Delaware Field and Vegetable Crop Insect Pest Management Trials 2019

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The purpose of this book is to disseminate insecticide, miticide, and molluscicide efficacy trial results for information only. These data are not meant to be used for marketing purposes. Inclusion or exclusion of a product from a trial is not meant as an endorsement of one or discrimination against another. Please note that not all products evaluated might be labeled for use on the crop in which they were tested on. If you have questions or concerns, feel free to contact David Owens.

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Brussels Sprouts 2019 Harlequin Bug

Location: Carvel REC, Field 31 East
Variety: See Table
Planting Date: See Table
Experimental Design: Randomized complete block design with 4 treatments and 4 replicates
Treatment Method: CO_2-pressurized backpack sprayer fitted with 3 D4 nozzles and #45 cores delivering 45 GPA at 62 PSI. Outer two nozzles were on 1' drops and oriented to spray the sides of the plant.
Treatment Date: 25 September
Plot size: 1 row x 18'
Row Spacing: 36"
Plant Spacing: 18"
Sample Size: 5 plants
Data Analysis: Data Log transformed. ANOVA; Dunnett's means separation

Notes: Treatment variability due to variety was extremely high. There may be varietal differences, but could not be determined based on the limited number of each variety assessed for harlequin bug. Sivanto Prime is not labeled for harlequin bug.

TRT	Material	Rate
1	UTC	---
2	Actara	5 oz/A
3	Carbaryl	0.75 qt/A
4	Sivanto Prime	14 fl oz/A

TRT	1 d (PRE)	2 DAT
1	22.7	21.3 a
2	80.5	0.3 b
3	70.0	30.5 a
4	22.0	4.6 ab
ANOVA	*NS*	*P = 0.051*

Variety	Planting Date	n	1 d (Pre)
Aurelius	6 March	1	34
Capitola	6 March, 23 April	3	50.7
Confidante	15 March	2	11.0
Dagan	6 March	1	41.0
Gustus	6 March, 23 April	3	11.0
Hestia	6 March, 23 April	3	127.7
Igor	23 April	1	76.0
Jade Cross	6 March	1	23.0
Marte	6 March	1	16.0

Cabbage 2019 a

Location: Carvel REC, Field 1
Variety: 'Early Round Dutch'
Transplant Date: 15 August
Experimental Design: Randomized complete block design with 6 treatments and 4 replicates
Plot size: 1 row x 18', 60" between plots
Plant Spacing: 1.5'
Treatment Method: CO_2-pressurized backpack sprayer with single-row boom equipped with 3 D4 tips and #45 cores delivering 45 GPA at 62 PSI. Outside nozzles were on drop tubes for sprays 2 and 3 with nozzles oriented perpendicular to the ground to achieve maximum side-coverage.
Harvest Date: 23 October
Sample Size: 5 plants/plot; 15 leaves/plot for aphids and whiteflies, 10 heads harvest/plot. Cabbage was graded on a 0-4 scale, where 0 = clean, 1 = frame leaf damage, 2 = slight wrapper leaf damage, 3 = significant wrapper leaf damage, 3.5 = slight head damage, 4 = significant head damage. Cabbage receiving a grade of 2 or less was considered marketable.
Data Analysis: ANOVA; Tukey-Kramer HSD means separation

Application Rates and Dates:

TRT	Material	Rate	Application Dates
1	Coragen	4.25 fl oz/A	9/17, 9/25, 10/11
2	Movento	5 fl oz/A	9/17, 9/25, 10/11
3	Orthene	1 lb/A	9/17, 9/25, 10/11
4	Harvanta	13 fl oz/A	9/17, 9/25, 10/11
5	Avaunt eVo	3 oz/A	9/17, 9/25, 10/11
6	UTC	---	

Induce was added to all treatments at a rate of 2 pints/100 gal

Season Total

TRT	ICW	DBM	Other	Total	Aphids	Whiteflies	Damage Rating	% Marketable
1	2.3	0.5	0.8	3.5 ab	13.3	3.5	1.2 b	80.0 a
2	4.8	6.8	4.0	15.5 ab	0.8	1.0	2.7 a	17.5 b
3	1.3	1.0	0.8	3.0 ab	50.0	2.3	1.3 b	82.5 a
4	0.3	0.3	0.3	0.8 b	6.0	1.3	1.1 b	82.9 a
5	1.3	1.0	1.3	3.5 ab	9.8	2.0	1.0 b	87.2 a
6	9.5	11.8	4.5	25.8 a	15.8	3.8	2.8 a	20.0 b
ANOVA	*P <0.001*	*NS*	*NS*	*P = 0.017*	*NS*	*NS*	*P <0.001*	*P <0.001*

ICW – Imported cabbageworm
DBM – Diamondback moth

16 Sept (1 d PRE)

TRT	ICW	DBM	Other	Total	Aphids	Whiteflies
1	0.8	1.5	0	2.3	10.8	2.0
2	0.5	1.0	0.5	2.0	0.5	2.0
3	1.0	0.7	0.3	2.0	3.0	9.0
4	1.5	0	0	1.5	6.0	1.5
5	1.0	0.3	0	1.3	0.8	1.3
6	1.0	0.5	0	1.5	24.8	3.5
ANOVA	*NS*	*NS*	*NS*	*NS*	*NS**	*NS*

*Welch's Test

19 Sept (2 DAT)

TRT	ICW	DBM	Other	Total	Aphids	Whiteflies
1	1.8	0	0 b	1.8	3.8	0.8
2	1.8	0	0 b	1.8	0	0.5
3	0.0	0	0 b	0	43.5	0.3
4	0.3	0.3	0 b	0.5	1.5	0.3
5	0.8	0	0 b	0.8	1.0	0.8
6	1.0	0	0.5 a	1.5	4.5	2.0
ANOVA	*NS*	*NS*	*P = 0.038*	*NS*	*NS*	*NS*

Sept 24 (7 DAT, 1 PRE)

TRT	ICW	DBM	Other	Total	Aphids	Whiteflies
1	0.3 b	0.3	0	0.5 b	4.5	1.5
2	1.8 ab	1.3	0	3.0 ab	0.3	0
3	0.3 b	0	0.3	0.5 b	6.0	0
4	0 b	0	0	0 b	1.8	0.3
5	0.3 b	0	0	0.3 b	1.3	0.5
6	3.8 a	1.3	0.5	5.5 a	0.8	0.3
ANOVA	*P <0.001*	*NS*	*NS*	*P = 0.002*	*NS*	*NS*

Sept 27 (2 DAT)

TRT	ICW	DBM	Other	Total	Aphids	Whiteflies
1	0	0	0.3	0.3	0.5	0.5
2	0.5	0.8	0	1.3	0	0.5
3	0.3	0	0.3	0.5	0	1.5
4	0	0	0	0	0	0.3
5	0	0.3	1.3	1.5	2.0	0
6	1.0	3.3	0.5	4.8	1.8	0.5
ANOVA	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*

Oct 1 (6 DAT)

