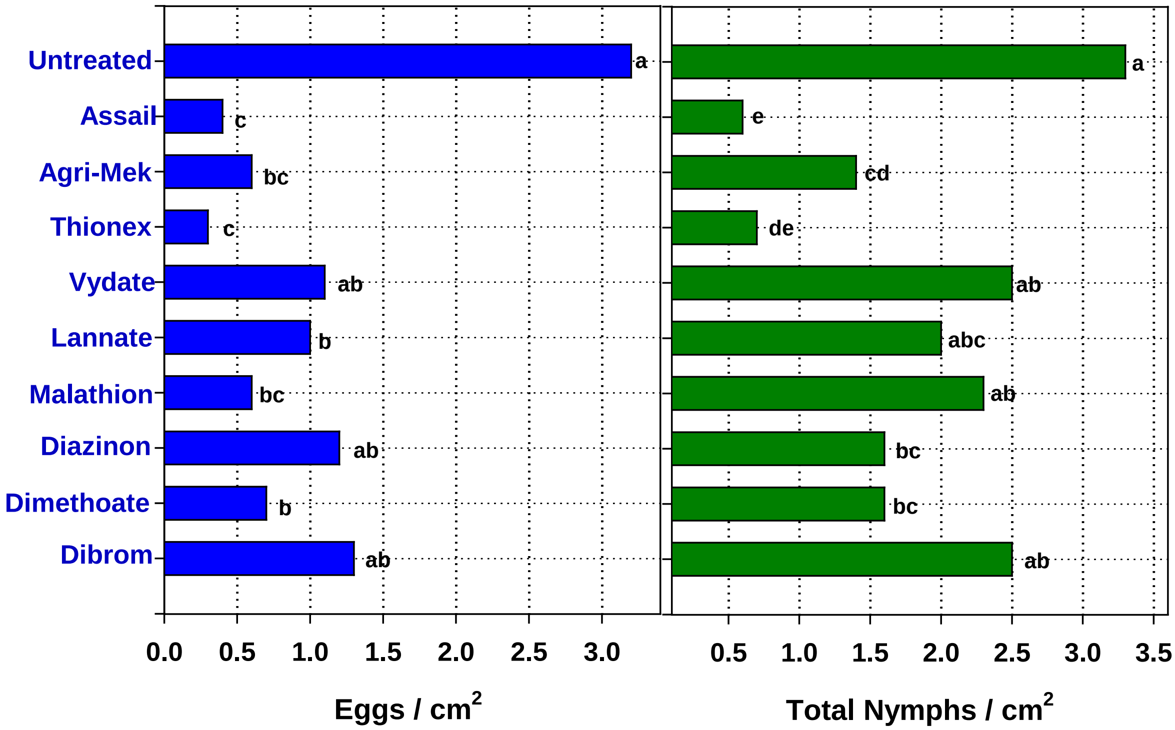


Figure 2. Phytotoxicity on melon leaves following the 1st application of Dibrom+Brigade .

Untreated **Dibrom+Brigade**

B. Experimental Foliar Alternatives for Whitefly Adult / CYSDV

Research procedures: Cantaloupe plots planted with 'Gold Express' were established at the Yuma Agricultural Center on 25 Apr, 2012 and managed similarly to local growing practices. Plots consisted of one 84-inch bed, 45 ft long with a 7 buffer between each plot. The study was designed as a randomized complete block design with 4 replicates / treatment. The treatments and rates are shown in the tables. Three foliar sprays were applied on 24, 31 May and 14 June with a CO_2 operated boom sprayer at 40 psi and 20.5 gpa. A broadcast application was delivered through 2 TXVS-18 ConeJet nozzles per bed. An adjuvant, Dyne-Amic (Helena Chemical Co.), was applied at 0.25% vol/vol to all treatments. Populations of whitefly adults and immatures were evaluated at various intervals following each application using the sampling method described above. CYSDV incidence was estimated on 5 Jul by counting the number of leaves per 30 row ft with yellow interveinal chlorosis (YIVC) symptoms.

Research Results: Similar to the previous conventional insecticide trial, adult pressure was light, but differences among the treatments were observed. Unlike the previous trial, several of the experimental compounds provide significant knockdown and residual activity against whitefly adults and nymphs comparable to the standards, Scorpion and Assail (Table 2, Figure 3). These included Pyrifluquinazon (PFQ), Exirel, and Sivanto. These compounds have shown good whitefly control in previous spring and fall studies conducted over the past several years. Unfortunately, CYSDV levels were very light and we were not able to assess their impact on virus suppression in this trial. Not surprisingly, Fulfill did not provide significant activity against whitefly adults and tank mixing with Vydate did not provide any improvement in activity. Closer, which has shown marginal residual activity in the past, similarly provided marginal activity relative to the standards. Based on these result, Exirel, Sivanto and PFQ were included in our fall trials.

Figure 3. Whitefly Egg and Nymph Densities averaged across all Applications of Experimental Insecticides.

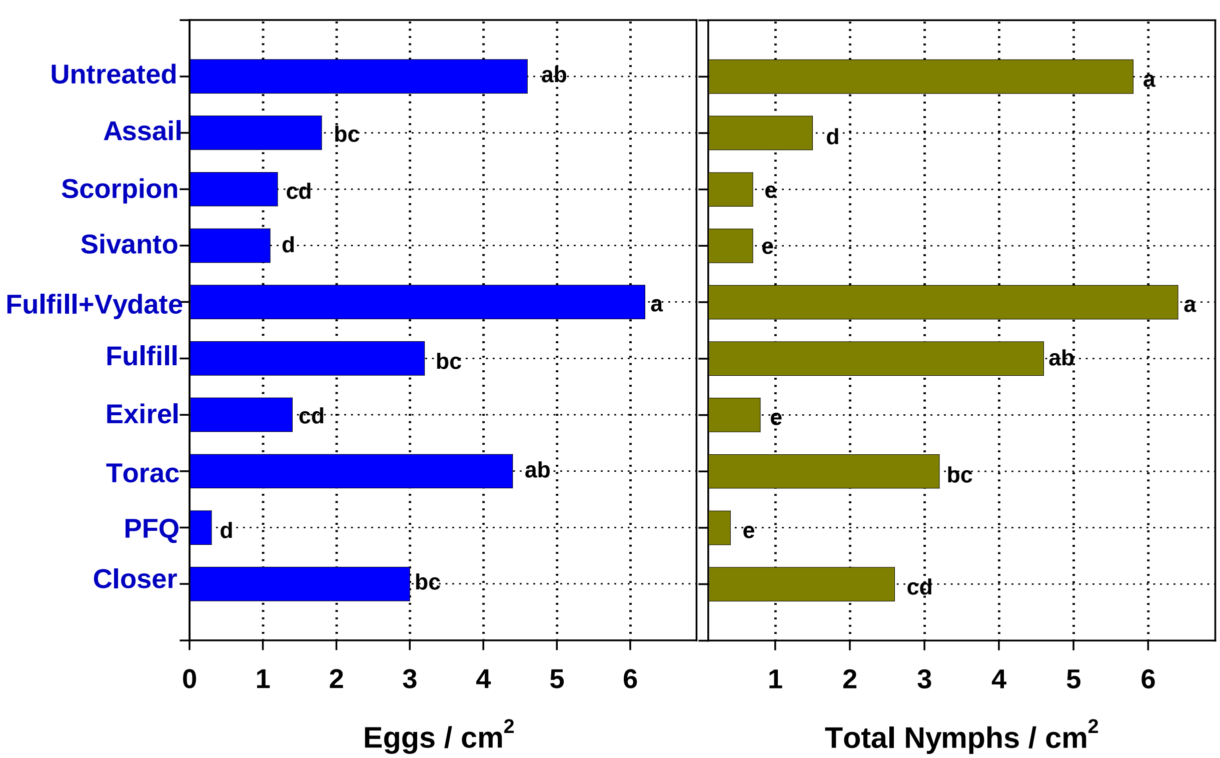


Table 2. Knockdown and Residual Efficacy of Experimental Insecticides Against Whitefly Adults in Spring Melons, 2012

