CALIFORNIA MELON RESEARCH BOARD
2019 Final Report

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PROJECT TITLE:

Evaluation of Insecticide Alternatives for Whiteflies and CYSDV in Melons

PRINCIPLE INVESTIGATOR:

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

SUMMARY OF RESEARCH RESULTS:

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

Objective 2: To evaluate foliar and soil systemic insecticides used in transplanted cantaloupes for CYSDV management.

- Whitefly management continues to be a research priority for desert melons and studies identifying foliar and soil insecticide alternatives to neonicotinoids and diamides in melons remained the focus this year. New research was initiated to examine foliar insecticides used in association with soil systemic insecticides on transplanted cantaloupes for CYSDV suppression.

- Field trials this year continued to show that PQZ and Sefina are excellent foliar alternatives for whitefly/CYSDV management in desert cantaloupes and should soon become industry standards. Studies further indicate that both products quickly disrupt whitefly feeding and virus transmission. When used in a program approach with soil insecticides, PQZ and Sefina effectively suppressed the expression of CYSDV and prevented yield/quality losses. In addition, both can effectively control whitefly nymphs following repeated applications.

- Spring and Fall trials further showed that diamide foliar alternatives (Harvanta, Exirel, Minecto Pro) failed to provide consistent whitefly efficacy and CYSDV suppression comparable to PQZ and Sefina. At best, Exirel should be used in rotation with PQZ and Sefina. Similarly, Cormoran provided inconsistent Whitefly/CYSDV suppression. Preliminary results suggest Sequoia, which was recently re-registered for use in melons, can provide good adult knockdown and may be an important rotational foliar alternative to diamides and neonicotinoids in fall melons.

- Comparison of soil insecticides applied to cantaloupe seedlings as transplant tray drenches showed that Venom provided good crop safety and was more effective in suppressing whiteflies and virus infection than other soil systemic products (Admire Pro, Verimark, Durivo, Sivanto. In contrast, application of Sivanto to transplants caused significant crop injury and seedling mortality under both spring and fall growing conditions. PQZ and Sefina foliar spray combinations used in association with Venom transplant drenches provided excellent crop protection from whiteflies and CYSDV under moderate pressure, regardless of rates or application sequences.

I. *EVALUATION OF FOLIAR INSECTICIDES FOR WHITEFLY AND CYSDV MANAGEMENT*

A. *PQZ and Sefina Rotations - Whitefly Adult Efficacy and CYSDV Suppression*

Spring Trial, 2019: Cantaloupe plots direct seeded with 'Olympic Gold' were established on 25 Apr 2019 at the Yuma Agricultural Center. The experimental plots were managed using local growing practices. Plots consisted of one 84-inch bed, 35 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 7, 17 and 25 Jun with a CO_2 operated boom sprayer at 20.5 GPA @ 40 psi. 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. Adult populations were estimated using a modified vacuum method was used that employed a DeWALT DC500 2- gallon portable vacuum which was fitted with 5 oz cloth-screened containers to capture and retain vacuumed adults. On each sample date following application (DAA), 5 separate plants from each replicate were sampled by vacuuming and containers with adults were taken into the laboratory, where the number of adults/samples were recorded. CYSDV incidence was measured on 2 and 9 July (harvest maturity) by recording the number of leaves that expressed symptoms of pale interveinal chlorosis (PIVC) and yellow interveinal chlorosis (YIVC) consistent with CYSDV infection in 40 ft of each plot. Because of heterogeneity of mean variances, data for adult whiteflies were transformed using a $\log_{10}(x + 1)$ function before analysis and subjected to ANOVA; means were compared using Turkey's HSD test ($P \leq 0.05$). Means from non-transformed data are presented in the tables.

Summary: The objective of this trial was to compare the efficacy of a PQZ and Sefina rotations against a neonicotinoid and diamide insecticides commonly used for control of adult whiteflies and CYSDV on melons. Whitefly pressure was moderate for a spring trial. Whitefly knockdown (1-3 DAA) efficacy was consistent among the treatments, especially following the 2nd spray application (Table 1). Residual control (7 DAA) was less consistent among the spray treatments, particularly for the treatment rotations that started with Sefina. However, when averaged across the 3 sprays, all spray treatments significantly reduced whitefly adults compared to the untreated control, and whitefly control did not differ among the PQZ treatments regardless of rates or number of sprays. CYSDV incidence was light in the trial, but the virus was present at harvest and varied among plots (Table 2). CYSDV incidence at harvest was significantly lower in all the PQZ (*2 sprays), PQZ (*2 sprays) followed by Venom, Sefina (*2 sprays), and Sefina (*2 sprays) fb Venom treatments compared with the untreated check. However, CYSDV symptomatic leaves in the PQZ~Sefina rotation and the Venom/Exirel rotation were not significantly reduced compared with the untreated plots. The results suggest that applying 2 back to back applications of PQZ or Sefina provided the best suppression of whiteflies and CYSDV, regardless of PQZ rate. Applying Venom (neonicotinoid) following the PQZ and Sefina sprays did not improve whitefly/CYSDV control suggesting that both PQZ and Sefina provide exceptional deterrence to whitefly feeding and virus transmission.

Table 1. Knockdown and residual activity of PQZ and Sefina rotations against WF adults, Spring 2019

Spray #1 Treatment	Rate	Spray #2 Treatment	Rate	Spray #3 Treatment	Rate	Whitefly Adults / Sample 1 DAA-1	3 DAA-1	7 DAA-1	1 DAA-2	3 DAA-2	7 DAA-2
PQZ	3.2 oz	PQZ	3.2 oz	Venom	4 oz	0.6abc	0.1c	0.6ab	1.6cd	1.3b	2.7b
PQZ	2.4 oz	PQZ	2.4 oz	Venom	4 oz	0.4bc	0.3bc	0.6ab	2.3bcd	2.0b	3.4b
PQZ	3.2 oz	PQZ	1.6 oz	-	-	0.6abc	0.1c	0.3b	1.1d	1.2b	3.1b
PQZ	2.4 oz	PQZ	2.4 oz	-	-	0.4c	0.2bc	0.3b	1.8cd	2.1b	2.9b
Sefina	14 oz	Sefina	14 oz	Venom	4 oz	1.5ab	0.5bc	0.3ab	7.8ab	4.3ab	6.9ab
Sefina	14 oz	Sefina	14 oz	-	-	2.0a	0.9ab	1.4ab	4.7bcd	3.2b	5.7ab
PQZ	3.2 oz	Sefina	14 oz	-	-	0.5abc	0.3bc	0.6ab	3.8bcd	3.3ab	5.3ab
PQZ	3.2 oz	Sefina	14 oz	Venom	4 oz	0.6abc	0.2bc	0.5b	3.8bcd	3.0b	4.0b
Venom	4 oz	Exirel	20 oz	Venom	4 oz	0.6abc	0.5bc	1.2ab	4.1bcd	0.9b	3.6b
UTC		UTC		UTC		2.1a	2.1a	3.0a	22.8a	17.5a	38.8a

Table 1. continued.