TRT	ICW	DBM	Other	Total	Aphids	Whiteflies
1	0.3	0	0.3	0.5 ab	0.3	0.5
2	0.3	1.0	0.8	2.0 ab	0	0
3	0	0	0	0 b	0	0.5
4	0	0	0.3	0.3 b	0.5	0
5	0.3	0	0	0.3 b	2.3	0
6	0.5	2.3	0	2.8 a	2.3	0
ANOVA	*NS*	*P = 0.027*	*NS*	*P = 0.006*	*NS*	*NS*

Oct 7 (13 DAT)

TRT	ICW	DBM	Other	Total	Aphids	Whiteflies
1	0	0	0	0	0	0
2	0	0.3	0.5	0.8	0	0
3	0	0	0	0	0	0
4	0	0	0	0	0	0
5	0	0	0	0	0.5	0.3
6	0.5	2.8	0.8	4.0	4.5	0
ANOVA	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*

Oct 11 (0 PRE)

TRT	ICW	DBM	Other	Total	Aphids	Whiteflies
1	0 b	0.3	0	0.3	3.3	0.3
2	0 b	2.8	1.5	4.3	0.3	0
3	0.5 ab	1.0	0.3	1.8	0.5	0
4	0 b	0	0	0	0.8	0.5
5	0 b	0.8	0	0.8	2.3	0.3
6	0.8 a	1.8	2.0	4.5	1.8	0.8
ANOVA	*P = 0.007*	*NS*	*NS*	*NS*	*NS*	*NS*

Oct 14 (3 DAT)

TRT	ICW	DBM	Other	Total	Aphids	Whiteflies
1	0 b	0	0.3	0.3 ab	0.8	0
2	0 b	0.3	0.3	0.5 ab	0	0
3	0 b	0	0	0 b	0	0
4	0 b	0	0	0 b	0.3	0
5	0 b	0	0	0 b	0.3	0.3
6	1.3 a	0	0	1.3 a	0.3	0.3
ANOVA	*P = 0.001*	*NS*	*NS*	*P = 0.015*	*NS*	*NS*

Oct 21 (10 DAT)

TRT	ICW	DBM	Other	Total	Aphids	Whiteflies
1	0	0	0	0	0.3	0
2	0.5	0.5	1.0	2.0	0.3	0
3	0.3	0	0	0.3	0	0
4	0	0	0	0	1.3	0
5	0	0	0	0	0.3	0
6	0.8	0.5	0.3	1.5	0	0
ANOVA	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*

Cabbage 2019 b

Location: Carvel REC, Field 1
Variety: 'Savoy Ace'
Transplant Date: 15 August
Experimental Design: Randomized complete block design with 6 treatments and 4 replicates
Plot size: 2 rows x 18', 60" between plots
Row Spacing: 30"
Plant Spacing: 1.5'
Treatment Method: CO_2-pressurized backpack sprayer with single-row boom equipped with 3 D4 tips and #45 cores delivering 45 GPA at 62 PSI. Outside tips were oriented sideways off of a drop arm.
Harvest Date: 6 November
Sample Size: 5 plants/plot; 15 leaves/plot for aphids and whiteflies, 10 heads harvest/plot. Cabbage was graded on a 0-4 scale, where 0 = clean, 1 = frame leaf damage, 2 = slight wrapper leaf damage, 3 = significant wrapper leaf damage, 3.5 = slight head damage, 4 = significant head damage. Cabbage receiving a grade of 2 or less was considered marketable.
Data Analysis: ANOVA; Tukey-Kramer HSD means separation

Application Rates and Dates:

TRT	Material	Rate	Application Dates
1	UTC	---	---
2	Movento	5 fl oz/A	9/17, 9/25, 10/3, 10/30
3	Voliam Xpress	7.5 fl oz/A	9/17, 9/25, 10/3, 10/30

Induce was added to all treatments at a rate of 2 pints/100 gal

Season Totals

TRT	ICW	DBM	Other	Total	Aphids	Whiteflies	Damage Rating	% Marketable
1	9.0	8.0 a	0.5	17.5 a	33.3	10.0	2.0 a	70.0 b
2	1.5	3.0 b	0.5	5.0 b	7.0	4.8	1.0 b	97.5 a
3	0	0 b	0	0 b	15.3	12.3	0.6 c	97.5 a
ANOVA	*P = 0.052*	*P = 0.003*		*P = 0.007*			*P <0.001*	*P = 0.002*

ICW – Imported cabbageworm
DBM – Diamondback moth
Total season data excludes first pre-treatment data (Sept. 16). 'Other' worms include various armyworm species, cross striped cabbaged worm, corn earworm, cabbage loopers, and unidentified larvae.

Sept 16 (1 PRE)

TRT	ICW	DBM	Other	Total	Aphids	Whiteflies
1	0.8	0	0	0.8	2.0	8.0
2	0.3	0	0	0.3	1.5	3.3
3	0.5	0.3	0	0.8	0.5	8.3
ANOVA	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*

Sept 19 (2 DAT)

TRT	ICW	DBM	Other	Total	Aphids	Whiteflies
1	0.8	0	0	0.8	1.5	5.0
2	0	0	0	0	2.5	0.3
3	0	0	0	0	0.3	2.3
ANOVA	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*

Sept 24 (7 DAT, 1 PRE)

TRT	ICW	DBM	Other	Total	Aphids	Whiteflies
1	1.0	0.8	0	1.8 a	3.0	0.5
2	0.3	0.5	0	0.8 ab	0.5	2.8
3	0	0	0	0 b	0.8	1.5
ANOVA	*NS*	*NS*	*NS*	*P = 0.034*	*NS*	*NS*

Sept 27 (2 DAT)

TRT	ICW	DBM	Other	Total	Aphids	Whiteflies
1	0	0.8	0	0.8	0.5	1.8
2	0	0.5	0	0.5	0	0.5
3	0	0	0	0	0	2.0
ANOVA	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*

Oct 1 (6 DAT, 2 PRE)

TRT	ICW	DBM	Other	Total	Aphids	Whiteflies
1	0.3	2.0	0	2.3	8.0	0.3
2	0.3	1.5	0	1.8	0	0.3
3	0	0	0	0	0.5	1.5
ANOVA	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*

Oct. 7 (4 DAT)

TRT	ICW	DBM	Other	Total	Aphids	Whiteflies
1	0.3	1.8	0	2.0	0	0
2	0.5	0	0	0.5	0	0.3
3	0	0	0	0	0	0.3
ANOVA	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*

Oct 11 (7 DAT)

TRT	ICW	DBM	Other	Total	Aphids	Whiteflies
1	1.8 a	1.5 a	0.3	3.5 a	0 b	1.3
2	0.3 b	0.3 b	0.3	0.8 b	0 b	0.3
3	0 b	0 b	0	0 b	1.0 a	0.3
ANOVA	*P = 0.007*	*P = 0.002*	*NS*	*P <0.001*	*P = 0.022*	*NS*

Oct 14 (14 DAT)

TRT	ICW	DBM	Other	Total	Aphids	Whiteflies
1	0.3	0.3	0	0.5	5.3	0.8
2	0	0.3	0.3	0.5	0.3	0
3	0	0	0	0	1.5	0
ANOVA	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*