Spray # 1 (24 May)		Adult Whiteflies / Sample		
		1 DAA	4 DAA	7 DAA
Treatment	Rate	25-May	28-May	31-May
Closer 2SC	5.7 oz	0.0b	0.5 cd	1.4 bcd
Pyrifluqinazon	3.2 oz	0.0b	0.2 d	1.1 cd
Torac 15EC	21 oz	0.0b	0.4 b	3.2 a
Exirel 10SE	20 oz	0.1b	0.6 bcd	0.9 cd
Fulfill 50WDG	2.8 oz	0.0b	0.8 bc	2.3 ab
Fulfill + Vydate L	2.8 oz + 3 pts	0.1ab	1.7 a	3.2 a
Sivanto 240SL	14 oz	0.0b	0.3 d	1.0 cd
Scorpion 35SL	7 oz	0.0b	0.3 d	0.8 d
Assail 30SG	5.3 oz	0.1b	0.4 cd	1.4 bcd
Untreated	-	0.2a	1.7 a	1.9 bc

Spray # 2 (31 May)		Adult Whiteflies / Sample			
		1 DAA	4 DAA	7 DAA	12 DAA
Treatment	Rate	1-Jun	4-Jun	7-Jun	12-Jun
Closer 2SC	5.7 oz	0.7 bcd	1.3 bc	7.8 bcd	5.1 cd
Pyrifluqinazon	3.2 oz	0.3 de	0.2 c	3.5 d	1.0 d
Torac 15EC	21 oz	0.6 bcde	1.4 bc	7.5 cd	10.9 bc
Exirel 10SE	20 oz	0.1 e	0.5 c	4.8 d	2.7 d
Fulfill 50WDG	2.8 oz	1.4 a	1.9 ab	10.0 abc	13.1 ab
Fulfill + Vydate L	2.8 oz + 3 pts	0.9 abc	2.5 ab	12.9 ab	19.5 a
Sivanto 240SL	14 oz	0.5 cde	0.5c	2.9d	2.4 d
Scorpion 35SL	7 oz	0.3 cde	0.3 c	3.9 d	1.8 d
Assail 30SG	5.3 oz	0.3 cde	0.4 c	5.2 cd	4.8 cd
Untreated	-	1.1 ab	2.8 a	13.7 a	14.4 ab

Spray # 3 (14 June)		Adult Whiteflies / Sample			
		1 DAA	4 DAA	7 DAA	11 DAA
Treatment	Rate	15-Jun	18-Jun	21-Jun	25-Jun
Closer 2SC	5.7 oz	1.7 cde	2.7 cd	8.6 c	15.1 bcde
Pyrifluqinazon	3.2 oz	0.1 e	1.2 d	1.6 d	2.2 e
Torac 15EC	21 oz	3.7 bc	7.6 bc	13.2 ab	25.3 bcd
Exirel 10SE	20 oz	0.8 de	1.1 d	3.2 d	6.9 de
Fulfill 50WDG	2.8 oz	5.7 ab	12.4 ab	9.5 bc	28.0 bc
Fulfill + Vydate L	2.8 oz + 3 pts	6.6 a	15.2 a	15.6 a	49.4 a
Sivanto 240SL	14 oz	0.2 e	0.5 d	2.9 d	6.3 de
Scorpion 35SL	7 oz	0.4 e	0.7 d	3.9 d	4.9 e
Assail 30SG	5.3 oz	0.8 de	1.4 d	4.7 d	11.3 cde
Untreated	-	3.4 cde	17.3 a	15.5	31.8 ab

Means followed by the same letter are not significantly different (P>0.05).

C. *Experimental Foliar Alternatives for Whiteflies - MBI 203*

Research procedures: A new biological insecticide, MBI-203 has recently been registered that presumably provides activity against whiteflies. The objective of this trial was to determine how effective MBI-203 is against whiteflies compared to standard conventional and organic treatments. Cantaloupe plots planted with 'Gold Express' were established at the Yuma Agricultural Center on 25 Apr, 2012 and managed similarly to local growing practices. Plots consisted of one 84-inch bed, 45 ft long with a 7 buffer between each plot. The study was designed as a randomized complete block design with 4 replicates / treatment. The spray treatments consisted of 3 rates of MBI 203 (rates are shown in the table 1 below). These were compared to a conventional standard regime (the first two sprays consisted of Oberon (8.5 oz) +Brigade (6 oz), followed by the last two sprays of Assail (5.3 oz) +Brigade (6 oz)). An organic treatment was also compared that consisted of M-Pede (2%) + Aza-Direct (1 pt) for the first two sprays, and flowed by Pyganic (2 qts) + Aza-Direct (1 pt) for the last two sprays. Foliar sprays were applied on 27 May, 3, 9 and 15 June with a CO_2 operated boom sprayer at 40 psi and 20.5 gpa. A broadcast application was delivered through 4 TXVS-18 ConeJet nozzles per bed. An adjuvant, Dyne-Amic was applied at 0.25% vol/vol to all treatments except the M-pede +Aza-Direct combination. Populations of whitefly adults and immatures were evaluated at various intervals following each application using the sampling method described above. CYSDV incidence was estimated on 5 Jul by counting the number of leaves per 30 row ft with yellow interveinal chlorosis (YIVC) symptoms.

Research Results: Following four applications at 6-7 day spray intervals under light population pressure, MBI-203 did not appear to provide significant activity against whitefly adults or nymphs when compared to the untreated check (Tables 3 and 4). Likewise, none of the MBI or organic sprays provided the level of control comparable to the conventional standard. The high rate of MBI (2 lb) did appear to provide whitefly control similar to the organic standard used in this trial.

Table 3. Adult whitefly counts at 7 days after each application.

		Mean adults / vacuum sample				
Tmt	**Rate**	**2-Jun**	**9-Jun**	**14-Jun**	**22-Jun**	**Trial avg.**
MBI-203 DF2	0.5 lb	1.4 a	8.7 a	12.8 a	11.2 ab	8.5 a
MBI-203 DF2	1 lb	1.7 a	8.0 a	17.2 a	13.2 a	10.0 a
MBI-203 DF2	2 lb	1.4 a	9.8 a	16.2 a	10.1 ab	9.5 a
Conventional	-	0.5 b	2.7 b	1.2 c	2.3 c	1.7 c
Organic	0	1.4 a	4.3 b	9.7 a	8.7 b	6.0 b
Untreated	-	1.2 a	10.2 a	13.9 a	10.4 ab	8.9 a

Means followed by the same letter are not significantly different (*P* > 0.05, *F*-protected LSD).

Table 4 Whitefly Egg and Nymph Densities averaged across all applications.