Spray #1 Treatment	Rate	Spray #2 Treatment	Rate	Spray #3 Treatment	Rate	Whitefly Adults / Sample 1 DAA-3	3 DAA-3	7 DAA-3	14 DAA-3	Trial Avg.
PQZ	3.2 oz	PQZ	3.2 oz	Venom	4 oz	0.6c	1.0b	12.6a	15.4a	3.6b
PQZ	2.4 oz	PQZ	2.4 oz	Venom	4 oz	0.9bc	0.9b	11.2a	17.9a	4.0b
PQZ	3.2 oz	PQZ	1.6 oz	-	-	1.3bc	3.0b	15.0a	11.5a	3.7b
PQZ	2.4 oz	PQZ	2.4 oz	-	-	1.9bc	0.7b	9.0a	5.1a	2.4b
Sefina	14 oz	Sefina	14 oz	Venom	4 oz	1.4bc	1.4b	13.6a	16.7a	5.5b
Sefina	14 oz	Sefina	14 oz	-	-	3.5b	1.9b	8.6a	8.9a	4.1b
PQZ	3.2 oz	Sefina	14 oz	-	-	3.1bc	3.6b	17.9a	14.8a	5.3b
PQZ	3.2 oz	Sefina	14 oz	Venom	4 oz	1.3bc	0.7b	12.4a	31.1a	5.7b
Venom	4 oz	Exirel	20 oz	Venom	4 oz	0.5c	0.9b	13.3a	9.7a	3.5b
UTC		UTC		UTC		46.6a	31.6a	34.8a	32.3a	23.1a

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

Table 2. Incidence of CYSDV in melons treated with PQZ/Sefina Rotations, spring 2019.

Spray #1		Spray #2		Spray #3		CYSDV Symptomatic Leaves / 35 ft			
						July 2		July 9	
Treatment	Rate	Treatment	Rate	Treatment	Rate	YIVC	Total	YIVC	Total
PQZ	3.2 oz	PQZ	3.2 oz	Venom	4 oz	1.3a	20.5a	7.5ab	40.3b
PQZ	2.4 oz	PQZ	2.4 oz	Venom	4 oz	0.3a	14.3a	3.8b	37.8b
PQZ	3.2 oz	PQZ	1.6 oz	-	-	1.3a	14.5a	4.8b	48.5b
PQZ	2.4 oz	PQZ	2.4 oz	-	-	2.3a	17.0a	3.0b	31.5b
Sefina	14 oz	Sefina	14 oz	Venom	4 oz	1.3a	18.5a	6.8ab	45.0b
Sefina	14 oz	Sefina	14 oz	-	-	0.5a	11.8a	5.0ab	33.0b
PQZ	3.2 oz	Sefina	14 oz	-	-	2.3a	20.3a	3.8ab	50.3ab
PQZ	3.2 oz	Sefina	14 oz	Venom	4 oz	0.5a	13.0a	5.3ab	40.0b
Venom	4 oz	Exirel	20 oz	Venom	4 oz	1.8a	25.3a	7.3ab	51.8ab
UTC		UTC		UTC		5.0a	38.0a	11.0a	88.0a

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

Fall Trial, 2019**:** Cantaloupe plots direct seeded with 'Sweet Spring' were established on 24 Aug 2019 at the Yuma Agricultural Center. The experimental plots were managed using local growing practices. Plots consisted of one 84-inch bed, 35 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 plots, except the untreated check, were treated with Sivanto prime (28 oz/ac) at-planting using a single soil shank injection at planting time applied 3" directly below the seed line in 10.5 GPA total volume. A side dress application of Venom (7.5 oz/ac) was shanked into the soil on both sides of the plants (10" from seed-line) at a depth of 6" and immediately incorporated via furrow irrigation to all treatments except the untreated check. Four foliar sprays were applied with a CO_2 operated boom sprayer at 20.5 GPA @ 40 psi. On the first two applications (6 and 13 Sep), a banded (50%) broadcast application was delivered through 2 TXVS-18 ConeJet nozzles per bed. On the last two applications (20 Sep and 2 Oct) 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 spray treatments.

Adult populations were estimated using a modified vacuum method was used that employed a DeWALT DC500 2- gallon portable vacuum which was fitted with 5 oz cloth-screened containers to capture and retain vacuumed adults. On each sample date following application (DAA), 5 separate plants from each replicate were sampled by vacuuming and containers with adults were taken into the laboratory, where the number of adults/samples were recorded. CYSDV was measured weekly by recording the number of leaves that expressed symptoms of pale interveinal chlorosis (PIVC) and yellow interveinal chlorosis (YIVC) consistent with CYSDV infection in 40 ft of each plot. Percent CYSDV incidence was measure on 14 and 25 Oct by estimating the % of leaves on all plants within the plot that expressed PIVC and YIVC symptoms. CYSDV at harvest and harvest data was not collected in the fall trail because plants in the untreated check had collapsed due to heavy whitefly damage. Because of heterogeneity of mean variances, data for adult whiteflies were transformed using a $\log_{10}(x + 1)$ function and data for percent CYSDV incidence with an arcsine transformation before analysis and subjected to ANOVA; means were compared using Turkey's HSD test ($P \leq 0.05$). Means from non-transformed data are presented in the tables.

Summary: Whitefly and CYSDV pressure was light-moderate for a fall trial. The objective of this trial was the same as the above spring trial but differed in that soil insecticides were applied to all the spray treatment plots, and foliar sprays including several PQZ~Sefina rotation treatments and a Venom~Assail~Exirel standard rotation were applied 4 times. Like the spring trial, all spray treatments significantly reduced whitefly adults compared to the untreated control, and whitefly control did not differ among the various PQZ~Sefina rotations regardless of PQZ rates or rotational sequence (Table 3). Similarly, all the spray rotations treatments significantly reduced CYSDV Incidence at harvest (Table 4). In fact, very little CYSDV was observed in the sprayed plots (< 10%) compared with 70% infection in the check. We had hoped to collect yield data to further support the strong activity of these products, but unfortunately the untreated checks collapsed due whitefly feeding and CYSDV 1 week before harvest. These results support the findings of the spring trial and further illustrates how effective both PQZ and Sefina are when used in association with a Harper cantaloupe variety and a soil insecticide program in suppressing whitefly feeding and CYSDV transmission on fall melons in the desert.