Oct 21 (21 DAT)

TRT	ICW	DBM	Other	Total	Aphids	Whiteflies
1	1.8	0.3	0.3	2.3 a	0	0
2	0	0	0	0 b	0	0.3
3	0	0	0	0 b	0	0
ANOVA	*NS*	*NS*	*NS*	*P = 0.015*	*NS*	*NS*

Oct 29 (28 DAT, 1 PRE)

TRT	ICW	DBM	Other	Total	Aphids	Whiteflies
1	1.0	0.5	0	1.5	10.5	0
2	0.3	0	0	0.3	2.3	0.3
3	0	0	0	0	4.8	0
ANOVA	*NS*	*NS*	*NS*	*P = 0.056*	*NS*	*NS*

Nov 1 (2 DAT)

TRT	ICW	DBM	Other	Total	Aphids	Whiteflies
1	1.5	0.3	0	1.8	3.0	0.5
2	0	0	0	0	1.5	0
3	0	0	0	0	2.5	4.0
ANOVA	*P = 0.007*	*NS*	*NS*	*P = 0.028*	*NS*	*NS*

Nov 5 (6 DAT)

TRT	ICW	DBM	Other	Total	Aphids	Whiteflies
1	0.5	0	0	0.5	1.5 ab	0
2	0	0	0	0	0 b	0
3	0	0	0	0	4.0 a	0
ANOVA	*NS*	*NS*	*NS*	*NS*	*P = 0.039*	*NS*

Peas 2019 Seedcorn Maggot 1

Location: Carvel REC, Dill Farm
Variety: 'Knight'
Planting Date: 9 April
Experimental Design: Randomized complete block design with 5 treatments, 4 replicates;
Treatment Method: Monosem planter with in-furrow application via fertilizer drops delivering 9.2 GPA.
Plot size: 2 row x 15'
Row Spacing: 30"
Plant Spacing: 70,000 seeds/acre
Sample Size: 3 row-ft per row
Data Analysis: ANOVA; Tukey-Kramer HSD means separation

Notes: Moistened 'Ol Roy' dog food and dried blood meal was spread over plots after planting at rates of 256 g per row each. Chicken manure spread ~1 week before planting at a rate of 6 tons/acre.

TRT	Material	Rate
1	UTC	
2	Verimark	13.5 fl oz/A
3	Radiant	6.0 fl oz/A
4	Orthene	8.0 oz/A
5	Capture LFR	8.5 fl oz/A
6	Admire Pro	7.0 fl oz/A

TRT	April 17	April 23		April 30			
	Stand/ft	Stand/ft	%Runts	Stand/ft	%Runts	%Cotyledon damage	%Cotyledon + Stem
1	3.88	4.47	11.6	3.38 ab	35.8 ab	55.5 a	19.3
2	3.38	4.56	11.0	4.10 ab	29.2 ab	31.8 bc	21.3
3	3.71	4.71	9.8	4.05 ab	30.3 ab	47.2 abc	12.3
4	4.19	5.07	5.3	3.84 ab	37.7 ab	50.5 ab	14.8
5	3.79	4.69	10.4	2.84 b	58.0 a	30.0 c	12.5
6	3.78	4.86	6.5	4.80 a	18.8 b	58.2 a	19.0
ANOVA	*NS*	*NS*	*NS*	*P = 0.016*	*P = 0.014*	*P = 0.036*	*NS*

Peas 2019 Seedcorn Maggot 2

Location: Carvel REC, Dill Farm
Variety: 'Hudson'
Planting Date: 9 April
Experimental Design: Randomized complete block design with 5 treatments, 4 replicates;
Treatment Method: Monosem planter with in-furrow application via fertilizer drops delivering 9.2 GPA.
Plot size: 2 row x 15'
Row Spacing: 30"
Plant Spacing: 70,000 seeds/acre
Sample Size: 14 row-ft stand counts, 6 row-ft maggot injury
Data Analysis: ANOVA; Tukey-Kramer HSD means separation

Notes: Moistened 'Old Roy' dog food was spread over plots after planting at rates of 256 g per row each

TRT	Material	Rate
1	UTC	
2	Verimark	13.5 fl oz/A
3	Radiant	6.0 fl oz/A
4	Orthene	8.0 oz/A
5	Capture LFR	8.5 fl oz/A
6	Admire Pro	7.0 fl oz/A
7	Cruiser	Seed Trt

TRT	May 6		May 14		May 17			
	Stand	Runts	Stand	Runts	Stand	Runts	%Cotyledon damage	%Cotyledon + Stem
1	50.5 bc	3.0	52.3	2.8	52.5	3.3	57.4	28.7
2	49.5 c	1.5	53.3	1.8	53.3	3.8	56.8	20.5
3	48.5 c	3.5	53.8	1.5	54.0	4.5	64.1	5.9
4	52.5 abc	3.3	55.5	1.8	57.0	4.3	69.9	9.3
5	54.8 ab	2.8	56.3	2.8	55.8	4.3	62.3	15.8
6	55.5 a	1.0	55.5	0.8	56.0	3.8	44.0	18.6
7	50.3 bc	2.0	54.0	0.5	53.0	3.3	41.2	11.8
ANOVA	*P = 0.026*	*NS*	*NS*	*P = 0.042*	*P = 0.016*	*P = 0.014*	*P = 0.036*	*NS*

Corn Earworm Cypermethrin Adult Vial Tests 2019

Purpose: Determine CEW susceptibility to cypermethrin as a proxy for pyrethroid susceptibility