		Mean Whitefly immatures / cm^2			
Tmt	**Rate**	**Eggs**	**Small Nymphs**	**Large Nymphs**	**Total Nymphs**
MBI-203 DF2	0.5 lb	1.0 a	0.7 ab	0.7 b	1.4 a
MBI-203 DF2	1 lb	1.0 a	0.9 a	0.7 b	1.6 a
MBI-203 DF2	2 lb	0.7 b	0.6 b	0.6 b	1.2 b
Conventional	-	0.3 c	0.2 c	0.1 c	0.2 c
Organic	-	0.5 c	0.5 b	0.6 b	1.1 b
Untreated	-	1.20	0.9 a	1.0 a	1.9 a

Means followed by the same letter are not significantly different (*P* > 0.05, *F*-protected LSD).

D. ***Experimental Soil Alternatives for Whiteflies - Sivanto and Verimark***

Research procedures: Cantaloupe plots planted with 'Gold Express' were established at the Yuma Agricultural Center on 25 Apr, 2012 and managed similarly to local growing practices. Plots consisted of one 84-inch bed, 45 ft long with a 7 buffer between each plot. The study was designed as a randomized complete block design with 4 replicates / treatment. The treatments and rates are shown in the tables. All soil insecticide treatments were applied prior to planting (24 Apr) by injecting each insecticide in 15 GPA final solution, 3 " below the seedline. No other insecticides were applied. Populations of whitefly adults and immatures were evaluated at various intervals following each application using the sampling method described above. CYSDV incidence was estimated on 5 Jul by counting the number of leaves per 30 row ft with yellow interveinal chlorosis (YIVC) symptoms.

Research Results: Sivanto (flupyrdifurone) is an experimental compound with a new mode of action that has shown activity against whiteflies and aphids. Verimark, (Cyazypyr) is a systemic compound shown to have good whitefly activity in lettuce and cole crops. Under low-moderate whitely pressure in this trial, the Sivanto soil treatment provided residual control of adults or nymphs comparable to the Venom 6 oz standard (Table 5 and 6). However, the Verimark soil treatment did not show consistent adult and nymph control comparable to the Venom standard. Durivo provide significantly better control than Exirel, but not as consistent as the Venom or Sivanto. We're not sure why the Verimark failed to provide good systemic activity relative to our experience in other vegetable crops, but could relate to placement and the melon root system. Based on these and previous results, Sivanto was included in our fall program as a soil alternative.

Table 5. Adult whitefly counts at various intervals following soil applications of experimental insecticides.

		Avg. WF adults / Vacuum Sample					
Treatment	**Rate**	**24-May**	**6-Jun**	**13-Jun**	**25-Jun**	**5-Jul**	**Avg.**
Sivanto	28 oz	0.7a	2.1a	9.1 cd	15.6a	22.4a	9.8b
Venom	6 oz	0.6a	4.0a	6.5 d	15.7a	30.8a	11.5b
Durivo	13 oz	1.2a	2.9a	12.4 bc	21.1a	27.2a	12.9b
Verimark	13.5 oz	0.5a	3.3a	18.3 ab	23.3a	47.0a	18.4ab
UTC	-	1.9a	6.9a	22.3a	23.1a	56.6a	22.1a

Table 6. Nymph Densities at at various intervals following soil applications of experimental insecticides.

		Avg. Large Nymphs / cm^2					
Treatment	**Rate**	**24-May**	**6-Jun**	**13-Jun**	**25-Jun**	**5-Jul**	**Avg.**
Sivanto	28 oz	0.0 a	0.2 bc	0.1 c	0.6 b	2.2 b	0.6 d
Venom	6 oz	0.0 a	0.1 c	0.1 c	0.6 b	2.2 b	0.6 d
Durivo	13 oz	0.0 a	0.4 b	0.3 bc	0.8 b	3.8 ab	1.1 b
Verimark	13.5 oz	0.2 a	0.7 a	0.4 ab	1.1 b	4.9 a	1.4 a
UTC	-	0.3 a	0.8 a	0.6 a	2.1 a	4.6 a	1.6 a

Means followed by the same letter are not significantly different ($P > 0.05$, F-protected LSD).

II. Whitefly Adult Control and CYSDV Management - Fall Cantaloupes

A. ***Experimental Foliar Alternatives for Whitefly Adults/CYSDV - Pyrifluquinazon (PFQ)***

Research procedures: Cantaloupe plots planted with 'Gold Express' were established at the Yuma Agricultural Center on 16 Aug, 2012 and managed similarly to local growing practices. Plots consisted of one 84-inch bed, 45 ft long with a 7 buffer between each plot. The study was designed as a randomized complete block design with 4 replicates / treatment. The treatments and rates are shown below. Foliar spray treatments were applied on 28 Aug and 5 and 13 September as a broadcast spray at 25 GPA at 40 psi using 4 -TX18 Conejet nozzles per bed. All spray treatments included an adjuvant DyneAmic at 0.25% v/v. Populations of whitefly adults and immatures were evaluated at various intervals following each application using the sampling method described above. CYSDV incidence was not estimated in this trial due to premature death in the untreated check. Similarly, yield estimates were not made due to collapse of all plots to *Monosporascus cannonballus* and heavy whitefly feeding about three weeks prior to harvest.

Research Results**:** In this fall trial, we evaluated the efficacy Pyrifluquinazon (PFQ) a compound with translaminar activity known for its whitefly activity, alone and in combination with Vetica for control of both adults and nymphs. Scorpion was included as a standard. Following each application, the PFQ provided excellent knockdown activity at 1 and 4 DAA compared to the UTC. It was only after the 2nd and 3rd applications did we observed residual control at 7 DAA (Fig 4, Table 6). The addition of Vetica did not enhance adult activity of PQR, however this combination provided better control of nymphs than the Vetica used alone. Vetica did not provide consistent control of adults but this was not anticipated. For the second consecutive season, PFQ has demonstrated adult whitefly control comparable to the standard. Unfortunately we were unable to measure CYSDV due to the collapse of the plots due to vine decline. However, prior to this visual observation suggested that there was fewer leaves with virus symptoms in the Scorpion and PQR+Vetica than in the untreated check plots.

Figure 4. Adult whitefly counts at various days after application (DAA).