Table 3. Knockdown and residual activity of PQZ and Sefina rotations against WF adults, Fall 2019

Spray Treatments -rate/ac				Whitefly Adults / Sample								
				7-Sep	*9-Sep*	*12-Sep*	*16-Sep*	*19-Sep*	*23-Sep*	*26-Sep*	*9-Oct*	
Spray #1	**Spray #2**	**Spray #3**	**Spray #4**	**1 DAA-1**	**3 DAA-1**	**6 DAA-1**	**3 DAA-2**	**6 DAA-2**	**3 DAA-3**	**6 DAA-3**	**7 DAA-4**	**Avg.**
PQZ-3.2 oz	PQZ-3.2 oz	Sefina-14 oz	Sefina-14 oz	1.0b	2.9b	1.2b	1.1b	11.2a	2.0bc	0.4b	2.7b	2.8b
PQZ-2.4 oz	PQZ-2.4 oz	Sefina-14 oz	Sefina-14 oz	1.6b	2.2b	1.3b	0.9b	7.7a	2.9b	1.3b	3.5b	2.7b
PQZ- 3.2 oz	PQZ-1.6 oz	Sefina-14 oz	Sefina-14 oz	1.0b	3.3b	1.7b	0.6b	4.8a	2.1bc	0.7b	2.4bc	2.0b
Sefina-14 oz	Sefina-14 oz	PQZ-3.2 oz	PQZ-3.2 oz	2.2b	4.0b	2.6b	2.7ab	6.5a	0.6cd	0.5b	1.0c	2.5b
PQZ-3.2 oz	Sefina-14 oz	PQZ-3.2 oz	Sefina-14 oz	1.1b	2.6b	1.3b	1.7b	6.1a	0.4d	0.5b	3.6b	2.4b
PQZ-3.2 oz	PQZ-3.2 oz	Assail-5.3 oz	Assail-5.3 oz	0.8b	2.2b	2.3b	0.9b	7.4a	2.0bc	1.5b	2.5bc	2.4b
Venom- 4 oz	Assail-5.3 oz	Assail-5.3 oz	Exirel- 20 oz	1.3b	2.6b	1.8b	2.6ab	7.6a	2.7b	1.8b	4.4b	3.1b
Untreated	Untreated	Untreated	Untreated	21.0a	19.8a	15.6a	6.9a	15.5a	40.1a	30.3a	16.5a	20.5b

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

Table 4. Incidence of CYSDV in melons treated with PQZ/Sefina Rotations, Fall 2019

Spray Treatments -Rate /ac				Total CYSDV symptomatic leaves / 35 ft				% CYSDV Incidence	
Spray #1	**Spray #2**	**Spray #3**	**Spray #4**	**24-Sep**	**4-Oct**	**14-Oct**	**25-Oct**	**14-Oct**	**25-Oct**
PQZ-3.2 oz	PQZ-3.2 oz	Sefina-14 oz	Sefina-14 oz	0.0b	5.0b	6.5ab	27.3	3.4b	6.0b
PQZ-2.4 oz	PQZ-2.4 oz	Sefina-14 oz	Sefina-14 oz	0.0b	2.3b	3.3b	15.8	1.4b	2.6b
PQZ- 3.2 oz	PQZ-1.6 oz	Sefina-14 oz	Sefina-14 oz	0.0b	2.0b	1.8b	10.5	1.3b	1.8b
Sefina-14 oz	Sefina-14 oz	PQZ-3.2 oz	PQZ-3.2 oz	0.0b	1.0b	2.0b	10.5	0.6b	1.6b
PQZ-3.2 oz	Sefina-14 oz	PQZ-3.2 oz	Sefina-14 oz	0.0b	0.0b	1.8b	16.5	1.0b	2.4b
PQZ-3.2 oz	PQZ-3.2 oz	Assail-5.3 oz	Assail-5.3 oz	0.0b	4.8ab	7.5ab	24.0	4.1b	4.5b
Venom- 4 oz	Assail-5.3 oz	Assail-5.3 oz	Exirel- 20 oz	0.0b	4.5ab	4.5ab	26.0	1.8b	4.5b
Untreated	Untreated	Untreated	Untreated	2.3a	34.8a	40.5a	n/a [a]	35.0a	70.0a

[a] plants in the untreated check had collapsed and were severely desiccated due to whitefly feeding and CYSDV
Means followed by the same letter are not significantly different (P>0.05).

B. *PQZ and Sefina Efficacy Against Whitefly Nymphs*

***Spring and Fall Trials, 2019*:** Cantaloupe plots direct seeded with 'Olympic Gold' were established on 25 Apr 2019 and plots with 'Sweet Spring' were established on 22 Aug 2019 at the Yuma Agricultural Center. All experimental plots were managed using local growing practices. Plots consisted of one 84-inch bed, 35 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 were the same for both trials and are shown in the tables. Three foliar sprays were applied on 5, 14 and 23 Jun in the spring trial and on 12, 20, and 27 Sep in the fall trial. Sprays were applied with a CO_2 operated boom sprayer at 22.5 GPA @ 40 psi. 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. Total nymph densities were estimated weekly following each application (DAA) by sampling 5 plants / plot, where 1-3 leaves per plant were collected from various node locations distant from the base or terminal of the primary vine. Leaves were taken into the laboratory where numbers of nymphs were counted on two, 2-cm^2 leaf discs of each leaf using a dissecting microscope. Because of heterogeneity of mean variances, data were transformed using a $\log_{10}(x + 1)$ function before analysis and subjected to ANOVA; means were compared using Turkey's HSD test ($P \leq 0.05$). Means from non-transformed data are presented in the tables.

Summary: The objective of this trial was to compare PQZ and Sefina for activity against whitefly nymphs to current standards. Whitefly pressure was heavier in the fall trial. Both PQZ and Sefina provide significant control of nymphs following three applications comparable to Sivanto and significantly better than Oberon (Table 5-6). However, both products provided good residual control - 14 d in the spring and 21 d in fall. These results indicate that PQZ and Sefina can significantly prevent the colonization of damaging nymphs on developing melon plants when used in a fall Whitefly/CYSDV management program.