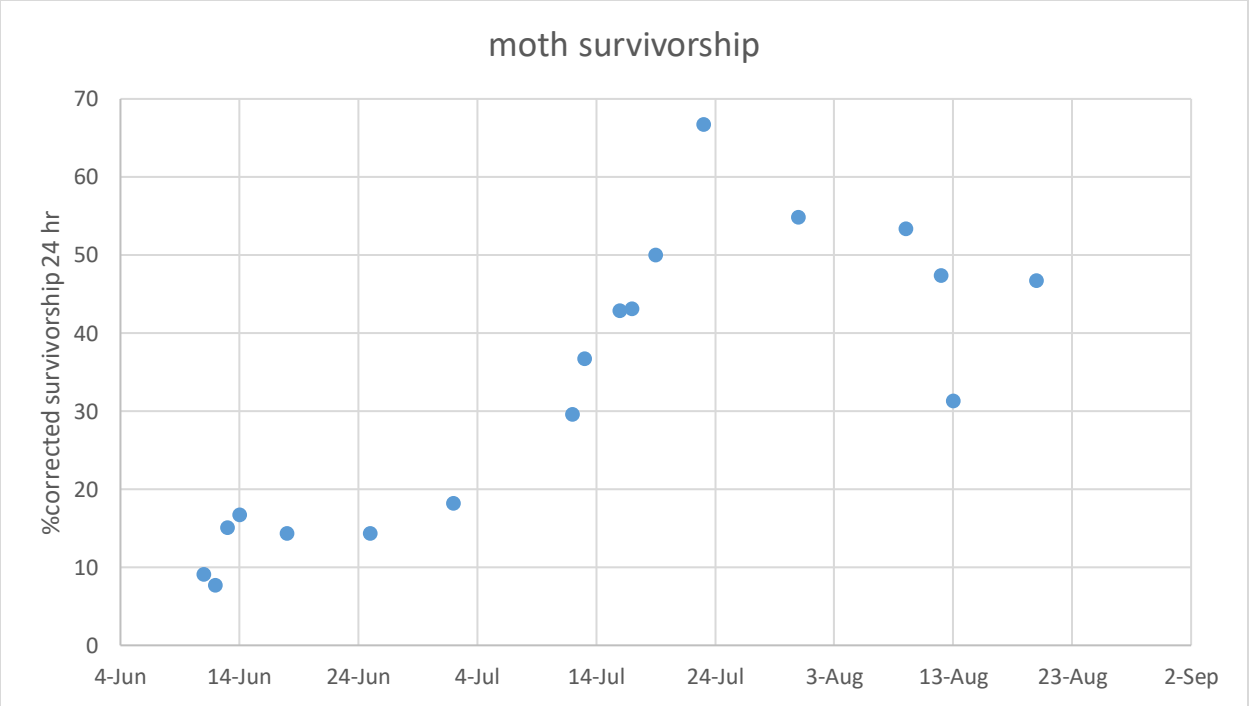
Method: Adult Vial Test

Procedure: Male CEW moths collected daily from Hartstack pheromone traps baited with Zealure pheromone strips. Moths placed in glass scintillation vials treated with 5 µg technical grade cypermethrin dissolved in acetone. Vials were treated by Virginia Tech's Tidewater Agricultural Research and Education Center. Vials were replaced 4 weeks post-preparation. Control vials were treated with acetone only. Moths were placed in vials for 24 hours. Vials were loosely capped and kept tilted at a 45° angle.

Evaluation Criteria: After 24 hours, moths were removed from vials. Moths that flew at least 3 feet were counted as alive, and moths that could not fly or were dead were counted as dead.

Data Analysis: Treated moth mortality was corrected for mortality in the untreated vials using Abbott's formula: Corrected mortality = (Treated mortality - Control mortality)/ 1 - Control mortality.

Overall, 76 moths were treated in June, 97 in July, and 80 in August for a season total of 253 treated moths. Control moths numbered 76 in June, 118 in July, and 80 in August for a season total of 274.



Sweet Corn 2019 Sentinel Plot CEW Bt Susceptibility

Location: Carvel REC, Field 31 East
Variety: See Table
Planting Date: 24 June
Experimental Design: Randomized complete block design with 5 varieties, 4 replicates
Plot size: 4 rows x 25'; minimum 5' alley between plots
Row Spacing: 30"
Seeding Rate: 24,000 seeds/A

Harvest Date: 30 August
Sample Size: 25 ears/plot from rows 2 and 3
Data Analysis: ANOVA; Tukey-Kramer HSD means separation

Variety	Type	Protein	% Clean Ears	% Clean + Tip	% Damage	% Sap Beetle	Area Damaged (cm^2)
Obsession	Sh2	---	0.0 b	36.0 b	64.0 a	15.0 ab	10.8 ab
Obsession II	Sh2	Cry1A.105 + Cry2Ab2	2.1 b	70.1 a	29.9 b	7.0 b	4.9 c
Providence	SE, Sh2	---	0.0 b	12.0 bc	88.0 a	27.0 a	14.6 a
BC0805 Attribute	SE, Sh2	Cry1Ab	0.0 b	22.2 bc	77.8 a	23.3 a	9.6 bc
Remedy Attribute II	SE, Sh2	Cry1Ab + Vip3A	100 a	0.0 c	0.0 c	2.0 b	0.0 d
ANOVA			*P < 0.001*	*P < 0.001*	*P < 0.001*	*P < 0.001*	*P < 0.001*

Variety	Protein	Total no. worms						
		2nd instar	3rd instar	4th instar	5th instar	6th instar	Exits	Median
Obsession	---	7	16	20	35	29	42	5th instar
Obsession II	Cry1A.105 + Cry2Ab2	29	50	37	19	11	8	3rd instar
Providence	---	7	24	47	42	48	51	5th instar
BC0805 Attribute	Cry1Ab	16	61	53	36	23	26	4th instar
Remedy Attribute II	Cry1Ab + Vip3A	0	0	0	0	0	0	---

Notes: Fall armyworm consisted of 2.5% of worm complex. No European corn borer were detected in ears or stalks.

Sweet Corn 2019 CEW 1

Location: Carvel REC, Field 1
Variety: 'Obsession'
Planting Date: 31 May
Experimental Design: Randomized complete block design with 12 treatments and 4 replicates
Plot size: 2 rows x 25', 60" between plots cut in at tassel push by removing a guard row
Row Spacing: 30"
Seeding Rate: 24,000 seeds/A
Treatment Method: Directed ear spray; CO_2-pressurized backpack sprayer with single-row boom equipped with 2 D2 tips and and #25 cores delivering 40 GPA at 38 PSI.

Harvest Date: 5 August
Sample Size: 25 ears/plot from rows 2 and 3
Data Analysis: ANOVA; Tukey-Kramer HSD means separation

Application Rates and Dates:

TRT	Material	Rate	Application Dates	App. No.
1	UTC	---	---	
2	Prevathon	14 fl oz/A	7/16, 7/19, 7/24, 7/28, 8/1	1-5
3	Besiege	10 fl oz/A	7/16, 7/24, 8/1	1, 3, 5
	Warrior II	1.92 fl oz/A	7/19, 7/28	2, 4
4	Baythroid XL	2.8 fl oz/A	7/16, 7/19, 7/24, 7/28, 8/1	1-5
5	Asana XL	9.6 fl oz/A	7/16, 7/19, 7/24, 7/28, 8/1	1-5
6	Warrior II	1.92 fl oz/A	7/16, 7/19, 7/24, 7/28, 8/1	1-5
7	Mustang Maxx	4.0 fl oz/A	7/16, 7/19, 7/24, 7/28, 8/1	1-5
8	Radiant Warrior II	6.0 fl oz/A 1.92 fl oz/A	7/16, 7/19, 7/24, 7/28, 8/1	1-5
9	Intrepid Warrior II	16 fl oz/A 1.92 fl oz/A	7/16, 7/19, 7/24, 7/28, 8/1	1-5
10	Brigade	6.4 fl oz/A	7/16, 7/19, 7/24, 7/28, 8/1	1-5

Penetrator Plus was added to treatments 2 and 3 at a 0.5% v/v rate. Induce was added to treatments 4-10 at a rate of 1 pint/100 gallons spray volume.