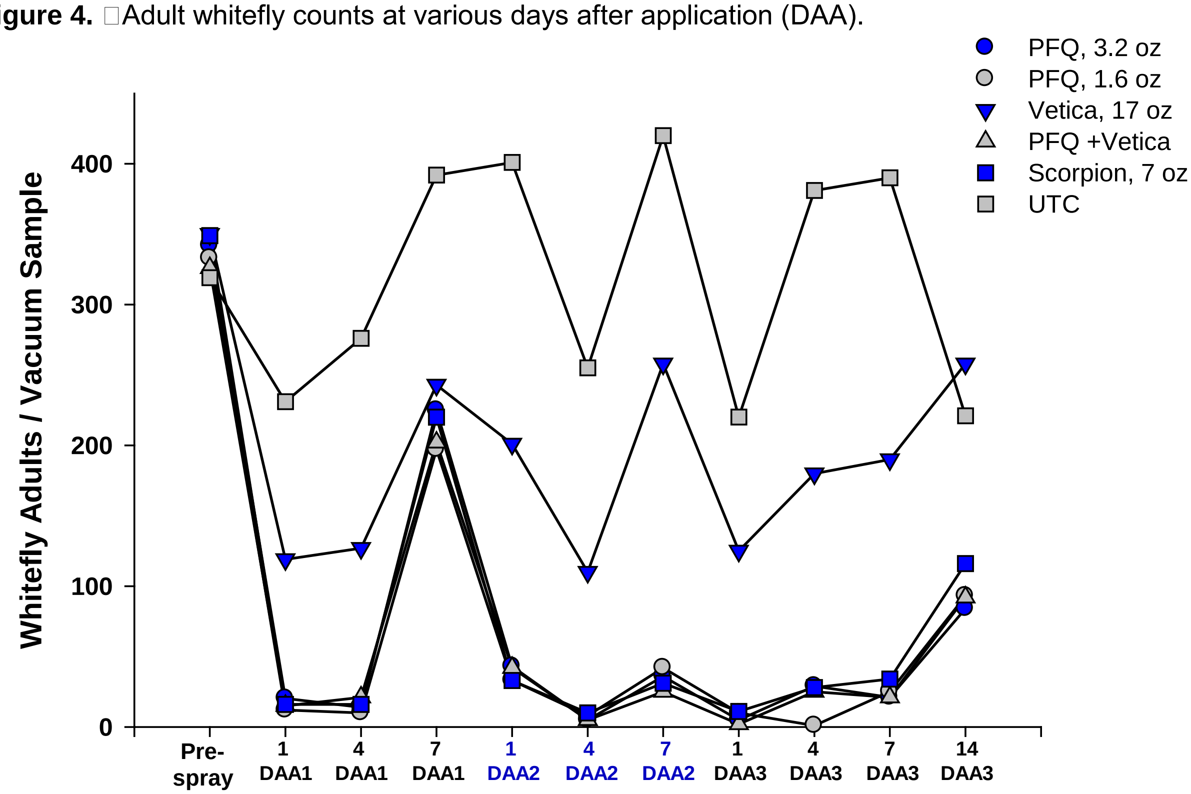


Table 6. Nymph Densities at at various intervals following foliar applications of PFQ.

		Total Nymph Densities (mean/cm^2)									
		7 DAA 1		*7 DAA 2*		*7 DAA 3*		*15 DAA 3*			
Treatment	**Rate**	**4-Sep**		**12-Sep**		**21-Sep**		**28-Sep**		***Trial Avg.***	
PFQ	3.2 oz	48.9	cd	45.2	b	1.3	cd	1.1	c	2.4	de
PFQ	1.6 oz	60.3	bcd	51.3	bc	2.4	c	0.7	c	3.1	cd
Vetica	17 oz	140.2	ab	141.1	b	7.0	b	10.7	b	17.7	b
PFQ+Vetica	1.6 oz+17 oz	43.5	d	49.4	cd	1.0	de	0.8	c	1.8	de
Scorpion	7 oz	26.1	d	20.9	d	0.4	e	0.9	c	1.3	e
UTC		185.6	a	251.5	a	41.7	a	47.0	a	88.7	a

Means followed by the same letter are not significantly different ($P > 0.05$, F-protected LSD).

B. <u>Experimental Foliar Alternatives for Whitefly - Closer</u>

<u>*Research procedures*</u>: Cantaloupe plots planted with 'Gold Express' were established at the Yuma Agricultural Center on 16 Aug, 2012 and managed similarly to local growing practices. Plots consisted of one 84-inch bed, 45 ft long with a 7 buffer between each plot. The study was designed as a randomized complete block design with 4 replicates / treatment. The treatments and rates are shown below. Foliar spray treatments were applied on 29 Aug and 10 and 18 September as a broadcast spray at 25 GPA at 40 psi using 4 -TX18 Conejet nozzles per bed. All spray treatments included an adjuvant DyneAmic at 0.25% v/v. Populations of whitefly adults and immatures were evaluated at various intervals following each application using the sampling method described above. CYSDV incidence was not estimated in this trial due to premature death in the untreated check. Similarly, yield estimates were not made due to collapse of all plots to *Monosporascus cannonballus* and heavy whitefly feeding about three weeks prior to harvest.

<u>Research Results</u>**:** In this trial, Closer was compared to Movento and an experimental numbered compound UAEXP_28 . Whitefly pressure was extremely heavy in this trial as shown in Figure 5. Similar to last year's trials, Closer provide excellent knockdown activity (1 DAA) even under these heavy adult numbers. However, residual control was marginal at 7 DAA. The UAEXP_28 treatment appeared to provide more consistent adult activity, particularly following the last spray, and maintained nymphs densities at significantly lower levels than any of the other treatments including Movento which has excellent activity against nymphs. Closer will be registered for use on melons in 2013, but based on these results, and from other previous trials, it will not likely provide growers with another alternative for whitefly control.

Figure 5. Adult whitefly counts at various days after application (DAA).

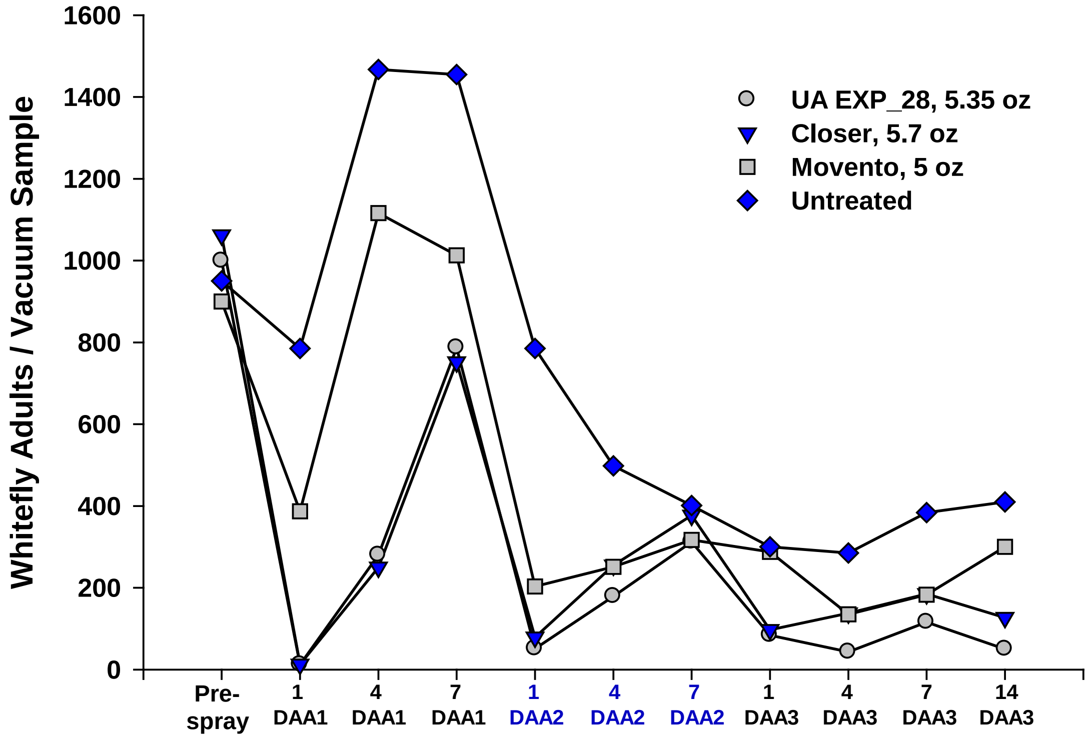


Table 7. Whitefly Nymph densities on leaves at various days after application (DAA).