Table 5. Total nymph densities on melons treated with PQZ and Sefina, Spring 2019

		Avg. Whitefly Nymphs /cm² / leaf			
Treatment	**Rate/ac**	***7 DAA-1***	***7 DAA-2***	***7 DAA-3***	***14 DAA-3***
Sivanto HL	7 oz	0.3cd	0.3bc	0.3d	0.2cd
Oberon	3.5 oz	0.6abc	0.7ab	1.4bc	1.3ab
Sefina	14 oz	0.2d	0.8ab	1.2abc	0.8bcd
PQZ	3.2 oz	0.5bc	0.5bc	0.2d	0.0d
Untreated	-	0.9a	2.1a	3.4a	2.3a

Table 6. Total nymph densities on melons treated with PQZ and Sefina, Fall 2019

		Avg. Whitefly Nymphs /cm² / leaf				
Treatment	**Rate/ac**	7 DAA-1	7 DAA-2	7 DAA-3	14 DAA-3	21 DAA-3
Sivanto HL	7 oz	0.9d	0.5b	0.1c	0.1c	0.5c
Oberon	3.5 oz	4.5b	2.1b	1.1b	1.0b	6.9b
Sefina	14 oz	2.6c	1.0b	1.2b	0.7b	2.1bc
PQZ	3.2 oz	8.2a	1.5b	0.2bc	0.1c	0.3c
Untreated	-	10.0a	4.8a	9.2a	12.3a	18.1a

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

C. ***Foliar Alternatives for Whiteflies and CYSDV Management***

***Spring Trial, 2019*:** Cantaloupe plots planted with 'Olympic Gold' were established on 25 Apr 2019 at the Yuma Agricultural Center. The experimental plots were managed using local growing practices. Plots consisted of one 84-inch bed, 35 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 10, 18 and 27 Jun with a CO_2 operated boom sprayer at 22.5 GPA @ 40 psi. 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.
Assessments and statistical analysis of whitefly adults and CYSDV incidence were conducted like the previous trials above. Data for whiteflies are presented as adults/sample at 1, 3 and 7 DAA by averaging across all three-spray application for each post-treatment evaluation.

Summary: The objective of this trial was to compare several alternative foliar insecticides against whitefly adults relative to PQZ and Sefina (new standards). At 1 DAA, only PQZ and Venom provided significant adult knockdown, and at 3 and 7 DAA Sefina and Exirel, along with PQZ and Venom had few whitefly adults /samples than the untreated control (Table 7). Consistent with previous efficacy trials Harvanta, Beleaf, Cormoran and Minecto Pro did not provide significant knockdown or residual control of adults. Nor did these treatments or Exirel significantly reduce the number of CYSDV symptomatic leaves relative to the untreated check. Although Exirel provided good adult residual control, it failed to suppress virus symptoms. This suggests that it does not rapidly cease whitefly feeding like PQZ and Sefina or provide rapid mortality like Venom or PQZ. Although Sefina did not provide significant 1 DAA knockdown of adults, it clearly disrupted feeding and virus transmission. Based on these and previous efficacy results, the alternatives to PQZ and Sefina evaluated in this trial are inconsistent and should be used sparingly in a whitefly/CYSDV management program.

Table 7. Average knockdown and residual efficacy of various foliar alternatives, Spring 2019

		Whitefly Adults / Sample *(averaged across all 3 applications)*				**CYSDV Symptomatic Leaves / 35 ft** *(9 Jul)*	
Treatment	**Rate** (oz/ac)	**1 DAA**	**3 DAA**	**7 DAA**	**Avg.**	**YIVC**	**TOTAL**
Harvanta	16.4	16.7ab	30.3a	29.9ab	25.6a	13.3a	77.0ab
Harvanta	10.9	17.2ab	28.3ab	24.6ab	23.4a	14.0a	72.5ab
Beleaf	16.5	12.2ab	20.2abc	29.2ab	20.1ab	8.5a	57.0ab
Cormoran	12	6.4abc	10.3abcd	10.1abc	9.0bc	10.8a	69.0ab
Exirel	15	4.6abcd	3.6cde	7.5cd	5.3cd	6.8a	59.5ab
Minecto Pro	10	6.6abc	12.3abcd	12.4abc	10.4abc	9.3a	64.0ab
PQZ	0.32	1.3c	1.7e	2.6d	1.9e	5.0a	36.3b
Sefina	14	9.4ab	4.1cde	8.3bc	7.3c	5.8a	46.8b
Venom	4	2.2cd	3.3de	7.4cd	4.3de	7.3a	50.7a
Untreated	-	25.1a	37.3a	31.2a	31.2a	15.0a	95.0a

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

Fall Trial, 2019: Cantaloupe plots planted with 'Olympic Gold' were established on 22 Aug 2019 at the Yuma Agricultural Center. The experimental plots were managed using local growing practices. Plots consisted of one 84-inch bed, 35 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 plots, except the untreated check, were treated with Sivanto (28 oz/ac) at-planting using a single soil shank injection at planting time applied 3" directly below the seed line in 10.5 GPA total volume. Similarly, on Sep 12 a side dress application of Venom (7.5 oz) was shanked into the soil on both sides of the plants (10" from seed-line) at a depth of 6" and immediately incorporated via furrow irrigation to all treatments except the untreated check. Three foliar sprays were applied on 10, 18 and 26 Sep with a CO_2 operated boom sprayer at 22.5 GPA @ 40 psi. 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. Assessments and statistical analysis of whitefly adults and CYSDV incidence were conducted like the previous trials above. Data for whiteflies shows the average adults/sample at 1, 3 and 7 DAA by averaging across all three-spray application for each post-treatment evaluation.

Summary: The objective of this trial was to compare several alternative foliar insecticides against whitefly adults relative to PQZ and Sefina (new standards). Unlike the spring trial, at 1 DAA all the spray alternatives provided significant adult knockdown, and by 7 DAA all products had fewer whitefly adults /sample than the untreated control (Table 8). Averaged across all sample dates, PQZ provided the most consistent whitefly control, flowed by Venom, Sequoia, Minecto, Sefina and Cormoran. However, Minecto Pro and Harvanta did not reduce the number of CYSDV symptomatic leaves relative to the untreated check. Lighter whitefly at the beginning of the fall trial likely allowed some of the less consistently performing products to provide suppression of CYSDV. Based on these trails and previous studies, we conclude that the diamides (Harvanta, Minecto Pro, Exirel) used alone may not provide adequate suppression of CYSDV and should be used minimally in fall melons.