TRT	Worms per 25 ears				
	Small CEW	**Med CEW**	**Large CEW**	**FAW**	**Total***
1	0.8	0.3	0.5	1.3	2.8
2	0.3	0	0.3	0	0.8
3	0	0	0	0.5	0.5
4	0.3	0	0	0.3	0.5
5	0.5	0	0	0.5	1.0
6	0.5	0	0	0.3	0.8
7	0	0	0	0	0
8	0	0.3	0	0.5	0.8
9	0.3	0.3	0	0.3	1.0
10	0.3	0	0	0	0.3
ANOVA	*NS*	*NS*	*NS*	*NS*	*NS*

*includes exit holes; FAW comprised 45.5% worm complex

TRT	% Clean ears	% Clean + tip ears	% Damaged ears	# sap beetle damaged kernels	# stink bug damaged kernels	% sap beetle ears
1	79.0 b	94.0	6.0	108.5 a	105.5 a	45.0 a
2	96.0 a	99.0	1.0	97.5 a	38.3 b	36.0 ab
3	98.0 a	99.0	1.0	18.5 b	16.0 b	10.0 c
4	98.0 a	98.0	2.0	9.0 b	17.0 b	14.0 bc
5	96.1 a	99.0	1.0	19.5 b	27.3 b	14.8 bc
6	92.0 ab	97.0	3.0	10.3 b	12.5 b	14.0 bc
7	99.0 a	100	0	8.5 b	13.3 b	9.0 bc
8	94.0 a	97.0	3.0	30.0 b	27.3 b	27.0 abc
9	94.0 a	98.0	2.0	7.8 b	29.8 b	11.0 bc
10	96.0 a	98.0	2.0	3.8 b	2.8 b	6.0 c
ANOVA	*P = 0.002*	*NS*	*NS*	*P <0.001*	*P <0.001*	*P<0.001*

Wire mesh pheromone trap captures for the block. Overall worm pressure was light and with two exceptions, indicated a 4 day spray schedule for the duration of the experiment.

Date	Average nightly CEW	ECB	Date	Average nightly CEW	ECB
7/15	16	1	7/24	0	0
7/16	5	0	7/25	0	0
7/17	22	0	7/26	0	0
7/18	6	0	7/29	4	0
7/19	5	0	7/30	4	0
7/22	2.3	0	7/31	2	0
7/23	5	0	8/1	7	0

Sweet Corn 2019 CEW 2a

Location: Carvel REC, Field 31 East
Variety: 'Obsession'
Planting Date: 24 June
Experimental Design: Randomized complete block design with 12 treatments and 4 replicates
Plot size: 2 rows x 25', 60" between plots
Row Spacing: 30"
Seeding Rate: 24,000 seeds/A
Treatment Method: Directed ear spray; CO_2-pressurized backpack sprayer with single-row boom equipped with 2 D2 tips and #25 cores delivering 40 GPA at 38 PSI.
Harvest Date: 28 August
Sample Size: 25 ears/plot from rows 2 and 3
Data Analysis: ANOVA; Tukey-Kramer HSD means separation

Application Rates and Dates:

TRT	Material	Rate	Application Dates	App. No.
1	UTC	---	---	
2	Prevathon*	14 fl oz/A	8/8, 8/11, 8/14, 8/17, 8/20, 8/23	1-6
3	Besiege	10 fl oz/A	8/8, 8/14, 8/20	1,3,5
	Warrior II	1.92 fl oz/A	8/11, 8/17, 8/23	2,4,6
4	Baythroid XL	2.8 fl oz/A	8/8, 8/11, 8/14, 8/17, 8/20, 8/23	1-6
5	Asana XL	9.6 fl oz/A	8/8, 8/11, 8/14, 8/17, 8/20, 8/23	1-6
6	Avaunt eVo	3.5 oz/A	8/8, 8/11, 8/14, 8/17, 8/20, 8/23	1-6
7	Mustang Maxx	4 fl oz/A	8/8, 8/11, 8/14, 8/17, 8/20, 8/23	1-6
8	Coragen	5.0 fl oz/A	8/8, 8/11, 8/14	1,2,3
	Radiant	6.0 fl oz/A	8/17	4
	Warrior II	1.92 fl oz/A	8/20, 8/23	5,6

Penetrator Plus was added to treatments 2,3 at a 0.5% v/v rate. Induce was added to treatments 4-8 at a rate of 1 pint/100 gallons spray volume.
*Not labeled for sweet corn

TRT	Small CEW	Medium CEW	Large CEW	Total/ 25 ears*
1	5.3 a	14.3 a	10.3 a	41.3 a
2	3.0 ab	3.5 bc	2.0 b	9.8 c
3	0.5 b	1.5 c	1.0 b	4.0 c
4	0.5 b	2.0 c	1.0 b	5.3 c
5	2.0 ab	2.8 c	1.8 b	11.3 c
6	3.8 ab	9.3 ab	3.8 b	21.5 b
7	2.0 ab	4.5 bc	2.3 b	11.3 c
8	0.8 b	2.5 c	2.0 b	7.0 c
ANOVA	*P = 0.002*	*P <0.001*	*P <0.001*	*P <0.001*

*includes exit holes; no FAW

TRT	% Clean ears	% Clean + tip ears	% Damaged ears	# sap beetle damaged kernels	# stink bug damaged kernels	% sap beetle ears
1	0 d	13.9 c	86.1 a	8.3	3.3	6.8
2	38.0 bc	83.0 a	17.0 c	5.8	50.5	8.0
3	63.0 a	88.0 a	12.0 c	0.3	1.5	1.0
4	64.0 a	85.0 a	15.0 c	0.3	0	1.0
5	34.0 bc	69.0 ab	31.0 bc	3.3	11.3	3.0
6	7.0 d	54.0 b	46.0 b	6.3	0.8	3.0
7	30.0 c	73.0 ab	27.0 bc	1.0	2.0	1.0
8	48.0 ab	81.0 abc	19.0 c	5.0	2.8	2.0
ANOVA	*P <0.001*	*P <0.001*	*P <0.001*	*NS*	*NS*	*NS*

Wire mesh pheromone traps adjacent to sweet corn

Date	Average nightly CEW	ECB
8/8	10	0
8/9	70	0
8/11	64.5	0
8/12	108	0
8/13	46	0
8/20	--	0
8/22	4	0

Sweet Corn 2019 CEW 2b + AgrowSil

Location: Carvel REC, Field 31 East
Variety: 'Obsession'
Planting Date: 24 June
Experimental Design: Strip plot design with 2 main un-replicated main factors (Obsession and Obsession II) and 3 subplot treatments
AgrowSil was applied at ~1.25 tons/acre on 7 May
Plot size: 2 rows x 25', 60" between plots
Row Spacing: 30"
Seeding Rate: 24,000 seeds/A
Treatment Method: Directed ear spray; CO_2-pressurized backpack sprayer with single-row boom equipped with 2 D2 tips and and #25 cores delivering 40 GPA at 38 PSI.

Harvest Date: 29 August
Sample Size: 25 ears/plot from rows 2 and 3
Data Analysis: Split plot analysis in SAS JMP; LS Means separation
T-test by treatment to compare TRT 1 and TRT 3 from Obsession with and without AgrowSil

Purpose: There is some indication sweet corn will uptake silicon and incorporate into cell walls. Does AgrowSil impact CEW infestation? Does a weak Bt trait affect spray performance? UTC and treatment 3 in Obsession block compared with UTC and treatment 6 in trial sweet corn 2.