		Total Nymph Densities (mean/cm^2)									
		7 DAA 1		***7 DAA 2***		***7 DAA 3***		***15 DAA 3***			
Treatment	**Rate**	**5-Sep**		**17-Sep**		**25-Sep**		**3-Oct**		***Trial Avg.***	
UA EXP_28	5.35 oz	127.6	b	22.3	b	1.8	c	1.1	b	38.2	c
Closer	5.7 oz	188.0	b	51.0	a	6.4	bc	2.9	b	62.1	b
Movento	4.6 oz	272.2	b	21.8	b	14.8	bc	8.3	b	79.3	b
Untreated		401.8	a	44.1	a	49.6	a	31.2	a	131.7	a

Means followed by the same letter are not significantly different ($P > 0.05$, F-protected LSD).

C. Conventional and Experimental Alternatives for Whiteflies and CYSDV – Soil and Foliar Programs

Research procedures: Cantaloupe plots planted with 'Gold Express' were established at the Yuma Agricultural Center on 16 Aug, 2012 and managed similarly to local growing practices. Plots consisted of one 84-inch bed, 45 ft long with a 7 buffer between each plot. The study was designed as a randomized complete block design with 4 replicates / treatment. The treatments and rates are shown below. The soil treatments were applied prior to planting by injecting each insecticide in a 15 GPA final solution, 3" below the seed line. A second soil application was made on 6 Sep as a side dress application. The compounds were shanked into the soil on both sides of the plants (14" from seed-line) at a depth of 6" and immediately incorporated via furrow irrigation. Foliar spray treatments were applied on 29 Aug and 10 and 18 September as a broadcast spray at 25 GPA at 40 psi using 4 -TX18 Conejet nozzles per bed. All spray treatments included an adjuvant DyneAmic at 0.25% v/v. Populations of whitefly adults and immatures were evaluated at various intervals following each application using the sampling method described above. CYSDV incidence was estimated at various time intervals prior to harvest, but yield estimates were not made due to collapse of all plots to *Monosporascus cannonballus* about three weeks prior to harvest

Soil Treament	Side-dress Treatment	Foliar Treatment
Sivanto-28 oz	-	Conventional
Sivanto-28 oz	Sivanto-28 oz	Conventional
Sivanto-28 oz	-	Experimental
Sivanto-28 oz	Sivanto-28 oz	Experimental
Venom, 6 oz	-	Conventional
Venom, 6 oz	Venom, 6 oz	Conventional
Venom, 6 oz	-	Experimental
Venom, 6 oz	Venom, 6 oz	Experimental
UTC	UTC	UTC

Spray Date	Plant Stage	Conventional-Foliar	Experimental- Foliar
26-Aug	1-2 lf	Lannate (0.8 lb) +Brigade (6 oz)	Lannate (0.8 lb) +Brigade (6 oz)
31-Aug	3-lf	Assail (5.3 oz) +Fulfill (2.8)	Pyrifluquinazone (PFQ-3.2 oz)
6- Sep *	5-lf	Vydate (3 pt) +Brigade (6 oz)	PFQ (3.2 oz)+Brigade (oz)
13-Sep	1st flower	Assail (5.3 oz) +Fulfill (2.8)	Exirel (20 oz) +Danitol (14 oz)
20-Sep	Bloom	Assail (5.3 oz) +Brigade (6 oz)	Exirel (20 oz) +Danitol (14 oz)
26-Sep	Fruiting	Assail (5.3 oz) +Danitol(16 oz)	PFQ (3.2 oz)+Brigade (oz)

Research Results: The purpose of this trial was to evaluate a standard fall whitefly/CYSDV management program to alternatives using both conventional and experimental insecticides. The standard would consist of at-plant and sidedress application of Venom, followed by multiple conventional spray applications at 6-7 d intervals. Whitefly populations and CYSDV incidence was heavy in this trial. Table 8 and Figure 6 show adult abundance during the trial where the adult untreated check exceeded 500 adults/sample following the second foliar spray. Prior to this time , none of the treatments provided more than 70% control of the adults. However following the 2nd foliar spray and the side-dress applications, adult numbers were significantly reduced at levels greater than 90% control (Figure 6). This ultimately resulted in less CYSDV in some treatments as the season progressed (Figure 7). Averaged across the trial, the Venom and Sivanto treatments (both with at plant and with side-dress applications) followed by the Experimental Foliar spray program provided the most consistent control of adults. This also translated into significantly reduced CYSDV in these plots (Figure 7.) Unfortunately, we were not able to carry the CYSDV estimates to harvest or measure yields and quality relative to management program due to the vine decline. However, this preliminary study provides support for obtaining expedited registrations of Pyrifluquinazon and Sivanto. Exirel will be registered in 2013 and should be a welcome addition to the program.

Table 8. Adult whitefly counts at various intervals following foliar and soil insecticide applications.

			Mean Whitefly Adults / Sample					
Soil Treament	**Side-dress Treatment**	**Foliar Treatment**	**3-DAA1 29-Aug**		**5-DAA2 4-Sep**		**5-DASD 5-DAA3 11-Sep**	
Sivanto	-	Conventional	124.7	b	70.6	b	20.9	b
Sivanto	+ sidedress	Conventional	122.7	b	63.9	b	10.0	bc
Sivanto	-	Experimental	113.2	b	31.7	bc	3.4	cd
Sivanto	+ sidedress	Experimental	102.9	b	30.6	bc	2.1	cd
Venom	-	Conventional	86.5	b	38.9	bc	15.2	b
Venom	+ sidedress	Conventional	82.8	b	41.0	bc	3.9	cd
Venom	-	Experimental	78.6	b	24.9	c	1.6	d
Venom	+ sidedress	Experimental	87.8	b	23.3	c	3.6	cd
UTC	-	-	204.0	a	539.0	a	120.4	a

			Mean Whitefly Adults / Sample							
Soil Treament	**Side-dress Treatment**	**Foliar Treatment**	**14-DASD 7-DAA4 20-Sep**		**21-DASD 7-DAA5 27-Sep**		**29-DASD 8-DAA6 5-Oct**		**Trial Avg.**	
Sivanto	-	Conventional	19.0	b	48.7	b	4.9	c	48.1	b
Sivanto	+ sidedress	Conventional	10.4	bcd	37.9	bc	13.2	b	43.1	bc
Sivanto	-	Experimental	17.8	b	27.3	bc	4.3	c	32.9	cde
Sivanto	+ sidedress	Experimental	10.4	bcd	38.3	bc	5.2	c	31.6	de
Venom	-	Conventional	17.5	b	33.6	bc	2.7	c	32.4	bcd
Venom	+ sidedress	Conventional	6.8	cd	18.4	c	3.7	c	26.1	de
Venom	-	Experimental	11.1	bc	29.7	bc	3.4	c	24.9	e
Venom	+ sidedress	Experimental	5.2	d	26.0	bc	4.7	c	24.1	e
UTC	-	-	163.8	a	272.3	a	59.3	a	226.5	a

Figure 6. % Whitefly control in plots treated with soil at-plant (AP) and side-dress (SD) applications of Venom and Sivanto abundance and Foliar sprays of conventional and experimental insecticides. Upper graph is number of whiteflies / sample in untreated check; lower graph is % control for each treatment at various days after foliar application (DAA) and side-dress (DASD).