Table 8. Average knockdown and residual efficacy of various foliar alternatives, Fall 2019

		Whitefly Adults / Sample *(averaged across all 3 applications)*					
Treatment	**Rate oz/ac**	**1 DAA**	**3 DAA**	**7 DAA**	**Avg.**	**YIVC leaves / 35 ft**	**% CYSDV Incidence**
Harvanta	16.4	2.2b	4.7ab	2.8b	3.4b	9.0ab	5.0ab
Harvanta	10.9	2.3b	4.9ab	3.9b	3.9b	8.5ab	4.8abc
Sequoia	5.7	0.6b	4.3b	1.5bc	2.3bcd	2.3b	0.6c
Cormoran	12	0.9b	3.0b	2.6b	2.3bcd	6.5b	2.6bc
Exirel	15	2.2b	6.2ab	3.7b	4.2bc	8.0ab	2.7bc
Minecto Pro	10	1.9b	3.9b	2.6b	2.9bcd	6.1ab	3.3abc
PQZ	0.32	0.6b	2.3b	0.9c	1.4d	2.0b	0.6c
Sefina	14	1.3b	4.9ab	1.8bc	2.8bcd	2.0b	0.9bc
Venom	4	0.5b	4.0b	1.5bc	2.2cd	5.0b	2.0bc
Untreated	-	15.0a	15.7a	16.3a	15.4a	40.5a	19.0a

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

II. TRANSPLANTED CANTALOUPES- FOLIAR AND SOIL INSECTICIDE EFFICACY

A. Comparison of Soil Insecticides Applied as Transplant Drenches

Spring 2019 Cantaloupes 'Sweet Spring' was transplanted on 25 April 2019 at the Yuma Valley Agricultural Center, Yuma, AZ into single row beds on 84-inch centers. Transplants were grown in a local nursery (Kiethly-Williams Transplants, Inc). Plants were set at an 12" inch spacing within the row. Stand establishment was achieved using drip irrigation and irrigated with drip for the duration of the trial. Plots were 1 bed wide by 45 ft long and bordered by a single unplanted bed. Four replications of each treatment were arranged in a RCB design. Formulations and rates for each treatment compound are provided in the tables. The transplant tray treatments were applied to two trays (n=128 cells/tray) for each treatment 12 hrs. prior to transplanting. The insecticide was applied by over-spraying the transplants within each trays a CO_2 operated, back-pack sprayer that delivered a banded application that was the width of the tray through a single flat-fan nozzle at 30 psi that simulated a greenhouse drench application. A total volume of 250 ml - water and chemical - was used to deliver each treatment. To calculate how much formulated product to use, we took the total number of plants in the 2 trays (n=256) and determined the area that would be transplanted (0.04 acres). We then adjusted the amount of product applied to the trays for that acreage. Following application of the insecticides, each treatment (2 trays) was treated with just enough water to incorporate the materials into the transplant plugs without leaching it out the bottom (~ 200 ml). No additional water was applied to the trays before transplanting. Further, no additional soil or foliar insecticides were applied during the trial. Crop injury was measured 7 days after transplanting (DATP) using a crop safety phytotoxicity rating for each product with the following index: 1-Excellent, no observable damage; 2-Good, very slight damage with an occasional leaf with marginal necrosis; 3-Satisfactory, damage acceptable with obvious marginal necrosis and chlorotic spotting on an occasional older leaf; 4-Marginal, damage usually not acceptable with marginal necrosis on numerous leaves with heavy chlorotic spotting on leaves; 5-Insufficicent, Damage unacceptable, leaves becoming necrotic and desiccating due to chemical burn; 6-Not Selective, total crop damage. Assessments and statistical analysis of whitefly adults and CYSDV incidence were conducted like the previous trials above.

Summary: The objective of this trial was to compare the efficacy of several soil, systemic insecticide when applied as transplant tray drench applications against whiteflies on spring cantaloupes. Immediately following the drench applications, it was obvious that all insecticides caused some level of crop injury relative to the untreated check (Table 9). Overall, most of the treatments had only slight damage with occasional leaves showing signs of marginal necrosis and which did not cause mortality or appear to affect plant development relative to the untreated control throughout the season. However, Sivanto was highly phytotoxic to transplants and caused over 90% seedling mortality shortly after transplanting; development in surviving plants were significantly delayed throughout the study (Figure 1 and 2). This was not a complete surprise since in previous CMRB projects we have observed significant crop injury following foliar applications and seedling stunting following shallow, soil applications on direct seeded plantings. Thus, we wee unable to collect efficacy data from the Sivanto treatment. Because of the light whitefly pressure during the first 30 days of the trial and that no additional foliar sprays were applied to the drench treatments, differences in adults and CYSDV were not detected among the remaining transplant tray drench treatments and the untreated control (Table 10 and 11). However, the Venom and Verimark treatments provided significant control of whitefly nymphs for 30-45 days (Table 12).

Table 9. Crop injury on cantaloupe seedlings associated with transplant tray drenches, Spring 2019

Treatment	Rate / ac	Crop Injury (7 DATP)	
		Phyto rating	% Dead Plants
Venom	7.5 oz	2.0c	0.0b
Sivanto	14 oz	5.8a	90.0a
Verimark	13.6 oz	1.8cd	0.0b
Durivo	10 oz	2.5bc	0.0b
Admire Pro	10.5 oz	3.1b	0.0b
Untreated	-	1.0d	0.0b

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

Figure 1 *Crop Injury to Sivanto melon seedlings 12 hrs. following Transplant Drench Treatments, Spring 2019*

Figure 2. *Injury to melon plants 28 days following transplanting resulting from tray drench application of Sivanto following, Spring 2019*

Table 10. Whitefly abundance in melon plants treated with tray drench applications, Spring 2019

		Whitefly Adults / Sample			
Treatment	**Rate / ac**	**23-May**	**30-May**	**12-Jun**	**27-Jun**
Venom	7.5 oz	0.3b	1.6a	2.6a	19.9a
Sivanto	14 oz	-	-	-	-
Verimark	13.6 oz	0.7ab	1.5a	1.7a	12.8a
Durivo	10 oz	0.4ab	1.7a	3.4a	30.4a
Admire Pro	10.5 oz	0.9ab	1.2a	1.1a	19.3a
Untreated	-	1.1a	2.4a	3.7a	27.5a

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

Table 11. Estimates of CYSDV incidence in melon plants treated with tray drench applications, Spring 2019

		CYSDV symptomatic leaves / 35 ft *(9 Jul)*		
Treatment	**Rate / ac**	**PIVC**	**YIVC**	**Total**
Venom	7.5 oz	39.3a	3.5a	42.8a
Sivanto	14 oz	-	-	-
Verimark	13.6 oz	48.3a	2.0a	50.3a
Durivo	10 oz	63.3a	6.5a	69.8a
Admire Pro	10.5 oz	52.3a	11.3a	63.5a
Untreated	-	55.8a	5.0a	60.8a

Table 12. Whitefly nymph densities in melon plants treated with tray drench applications, Spring 2019

		Avg. Whitefly Nymphs /cm² / leaf			
Treatment	**Rate / ac**	**23-May**	**30-May**	**10-Jun**	**27-Jun**
Venom	7.5 oz	0.1b	0.1b	0.4b	3.0ab
Sivanto	14 oz	-	-	-	-
Verimark	13.6 oz	0.1b	0.5ab	0.9ab	1.4b
Durivo	10 oz	0.7a	1.1a	0.6ab	4.7ab
Admire Pro	10.5 oz	0.3ab	0.9a	0.8ab	2.8ab
Untreated	-	1.0a	1.9a	1.7a	6.6a