Summary: Obsession II did not provide any improved control on the treatment program. AgrowSil did not impact earworm injury or total earworm numbers. Total earworm includes small, medium, large, and exits where worms completed development.

Application Rates and Dates:

TRT	Material	Rate	Application Dates
1	UTC	---	---
2	Warrior II	1.92 fl oz/A	8/8, 8/11, 8/14, 8/17, 8/21, 8/23
3	Besiege	10 fl oz/A	8/8, 8/14, 8/21
	Warrior II	1.92 fl oz/A	8/11, 8/17, 8/23

Induce was added to treatments at a rate of 1 pint/100 gallons spray volume.

Obsession II vs Obsession

Variety	TRT	Total worms	%Clean	%Clean + Tip	%Damage
Obsession	1	41.0	0	9.0	91
Obsession	2	12.5	36.0	76.0	24
Obsession	3	5.0	60.0	88.0	12
Obsession II	1	32	2.0	29.0	71.0
Obsession II	2	16.8	29.0	64.0	36.0
Obsession II	3	6.5	55.0	87.0	13.0
	ANOVA Variety	*NS*	*NS*	*NS*	*NS*
	ANOVA TRT	*P = 0.001*	*P = 0.002*	*P <0.001*	*P <0.001*
	*ANOVA Vareity*TRT*	*NS*	*NS*	*NS*	*NS*

AgrowSil

Effect	TRT	Small	Medium	Large	Total Worms	%Clean	%Clean+Tip	%Damage
Agrowsil	1	3.0	7.5 b	7.5	41.0	0	9.0	91.0
No Agrowsil	1	5.3	14.3 a	10.3	41.3	0	13.9	86.1
	T-test	*NS*	*P <0.001*	*NS*	*NS*	*NS*	*NS*	*NS*
Agrowsil	3	1.3	1.3	1.0	5.0	60.0	88.0	12.0
No Agrowsil	3	0.5	1.5	1.0	4.0	63.0	88.0	12.0
	T-test	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*

Warrior vs Baythroid. Do not read too much in these data. Warrior treatment from AgroSil block and Baythroid data from Sweet Corn 2a block. Blocks planted adjacent to each other, but no blank guard row in the AgroSil plots. **One application date differed by a day.**

TRT	Total worms	%Clean	%Clean + Tip	%Damage
Warrior	12.5	36.0	76.0	24.0
Baythroid	5.3	64.0	85.0	15.0
T-test	*P = 0.013*	*P = 0.013*	*NS*	*NS*

Summer Squash IR4 Crop Safety, Cyflumetofen

Location: Carvel REC, Field 1
Variety: 'Paycheck' zucchini
'Conqueror III' yellow squash
Planting Date: 20 June
Experimental Design: Randomized complete block design with 5 treatments and 4 replicates
Plot size: 2 rows (1 of each variety) x 15'
Row spacing: 30"
60" between plots
Treatment Method: CO_2- pressurized backpack sprayer with a 6.6' boom equipped with 4 D4 tips and #45 cores delivering 50 GPA at 70 PSI.
Treatment Dates: July 30, August 13
Harvest Dates: 1 Aug, 8 Aug, 12 Aug, 16 Aug, 23 Aug

Notes: No phytotoxicity was observed on foliage or fruit following treatments. Visual observations conducted on August 1, August 8, August 12, August 16, August 20, and August 27. Yield and quality did not appear to be affected by any treatment.

TRT	Stand count	Material	Rate
1	40	UTC	---
2	37	Nealta	13.7 fl oz/A
3	40	Nealta	27.4 fl oz/A
4	39	Nealta + Kinetic	13.7 fl oz/A x2
5	37	Nealta + Induce	13.7 fl oz/A x2

Kinetic was applied at a rate of 38 fl oz/100 gal., Induce was applied at a rate of 28 fl oz/100 gal.

‘Conqueror III’ Yellow Squash

TRT	No. 1 (kg)/plant	No. 2 (kg)/plant	Oversize (good; kg)/plant	Cull (kg)/plant
August 1				
1	0.076	0.010	0.121	0.078
2	0.049	0.031	0.053	0.032
3	0.028	0.017	0.112	0.087
4	0.041	0.020	0.042	0.066
5	0.050	0.018	0.016	0.027
August 8				
1	0.023	0.029	0.099	0.030
2	0.008	0.030	0.339	0.030
3	0.033	0.022	0.256	0.080
4	0.014	0.017	0.174	0.046
5	0.036	0.053	0.087	0.034
August 12				
1			0.317	
2			0.328	
3			0.367	
4			0.322	
5			0.061	
August 16				
1	0.005	0.042	0.092	0.041
2	0.021	0.027	0.067	0.041
3	0.016	0.040	0.025	0.042
4	0.016	0.041	0.073	0.016
5	0.013	0.028	0.031	0.047
August 23				
1		0.013	0.038	0.052
2		0.021	0.053	0.022
3		0	0.073	0.018
4		0.015	0.078	0.020
5		0.011	0.034	0.046
Total				
1	0.105	0.094	0.666	0.201
2	0.078	0.109	0.840	0.125
3	0.078	0.078	0.834	0.227
4	0.071	0.093	0.689	0.148
5	0.099	0.110	0.228	0.153

There were no significant treatment differences (ANOVA; $P < 0.05$)

‘Paycheck’ Zucchini

TRT	No. 1 (kg)/plant	No. 2 (kg)/plant	Oversize (good; kg)/plant	Cull (kg)/plant
August 1				
1	0.137	0.031	0.331	0.095
2	0.058	0.048	0.231	0.083
3	0.050	0.011	0.295	0.083
4	0.052	0	0.315	0.081
5	0.048	0.040	0.161	0.080
August 8				
1	0.011	0.015	0.258	0.070
2	0.006	0.026	0.531	0.042
3	0.041	0.021	0.559	0.044
4	0.030	0.015	0.472	0.060
5	0.013	0.008	0.350	0.046
August 12				
1			0.605	
2			0.403	
3			0.424	
4			0.498	
5			0.555	
August 16				
1	0.042 ab	0.025	0.194	0.023
2	0.014 ab	0.034	0.108	0.054
3	0.007 b	0.039	0.295	0.026
4	0.024 ab	0.028	0.148	0.029
5	0.094 a	0.009	0.153	0.047
	F = 3.61, df = 4, 15, P = 0.030			
August 23				
1	0	0.017	0.099	0
2	0.013	0	0.684	0.060
3	0	0.026	0.408	0.175
4	0.001	0.040	0.200	0.164
5	0	0.026	0.297	0.066
Total				
1	0.116	0.087	1.486	0.188
2	0.092	0.108	1.957	0.239
3	0.115	0.097	1.981	0.327
4	0.155	0.083	1.633	0.333
5	0.155	0.084	1.516	0.239

Cucumber IR4 Crop Safety, Cyflumetofen

Location: Carvel REC Field 1
Variety: 'Bristol'
'Vlaspik'
Planting Date: 5 June
Experimental Design: Randomized complete block design with 5 treatments and 4 replicates
Plot size: 2 rows (1 of each variety) x 15'
Row spacing: 30"
60" between plots
Treatment Method: CO_2- pressurized backpack sprayer with a 6.6' boom equipped with 4 D4 tips and #45 cores delivering 50 GPA at 70 PSI.
Treatment Dates: 16 July, 30 July
Harvest Dates: 19 July, 25 July, 1 August, 8 August

Notes: No phytotoxicity was observed on foliage or fruit following treatments. Visual observations conducted on 19 July, 25 July, 30 July, 1 August, 8 August, and 12 August. 'Bristol' cucumber were graded according to USDA standards for fresh market cucumbers, and 'Vlaspik' cucumbers were graded according to pickling cucumber size standards. Yield and quality did not appear to be affected by any treatment.