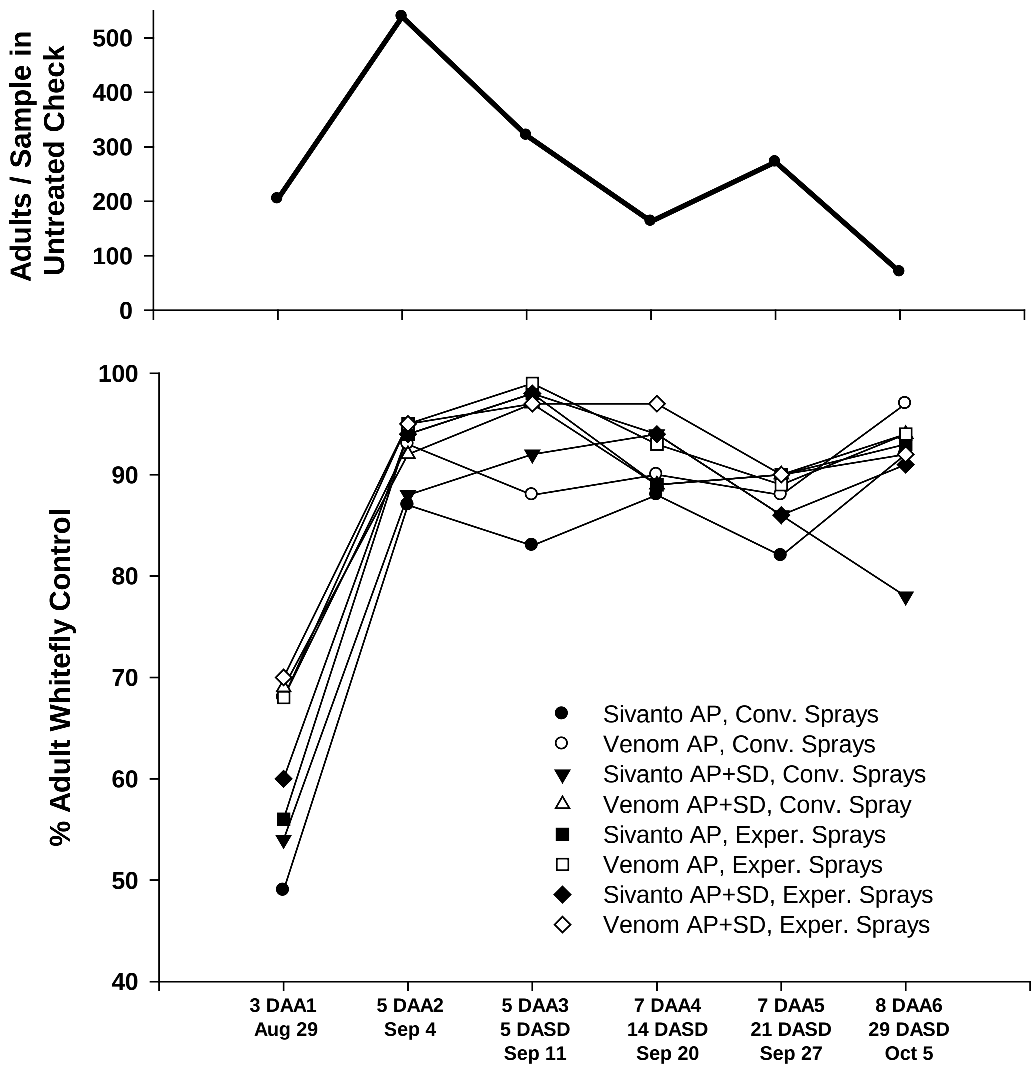
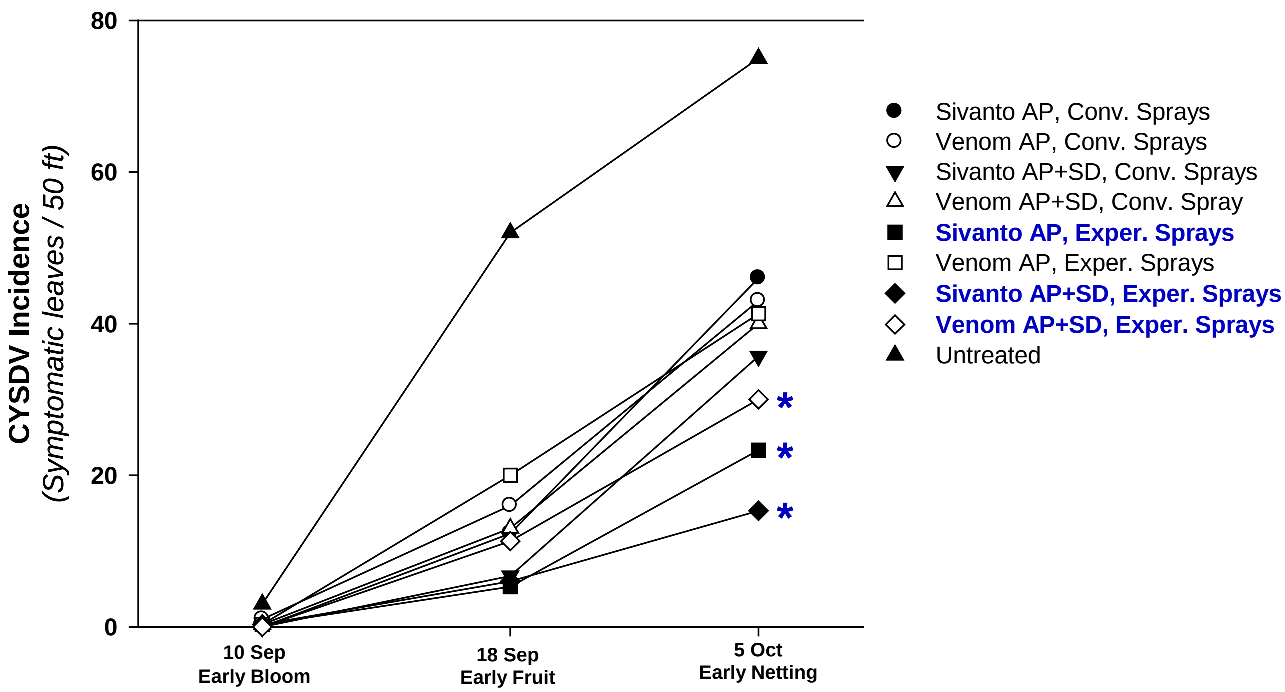


Figure 7. CYSDV Incidence in plots treated with soil at-plant (AP) and side-dress (SD) applications of Venom and Sivanto abundance and Foliar sprays of conventional and experimental insecticides. Treatments with an asterisk (*) next to symbol indicate that treatment has significantly less CYSDV symptomatic leaves than the untreated check.