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

Fall 2019 Cantaloupes 'Sweet Spring' was transplanted on 23 Aug 2019 at the Yuma Valley Agricultural Center, Yuma, AZ into single row beds on 84-inch centers. Plants were set at an 12" inch spacing within the row. Stand establishment was achieved using drip irrigation and irrigated with drip for the duration of the trial. Plots were 1 bed wide by 35 ft long and bordered by a single unplanted bed. Four replications of each treatment were arranged in a RCB design. Formulations and rates for each treatment compound are provided in the tables. The transplant tray treatments were applied to the trays using the same methodology as explained in the Spring 2019 trial above. Two banded (50%) foliar sprays of PQZ at 3.2 oz/ac were applied to the treated transplants on 5 and 12 Sep using standard application methods described in previous studies. A third application of Assail, 5.3 oz + Vetica, 20 oz was made to all plots, including the untreated check, on 23 Sep. Th untreated check was sprayed to prevent nymphs from killing the vines at harvest. Assessments and statistical analysis of crop injury, whitefly adults and CYSDV incidence were conducted like the previous trials above. Yields were estimated by harvesting all mature melons in 20 row ft within each plot. Plots were harvested 3 times. Fruit yields were measured by harvesting and recording the number of mature melons /plot and classifying their numbers by carton size: (large - 6, 9, 12) and (small- 15, 18, 23). % Sugar levels (Brix) for 3 fruit from each plot on each harvest date were recorded using a digital refractometer.

Summary: The trial differed slightly from the spring trial. Three foliar sprays were applied early season to augment the transplant tray drench applications in whitefly control and CYSDV suppression. Among tray drench treatments, only Admire Pro and Sivanto had a crop injury rating than the untreated check (Table 13). Like the spring trial, Sivanto was highly phytotoxic to transplants and caused over greater than 50 % seedling mortality shortly after transplanting and growth of surviving plants were significantly delayed throughout the study (Figure 3-4). This was anticipated, but overall crop injury in the Sivanto treatment was not as severe in the fall. Nonetheless we were able to collect insect, virus and harvest data from the Sivanto plots throughout the season. Whitefly /CYSDV pressure was heavy enough to detect differences among the tray drench treatments (Table 14 and 15). Venom and Durivo provided the most significant adult control, although Admire Pro, Sivanto, and Verimark did control adults relative to the untreated check. Although virus incidence was moderate in the untreated check one week before harvest (38%), only the Venom and Durivo treatments significantly reduced the incidence of CYSDV. The lighter whitefly and CYSDV pressure allowed for all the treatments except Sivanto to produce significantly higher yields (large fruit) than the check (Table 16). Yield reductions in the Sivanto plots resulted from lower plant densities and stunted growth of surviving plants following transplant tray application (Figure 3-4). Only the Venom treatment had significantly higher percent sugar than the untreated check, a result of significantly more consistent suppression of both whitefly adults and virus than the other tray drench treatments. These results partly support our initial hypothesis that Venom or Sivanto would be the insecticides of choice for treating transplants given that both soil systemics provide excellent efficacy of whiteflies and CYSDV when applied as soil shank applications for direct seeded melons. The Venom tray drench provides both the crop safety and crop protection needed for fall melon production. However, it is obvious that application of Sivanto, at the rate and concentration used in this study, is extremely phytotoxic to cantaloupe seedlings and not acceptable for insect management. Further trials will explore applying Sivanto to transplants at lower rates (14 and 21 oz), as well as through drip chemigation during stand establishment.

Figure 3. *Crop Injury to Sivanto melon seedlings 12 hrs. following Transplant Drench Treatments, Fall 2019*

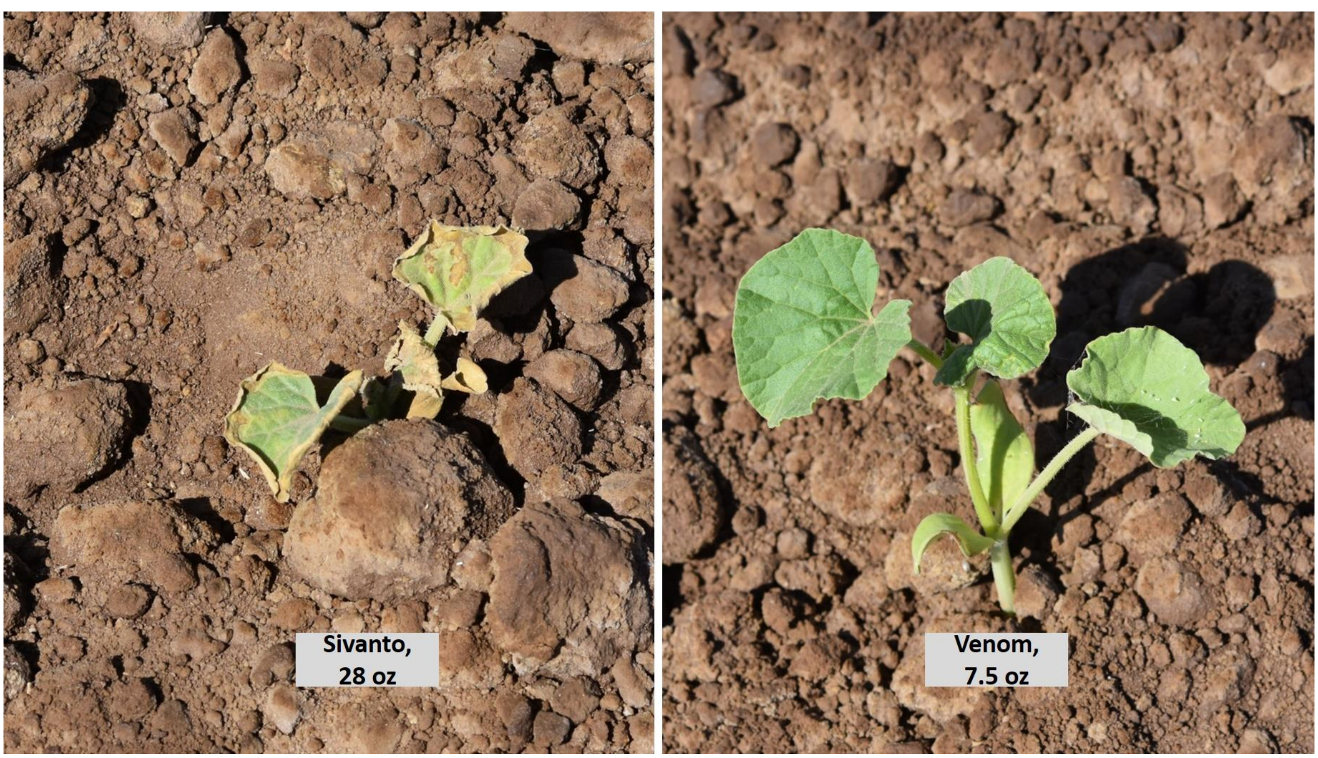

Figure 4. *Injury to melon plants 3 days following transplanting resulting from tray drench application of Sivanto following, Fall 2019*