TRT	Stand count	Material	Rate
1	40	UTC	---
2	37	Nealta	13.7 fl oz/A
3	40	Nealta	27.4 fl oz/A
4	39	Nealta + Kinetic	13.7 fl oz/A x2
5	37	Nealta + Induce	13.7 fl oz/A x2

Kinetic was applied at a rate of 38 fl oz/100 gal., Induce was applied at a rate of 28 fl oz/100 gal.

‘Bristol’ cucumber harvest data

TRT	Fancy (kg)	No. 1 (kg)	No. 2 (kg)	Oversize (kg)	Cull (kg)
19 July					
1	0.493	0.180	1.365		0.805
2	0.110	0.858	0.565		0.223
3	0.670	0.953	1.360		0.650
4	0.663	0.453	0.998		1.208
5	0.900	0.668	1.045		0.735
25 July					
1	0.368	0.143 b	0.395		0.875
2	0.655	0.810 a	1.365		1.253
3	0.208	0.360 ab	0.555		1.240
4	0.145	0.153 b	0.998		0.725
5	0	0.353 ab	0.173		1.165
		F = 3.52, df = 4, 15, P = 0.032			
1 August					
1	0	0.565	1.435		1.335
2	0.145	0.280	1.280		0.940
3	0.130	0.388	1.045		1.318
4	0.123	0	0.891		0.843
5	0.293	0.390	1.313		1.423
8 August					
1	0.148	0	0	0.550	0.890
2	0.113	0.195	0.388	0.550	1.123
3	0	0	0.300	0.365	1.438
4	0	0.068	0.125	0.630	0.970
5	0.080	0.085	0.230	1.650	1.360
Total					
1	1.008	0.888	3.195	0.550	3.905
2	1.023	2.143	3.598	0.550	3.538
3	1.008	1.700	3.260	0.365	4.645
4	0.930	0.673	3.011	0.630	3.745
5	1.273	1.496	2.760	1.650	4.683

‘Vlaspik’ cucumber harvest data.

TRT	No. 1 (kg)	No. 2 (kg)	No. 3 (kg)	Oversize cull (kg)	Culls (kg)
19 July					
1	0	0.728	1.750	0.240	0.490
2	0	0.540	1.795	0.660	0.315
3	0	0.325	1.975	0.608	0.278
4	0	0.703	2.513	0.898	0.250
5	0	0.522	1.640	0.598	0.310
25 July					
1	0	0.358	0.245	0.063	1.208
2	0	0.340	0.448	0.378	1.418
3	0	0.338	0.688	0.555	1.788
4	0	0.598	0.573	0.613	1.235
5	0	0.360	0.480	0.573	0.988
1 August					
1	0	0.200	0.840	0.618	1.298
2	0	0.370	0.630	0.518	1.333
3	0	0.343	0.463	0.108	0.858
4	0.008	0.395	0.980	0.670	0.438
5	0.008	0.260	0.763	0.918	1.070
8 August					
1	0	0.275	0.228	0.403	0.523
2	0.008	0.235	0.200	0.080	0.608
3	0.008	0.053	0.115	0	0.648
4	0	0.363	0.268	0.373	0.448
5	0.008	0.053	0.063	0.638	0.493
Total					
1	0	1.560	3.063	1.323	3.518
2	0.008	1.485	3.073	1.635	3.673
3	0.008	1.058	3.240	1.270	3.570
4	0.008	2.058	4.333	2.553	2.370
5	0.015	1.200	2.945	2.725	2.860

Watermelon 2019 Spider Mite Survey

Procedure: 5 crown leaves in 8 to 16 stops per field examined for spider mites

Rye strips were sampled by removing 3 row-ft in 6 to 10 locations per field and washing plant material with soapy water. Rinsate was filtered and filter papers examined for mites under a stereo microscope.

Watermelon Spider Mite Survey

Location	Date mites first detected	Location in field	Notes
Laurel Ellis Grove 2	June 24	Edge and field interior	A few located in interior
Sharptown	June 24	Edge	
Airport Rd	June 4	Interior and woodline	
Georgetown Rt 404	June 18	Weeds/pokeweed in an uncultivated area near field edge	Mites not detected again until July 1 on woodline
Laurel Susan Beach Rd	July 15	Woodline	
Seaford	June 18	Edge	Mite hotspots in interior of field July 22
Laurel Hitch Pond Rd	June 17	Woodline and road margin ditch	
Georgetown Governor Stockley Rd	June 12	Edge	Mite populations never established
Laurel Ellis Grove 1	July 1	Edge, woodline	
Georgetown Tyndall Rd	June 17	Interior	Large hotspots, few on edge

Rye Samples

Farm Location	Date Sampled	Thrips	Spider Mites
Tyndall Rd	7 May	11	0
Airport Rd	15 May	4	0
Ellis Grove Rd 2	7 May	9	0
Ellis Grove Rd 3	7 May	8	0
Rt 404	3 May	7	0
Elk Rd	15 May	0	0
Susan Beach Rd	7 May	19	0
Old Sharptown Rd	17 May	16	0
Hitch Pond Rd	17 May	25	0

Watermelon 2019 Spider Mite Threshold Study

Location: Carvel REC, Field 2
Variety: 'Road Trip'
'Wingman' pollinizer
Planting Date: 8 May
Experimental Design: Randomized complete block design with 9 treatments and 4 replicates
Plot size: 3 rows x 21'
Treatment Method: Foliar treatments delivered using a CO_2- pressurized backpack sprayer with a 6.6' boom equipped with 4 D4 tips and #45 cores delivering 50 GPA at 70 PSI.
Sample Size: 10 leaf samples/plot. All harvestable melons/ plot.
Harvest Dates: August 5, August 16, September 4