Objective 2. Evaluation of Alternative Insecticides for Diazinon and Bifenthrin

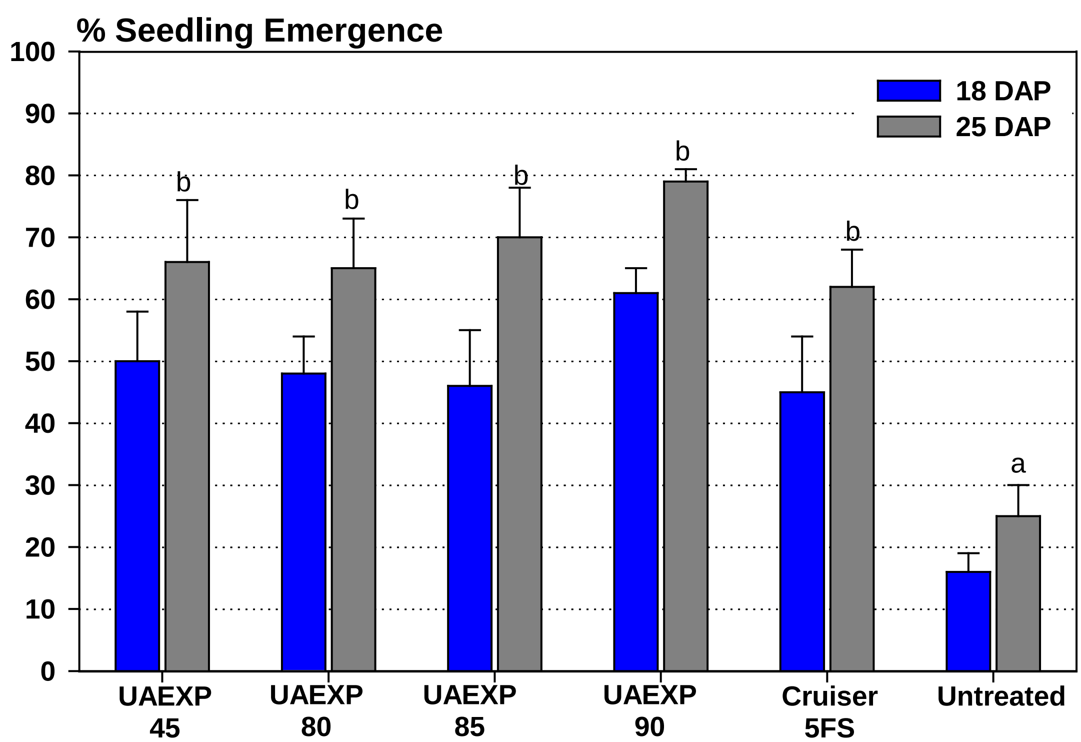
A. ***Seed Corn Maggot Efficacy - Experimental Seed Treatments***

Research Procedures: The purpose of this study was to evaluate the efficacy of several experimental insecticides applied as a seed treatment against seed corn maggots (SCM) in spring melons. This experiment was conducted at UA's Yuma Agricultural Center in the spring of 2011. Three weeks before planting, a 0.5 acre block of cabbage was incorporated into the soil so that the decaying plant matter would attract SCM females to infest the test site. The field was planted with melon seed 'Gold Express' at a precise density on 16 Mar. Seeds were hand planted at a seed spacing of 6 in. for a total 50 seeds per row. Plots consisted of one row 25-ft long and rows were spaced 84 inches apart (n=200 seeds / treatment). An attempt was made to ensure that depth of seeds was consistent at 0.5-0.75 inches. Plots were separated within rows by a 7-ft section of bare ground. Immediately after seeds were planted and covered with soil, a combination of bone and meat meal was placed in a narrow band over the row to further attract SCM females at a rate of 320 g per 20-ft row.

Seeds were treated with insecticides by the seed company. Because of the confidential nature most of the products the names of the active ingredients cannot be provided at this time. Cruiser (thiamethoxam) was included as a standard. The experimental design included these treatments plus an untreated control arranged in a randomized complete block design replicated 4 times. Stand counts were taken in the entire length of each plot on 3 and 10 April to assess plant emergence and survival. Only emerged seedling plants were counted and classified as either healthy (cotyledons green and fully expanded), or dead (cotyledons severely wilted or stem brown and dried out). Additionally, seeds were dug up along with the soil surrounding them in 6 areas within each row to inspect for SCM damaged seeds and un-emerged plants, and SCM larvae and pupae.

Research Results: Conditions were ideal for maggot pressure and the beds were irrigated twice prior to emergence. Stand counts taken at 18 DAP showed that damage to seeds and seedling by SCM was moderately high in the untreated control plots (Figure 8). Both dead plants and SCM damaged seed was observed in untreated plots. In contrast, SCM control was significantly more effective in plots planted with the seed treatments. Plant stands (% seedling emergence) were not significantly different among seed treatments which ranged from 45-60 % emergence. Counts taken at 25 DAP showed that all seed treatments had significantly more plants than the untreated check, and differences among treatments was not observed. Emergence in the untreated check only reached 25% whereas the highest for seed treatments was 79% emergence. Research is planned for next spring to continue to evaluate these treatments.

Figure 8. Control of seed corn maggots on cantaloupe seed treated with experimental insecticides.



B. Seed Corn Maggot Efficacy, In-furrow vs. Soil Surface Band Applications

Research procedures: The purpose of this study was to evaluate the efficacy of several insecticides applied as in-furrow sprays compared to a soil surface band against seed corn maggots (SCM) in spring melons. This experiment was conducted at UA's Yuma Agricultural Center in the spring of 2012, and plots were prepared similar to the previous study. Seeds were hand planted at a seed spacing of 6 in. for a total 50 seeds per row. Plots consisted of one row 25-ft long and rows were spaced 84 inches apart (n=200 seeds / treatment). An attempt was made to ensure that depth of seeds was consistent at 0.5-0.75 inches. Plots were separated within rows by a 7-ft section of bare ground. All insecticides were applied as sprays either in-furrow at planting using a single-row-boom equipped with 1 flat fan nozzle (8004VS) and calibrated to deliver 8.5 gallons of spray per acre at 40 psi, or as a 8 " band directly over the seedline following planting. The experimental design included these treatments plus an untreated control arranged in a randomized complete block design replicated 4 times. Evaluations were made similar to the above study.

Research Results: Similar to the previous trial, conditions were ideal for SCM pressure. At seedling emergence (14 and 22 DAP), there were significant differences among the insecticides and application methods tested (Figures 9 and 10). At both evaluations, the Capture LFR and Athena plots applied in-furrow had significantly better emergence (>90%) compared to when they were applied as a surface band spray. Verimark applied in-furrow was not different from either of these pyrethroids treatments at 22 DAP, however the Verimark applied as a surface band treatment was not different from the untreated check. Surprisingly, seedling emergence in Radiant plots, regardless of which application was used, did not differ from the untreated check. Previous experiments have shown that Radiant can provide good activity when applied in-furrow. The results of this study should discourage growers from applying these products as a banded spray in attempt to control SCM in spring melons. However, the results are further evidence that in-furrow application of bifenthrin (the active ingredient in both Capture LFR and Athena) and Cyazypyr (Verimark) are viable options for SCM control.

Figure 9. Control of seed corn maggots on cantaloupe treated with insecticides as in-furrow or soil surface banded applications at 14 days after planting (DAP).