Table 13. Crop injury on cantaloupe seedlings associated with transplant tray drenches, Fall 2019

		Crop Injury	
Treatment	**Rate / ac**	**Phyto rating**	**% Dead Plants**
Venom	7.5 oz	1.1c	0 b
Sivanto	14 oz	4.5a	53.7a
Verimark	13.6 oz	1.0c	0 b
Durivo	10 oz	1.8bc	0 b
Admire Pro	10.5 oz	2.0b	0 b
Untreated	-	1.0c	0 b

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

Table 14. Whitefly abundance in melon plants treated with tray drench applications, Fall 2019

		Whitefly adults / sample						
Treatment	**Rate / ac**	**27-Aug**	**3-Sep**	**11-Sep**	**17-Sep**	**26-Sep**	**1-Oct**	**Avg.**
Venom	7.5 oz	9.6a	1.7c	0.9b	3.5c	0.5a	3.4a	3.2c
Sivanto	14 oz	7.4a	3.9ab	0.4b	7.6c	1.0a	9.8a	5.0b
Verimark	13.6 oz	15.8a	5.0ab	1.0b	3.1c	0.8a	6.9a	5.4b
Durivo	10 oz	12.3a	2.2bc	0.4b	2.0c	1.2a	3.4a	3.6c
Admire Pro	10.5 oz	9.7a	2.9abc	0.7b	4.0bc	0.9a	3.8a	3.8bc
Untreated	-	12.2a	5.0ab	18.5a	18.1a	2.1a	8.1a	10.6a

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

Table 15. Estimates of CYSDV incidence in melon plants treated with tray drench applications, Fall 2019

		% CYSDV Incidence		
Treatment	**Rate / ac**	**9-Oct**	**17-Oct**	**25-Oct**
Venom	7.5 oz	1.5a	1.6b	5.1c
Sivanto	14 oz	1.8a	4.0b	17.5abc
Verimark	13.6 oz	3.8a	13.1ab	20.5abc
Durivo	10 oz	2.2a	9.3b	14.8bc
Admire Pro	10.5 oz	2.3a	11.8ab	26.3ab
Untreated	-	6.0a	27.5a	38.8a

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

Table 16. Yields and Fruit Quality in melons treated with transplant tray applications, Fall 2019

		Yields - Mean Fruit / 20 row ft		**Sugar**
Treatment	**Rate / ac**	*Large*	*Small*	*(% Brix)*
Venom	7.5 oz	20.3a	6.5b	12.8a
Sivanto	14 oz	6.8c	10.0b	9.7b
Verimark	13.6 oz	17.0ab	8.0b	11.5b
Durivo	10 oz	17.8ab	8.8b	11.8ab
Admire Pro	10.5 oz	14.3b	9.0b	11.3b
Untreated	-	9.8c	19.0a	11.5b

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

B. Foliar Insecticides and Venom Transplant Tray Drench

Spring 2019 Cantaloupes 'Sweet Spring' was transplanted on 23 Aug 2019 at the Yuma Valley Agricultural Center, Yuma, AZ into single row beds on 84-inch centers. Plants were set at an 12" inch spacing within the row. Stand establishment was achieved using drip irrigation and irrigated with drip for the duration of the trial. Plots were 1 bed wide by 45 ft long and bordered by a single unplanted bed. Four replications of each treatment were arranged in a RCB design. Formulations and rates for each treatment compound are provided in the tables. All transplant trays, except the untreated check, were treated with Venom (7.5 oz/ac) 15 hrs. prior to transplanting. The insecticides were applied to transplants using the same methods as described above. Three of the transplant treatments received a foliar spray application of PQZ (3.2 or 2.4 oz) or Sefina (14 oz) just prior to transplanting (Pre-TP) by spraying the transplants in the trays with a broadcast foliar spray 12 hrs. before transplanting. Three additional treatments were treated with the same insecticides and rates immediately following the completion of planting (At-TP) by applying a 25% banded application directly over plants in the field. At 7 days after transplanting (DATP), either PQZ or Sefina was applied to all treatments using a banded (25%) broadcast application delivered through 2 TXVS-18 ConeJet nozzles per bed. All sprays were applied with a CO_2 operated boom sprayer at 20.5 GPA @ 40 psi. Assessments and statistical analysis of crop injury, whitefly adults CYSDV incidence and yields were conducted like the previous trial above.

Summary: Whitefly pressure was very light at the beginning of this trial and adult numbers were too low to detect significant differences among the spray treatments at 7, 14 or 21 days after transplanting (Data not shown). Furthermore, no differences in CYSDV were observed and yield data was not taken. No crop injury was observed with either the transplant tray drench with Venom, or the foliar sprays applied to the seedling melons at transplanting.

Fall 2019 Cantaloupes 'Sweet Spring' was transplanted on 23 Aug 2019 at the Yuma Valley Agricultural Center, Yuma, AZ into single row beds on 84-inch centers. Plants were set at an 12" inch spacing within the row. Stand establishment was achieved using drip irrigation and irrigated with drip for the duration of the trial. Plots were 1 bed wide by 45 ft long and bordered by a single unplanted bed. Four replications of each treatment were arranged in a RCB design. Formulations and rates for each treatment compound are provided in the tables. All transplant trays, except the untreated check, were treated with Venom (7.5 oz/ac) 12 hrs. prior to transplanting. The insecticides were applied to transplants using the same methods as described above. Three of the transplant treatments received a foliar spray application of PQZ (3.2 or 2.4 oz) or Sefina (14 oz) just prior to transplanting (Pre-TP) by spraying the transplants in the trays with a broadcast foliar spray 12 hrs. before transplanting. Three additional treatments were treated with the same insecticides and rates immediately following the completion of planting (At-TP) by applying a 25% banded application directly over plants in the field. Additional applications were made at 7, 14 and 21 days after transplanting (DATP) to all plots; either PQZ or Sefina was applied to treatments using a banded (25-50%) broadcast application delivered through 2 TXVS-18 ConeJet nozzles per bed, or a broadcast application was delivered through 4 TXVS-18 ConeJet nozzles per bed. All sprays were applied with a CO_2 operated boom sprayer at 20.5 GPA @ 40 psi. A final application or Assail, 5.3 oz and Vetica, 20 oz was applied to all plots, including the untreated check in order to prevent vine collapse at harvest due to immature whitefly feeding. Assessments and statistical analysis of crop injury, whitefly adults CYSDV incidence and yields were conducted like the previous trials.

<u>Summary:</u> No significant crop injury resulted from the Venom transplant drench. Whitefly adult pressure was light for the first 10 days following transplanting and adult knockdown was inconsistent among treatments (Table 17). Thereafter, adult numbers increased in plots and spray treatments provided significant control, most consistently following PQZ sprays. Averaged across all applications, all spray combinations provided similar control, including the treatment that did not receive an At- or Pre-TP spray application. Virus incidence was lower at harvest in the check (47.5%) than in previous years, and but all spray combinations maintained CYSDV infection below 15% (Table 18). Accordingly, at harvest, there were no differences in yield and quality among all spray combinations, and these treatments yielded significantly more large fruit and had higher percent sugars at harvest than the untreated control (Table 19). This further support other studies in this report that rate and spray sequence of PQZ and Sefina applications during the early season are not critical. Regardless of which product is used first, a rotation with these compounds in association with soil insecticides will provide excellent crop protection. It is critical that both products are used because they provide comparable deterrence to whitefly feeding and virus transmission. We had also hypothesized that spraying the transplant in trays with PQZ or Sefina before transplanting would provide enhanced control. However, the results indicate that spraying after transplanting provided the same level of control. This may be a bit misleading since our whitefly pressure was light at stand establishment and may have resulted in different results had we had heavy adult migrations in plots at transplanting. This trial will be repeated next season to support or refute this conclusion.

Table 17. Whitefly abundance in melon plants treated with PQZ/Sefina spray combinations, Fall 2019

Transplant spray		Post-Transplant Spray Treatments			Whitefly Adults / Sample								
Treatments		**7 DATP**	**14 DATP**	**21 DATP**	**26-Aug**	**29-Aug**	**2-Sep**	**5-Sep**	**12-Sep**	**18-Sep**	**26-Sep**	**1-Oct**	**Avg.**
Sefina-14 oz	Pre-TP	PQZ-3.2 oz	PQZ-3.2 oz	Sefina-14 oz	2.2ab	1.0ab	1.5a	10.0b	2.3c	10.6b	1.1a	4.6a	4.1b
PQZ-3.2 oz	Pre-TP	PQZ-3.2 oz	Sefina-14 oz	Sefina-14 oz	1.7b	0.5b	2.2a	8.9b	6.1b	17.7ab	2.2a	6.6a	5.7b
PQZ -2.4 oz	Pre-TP	PQZ -2.4 oz	Sefina-14 oz	Sefina-14 oz	2.3ab	0.5b	1.7a	7.8b	6.4b	10.0b	1..2a	4.0a	4.2b
Sefina-14 oz	At-TP	PQZ-3.2 oz	Sefina-14 oz	PQZ-3.2 oz	1.0b	1.0ab	1.0a	8.9b	5.2b	15.2b	1.0a	3.9a	4.6b
PQZ-3.2 oz	At-TP	PQZ -2.4 oz	Sefina-14 oz	Sefina-14 oz	2.1ab	0.7b	1.5a	11.8b	3.9b	10.6b	1.6a	3.5a	4.4b
PQZ -2.4 oz	At-TP	PQZ-3.2 oz	Sefina-14 oz	Sefina-14 oz	2.1ab	0.8b	1.8a	10.5b	5.2b	15.6b	1.6a	4.7a	5.3b
-	-	PQZ-3.2 oz	PQZ-3.2 oz	Sefina-14 oz	1.8b	1.3ab	1.5a	12.0b	3.0b	12.5b	1.9a	4.9a	4.8b
Untreated	-	Untreated	Untreated	Untreated	5.3a	3.0a	3.3a	54.0a	24.8a	41.2a	4.1a	10.1a	18.2a

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

Table 18. Estimates of CYSDV incidence in melon plants treated with PQZ/Sefina spray combinations, Fall 2019

Transplant spray		Post-Transplant Spray Treatments			% CYSDV Incidence		
Treatments		**7 DATP**	**14 DATP**	**21 DATP**	**9-Oct**	**17-Oct**	**25-Oct**
Sefina-14 oz	Pre-TP	PQZ-3.2 oz	PQZ-3.2 oz	Sefina-14 oz	2.0b	4.6b	11.4b
PQZ-3.2 oz	Pre-TP	PQZ-3.2 oz	Sefina-14 oz	Sefina-14 oz	2.5b	5.4b	14.0b
PQZ -2.4 oz	Pre-TP	PQZ -2.4 oz	Sefina-14 oz	Sefina-14 oz	2.3b	4.8b	10.9b
Sefina-14 oz	At-TP	PQZ-3.2 oz	Sefina-14 oz	PQZ-3.2 oz	2.1b	6.4b	8.8b
PQZ-3.2 oz	At-TP	PQZ -2.4 oz	Sefina-14 oz	Sefina-14 oz	4.0ab	4.4b	11.0b
PQZ -2.4 oz	At-TP	PQZ-3.2 oz	Sefina-14 oz	Sefina-14 oz	3.8ab	5.5b	9.6b
-	-	PQZ-3.2 oz	PQZ-3.2 oz	Sefina-14 oz	3.8ab	6.1b	13.6b
Untreated	-	Untreated	Untreated	Untreated	15.8a	32.0a	47.5a

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

Table 19. Yields and Quality in melon plants treated with PQZ/Sefina spray combinations, Fall 2019

Transplant spray		**Post-Transplant Spray Treatments**			**Yields** - Mean Fruit / 20 row ft		**Quality**
Treatments		**7 DATP**	**Treatments**	**7 DATP**	**Large** (cartons 6,9 and 12)	**Small** (cartons 15-23)	(BRIX, %)
Sefina-14 oz	Pre-TP	PQZ-3.2 oz	PQZ-3.2 oz	Sefina-14 oz	19.5a	9.8b	11.9a
PQZ-3.2 oz	Pre-TP	PQZ-3.2 oz	Sefina-14 oz	Sefina-14 oz	18.3a	9.5b	11.6a
PQZ -2.4 oz	Pre-TP	PQZ -2.4 oz	Sefina-14 oz	Sefina-14 oz	19.0a	7.3b	11.6a
Sefina-14 oz	At-TP	PQZ-3.2 oz	Sefina-14 oz	PQZ-3.2 oz	16.3a	8.8b	11.5a
PQZ-3.2 oz	At-TP	PQZ -2.4 oz	Sefina-14 oz	Sefina-14 oz	17.5a	8.5b	12.3a
PQZ -2.4 oz	At-TP	PQZ-3.2 oz	Sefina-14 oz	Sefina-14 oz	18.5a	10.0b	12.2a
-	-	PQZ-3.2 oz	PQZ-3.2 oz	Sefina-14 oz	18.3a	8.0b	11.4a
Untreated	-	Untreated	Untreated	Untreated	9.0b	17.5a	10.1b