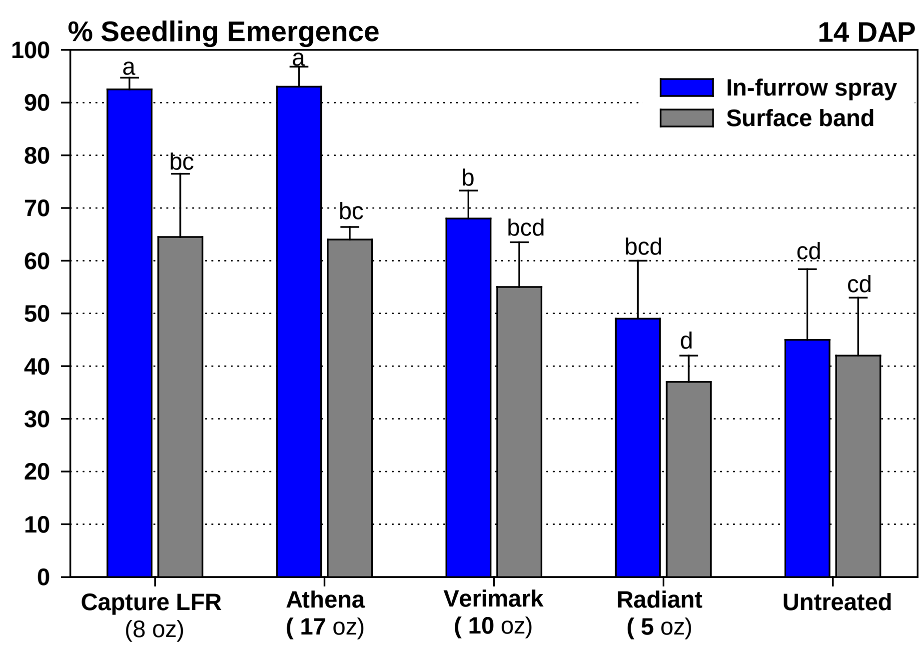
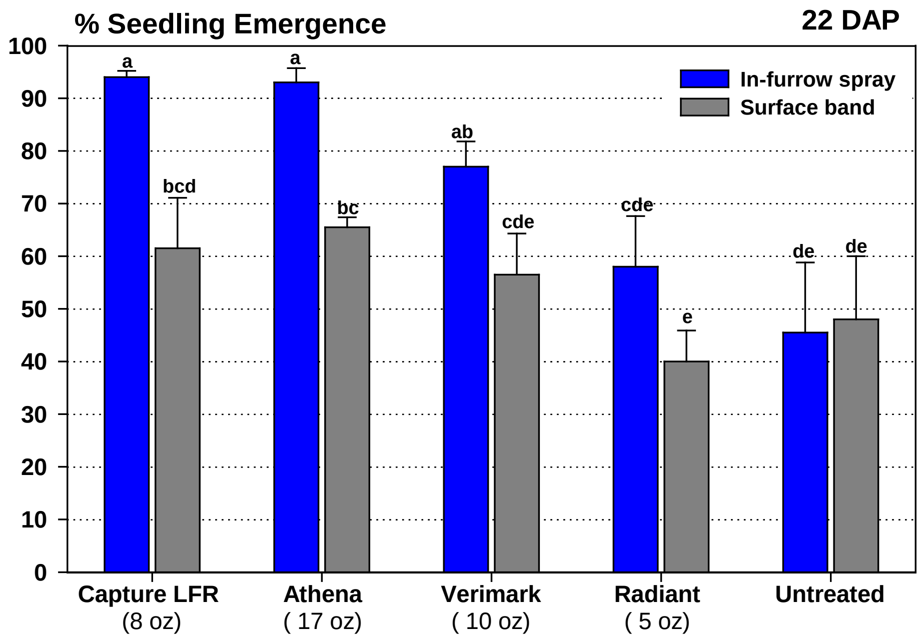


Figure 10. Control of seed corn maggots on cantaloupe treated with insecticides as in-furrow or soil surface banded applications at 22 days after planting (DAP).



C. Evaluation of Foliar Insecticides for Control of Lepidopterous Larvae

Research Procedures: The purpose of this study was to evaluate the efficacy of several newly registered products for control of cabbage loopers in fall cantaloupes. A small plot efficacy trial was initiated to measure knockdown and residual activity following foliar applications to melon plants. Fall melons 'Gold Express' were planted at the Yuma Agricultural Center on August 24. Plots consisted of a single 84" bed by 40 ft long and bordered by an untreated bed. Four replications of each treatment were arranged in a randomized complete block design. The foliar spray treatments were applied with a CO_2 backpack sprayer that delivered 20 GPA at 60 psi, using 4 - TX18 ConeJet nozzles per bed. The first application was made on 10 Sep when plants had 5-6 true leaves. The 2nd spray was made on Sep 19 at the 8-9 leaf stage (on the primary vine). An adjuvant (DyneAmic @ 0.125% v/v) was applied with each treatment. Evaluation of cabbage looper (CL) larvae control was based on the number of live larvae per 15 leaves randomly sampled from each replicate. The plots were sampled at intervals after each spray treatment was applied (DAA). The sample unit consisted of examination of a single leaf collected from the mid-vine area of plant. The leaves were examined for presence of small and large larvae and the incidence of fresh feeding tracks.

Research results: Looper populations were light-moderate in this trial. All of the compounds tested in this trial are presently available for use in melons. All of the treatments, except Perm-Up, consistently prevented cabbage looper larvae from developing in the melon plots for up to 8 days following each application (Table 9 and 10) . This data is encouraging because is demonstrates that melon growers now have multiple modes of action for looper control including the spinosyns (Radiant), diamides (Coragen, Voliam Xpress, and Belt), and an IGR (Intrepid). Perm-Up, a generic formulation of permethrin, was included because it is an inexpensive pyrethroids often included in tank-mixtures for looper control. Based on these results, it may not be the best product for worm control, particularly under heavy population pressure.

Table 9. Fresh feeding damage on melon leaves treated with insecticides at days after applications (DAA).

Treatment	Rate/ac	% Leaves with fresh feeding signs									
		4-DAA1 14-Sep		8-DAA1 18-Sep		3-DAA2 22-Sep		7-DAA2 26-Sep		Trail Avg.	
Radiant	5 oz	5.0	bc	6.7	c	3.3	c	1.7	b	4.2	c
Intrepid+Warrior	10 oz +1.9 oz	3.3	c	6.7	c	6.7	c	3.3	b	5.0	c
Coragen	5.0 oz	5.0	bc	8.3	c	8.3	c	1.7	b	5.8	c
Voliam Xpress	8 oz	6.7	bc	11.7	c	3.3	c	5.0	b	6.7	c
Belt SC	2.2 oz	6.7	bc	8.3	c	3.3	c	5.0	b	5.8	c
Perm-Up	12.8 oz	11.7	bc	25.0	b	15.0	b	8.3	b	15.0	b
UTC	--	58.3	a	55.0	a	53.3	a	33.3	a	50.0	a

Means followed by the same letter are not significantly different (*P* > 0.05, *F*-protected LSD).

Table 10. Cabbage looper control on melons treated with insecticides at days after applications (DAA).

Treatment	Rate/ac	Avg. cabbage looper larvae (2nd instar or >) / 15 leaves									
		4-DAA1 14-Sep		8-DAA1 18-Sep		3-DAA2 22-Sep		7-DAA2 26-Sep		Trail Avg.	
Radiant 1SC	5 oz	0.0	b	0.0	b	0.0	c	0.0	b	0.0	c
Intrepid+Warrior	10 oz +1.9 oz	0.0	b	0.3	b	0.0	c	0.5	ab	0.2	c
Coragen	5.0 oz	0.0	b	0.0	b	0.0	c	0.0	b	0.0	c
Voliam Xpress	8 oz	0.0	b	0.3	b	0.0	c	0.0	b	0.1	c
Belt SC	2.2 oz	0.0	b	0.3	b	0.0	c	0.0	b	0.1	c
Perm-Up	12.8 oz	0.0	b	1.0	a	0.5	b	0.5	ab	0.5	b
UTC	--	1.0	a	1.5	a	1.3	a	1.0	ab	1.2	a

Means followed by the same letter are not significantly different (*P* > 0.05, *F*-protected LSD).