Notes: Field infested 30 May

Mites/leaf

TRT Goal (mites/leaf)	6 June	11 June	18 June	25 June	1 July	8 July	15 July	22 July	29 July	16 Aug	CMD
0 mites	0.1	0.9	2.4	0.8	0.1	0	0	0.2	0.5	0.5	41.3 a
0.6 mites	0.4	0.9	3.8	3.6	2.9	10.2	4.4	3.1	11.2	0.4	283.9 b
3 mites	0.1	0.2	2.4	4.7	7.0	12.4	8.7	1.3	9.0	1.8	346.1 b
30 mites	0.2	0.6	7.6	4.9	6.6	12.6	6.1	3.7	13.8	1.4	409.3 b
ANOVA		*NS*			*P <0.001*	*P = 0.001*		*P = 0.006*	*P<0.001*		*P = 0.002*

TRT Goal (mites/ leaf)	Harvest 1			Harvest 2			Harvest 3			Total		
	# melons	Avg wght (kg)	Brix	No. melons	Avg wght (kg)	Brix	No. melons	Avg wght (kg)	Brix	No. melons	Avg. wght (kg)	Brix
0 mites	90	6.7	11.0	11.0	6.1	10.9	13.0	6.3	10.3	46.8	6.4	10.7
0.6 mites	71	6.5	11.0	17.3	6.4	10.9	11.3	6.5	10.1	460	6.4	10.7
3 mites	91	6.9	11.0	12.8	6.2	10.8	15.3	6.4	10.1	50.8	6.6	10.6
30 mites	92	6.9	11.0	16.3	6.2	10.7	12.3	6.5	10.4	51.5	6.6	10.7
ANOVA		*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*

Watermelon 2019 Two Spotted Spider Mite Efficacy

Location: Carvel REC, Field 38
Variety: 'Road Trip'
'Wingman' pollinizer
Planting Date: 10 May
Experimental Design: Randomized complete block design with 9 treatments and 5 replicates
Plot size: 1 row x 24'
Row Spacing: 7'
Plant Spacing: 3'
Treatment Method: CO_2- pressurized backpack sprayer with a 6.6' boom equipped with 4 D4 tips and #45 cores delivering 50 GPA at 70 PSI.
Plots infested: 30 May
Mite Source: colony initiated from overwintering mites collected from clover in and around a rain Shelter in April and from pokeweed growing adjacent to a melon field off of Rt 404 in May.
Treatment Dates: 27 June
Sample Size: 7 leaves; **Vigor rating** on a 0-10 scale, with a 0 representing dead plants and a 10 representing a fully closed canopy with no disease.

TRT	Material	Rate
1	UTC	---
2	Portal	2.0 pt/A
3	Oberon	8.5 fl oz/A
4	Radiant	6.0 fl oz/A
5	Minecto Pro	10.0 fl oz/A
6	Kanemite	31.0 fl oz/A
7	Zeal	6.0 fl oz/A
8	Brigade	6.4 fl oz/A
9	Grandevo	3.0 lbs/A

TRT	Spider mites/ leaf						Vigor Rating August 6
	3 d PRE	4 DAT	7 DAT	15 DAT	19 DAT	29 DAT	
1	1.3	11.9	4.5	6.8 b	7.9 ab	29.7 ab	4 bc
2	2.3	0.7	0.8	3.8 b	1.2 b	8.9 b	5.6 ab
3	2.2	4.9	3.8	8.1 b	12.2 ab	24.3 ab	5 ab
4	3.3	7.1	5.9	42.7 a	32.9 ab	53.0 a	2.8 c
5	2.3	3.3	3.7	1.3 b	7.6 ab	23.7 ab	5.8 ab
6	2.1	2.9	7.2	5.3 b	16.5	45.0 a	4.8 abc
7	1.6	2.7	1.2	0.5 b	0.7 b	9.6 b	6.5 a
8	3.7	8.0	11.0	24.6 ab	42.5 a	52.6 a	4 bc
9	1.4	6.0	9.0	2.4 b	13.3 ab	32.0 ab	4.4 abc
ANOVA	*NS*	*NS*	*NS*	*P = 0.001*	*P = 0.005*	*P = 0.040*	*P <0.001*

TRT	Eggs/ leaf					
	3 d PRE	**4 DAT**	**7 DAT**	**15 DAT**	**19 DAT**	**29 DAT**
1	.	16.9	5.2	2.6 b	9.8 a	15.1
2	.	0.7	0.6	1.4 b	2.5 b	2.9
3	.	7.3	2.3	8.1 ab	15.4 ab	19.5
4	.	6.4	7.1	9.9 ab	18.1 ab	21.9
5	.	1.7	5.0	0 b	6.2 b	10.6
6	.	1.9	7.8	0.9 b	14.6 ab	16.5
7	.	6.5	2.3	3.8 ab	4.9 b	8.6
8	.	1.3	11.8	22.8 a	33.1 a	32.7
9	.	5.6	8.2	0.6 b	14.2 ab	11.8
ANOVA	.	*NS*	*NS*	*P = 0.011*	*P = 0.021*	*NS*

Watermelon 2019 Cucumber Beetle Efficacy Trial

Location:	Carvel REC, Georgetown, DE Field 2
Variety:	'Road Trip' 'Wingman' pollinizer
Planting Date:	8 May
Experimental Design:	Randomized complete block design with 9 treatments and 4 replicates
Plot size:	3 rows x 21'
Treatment Method:	Drip treatments delivered by injecting 2,000 mL water into a 25' dripline to prime, followed by 2,000 mL treatment solution, and flushed with 2,000 mL water. Foliar treatments delivered using a CO_2- pressurized backpack sprayer with a 6.6' boom equipped with 4 D4 tips and #45 cores delivering 50 GPA at 70 PSI.
Treatment Dates:	May 30 (foliar, trt 2 drip), May 31 (trt 3, 5, 8, 9, 10 drip), July 4, July 26
Sample Size:	No. beetles on middle row, No. beetles emerging in cages, Seedless fruit per middle row, Brix on 2 melons per plot.
Harvest Dates:	July 30, August 14

Notes: Induce was added to all foliar treatments at the rate of 0.5 pints per 100 gallons water 13.1% of beetles observed were spotted cucumber beetles. Rind feeding considered unacceptable if greater than 2.5 cm diameter, assuming a tight market.

Summary: Foliar applications of Assail had the greatest impact on cucumber beetles observed in plots. Sivanto and Experimental appeared to have a numeric effect on cucumber beetles, but not significantly different from the untreated check. Low numbers of dead beetles were observed in these plots but also in plots that were not treated with a foliar insecticide, most likely the result of beetles that were intoxicated from other plots or from adjacent treated cucurbits.

While there were significant treatment differences in terms of flower feeding following the July 4 application, the untreated check did not have flower feeding while the three nematode-treated plots (foliarly unprotected) did. 8DAT, the only plot to have significantly less flower feeding was Sivanto. Flower feeding following the July 26 application were numerically lower in Assail, Sivanto, and Experimental plots, but did not differ significantly from the untreated check.

The only harvest data metric that resulted in significant treatment differences was season total rind feeding. However, the lowest and the greatest rind feeding occurred in nematode treated plots that did not receive any foliar insecticide.

Nematodes are hypothesized to help reduce first generation beetle emergence. Emergence cage data did not indicate any treatment differences in terms of beetles emerging from the soil. Cages were constructed of row cover material that may have interacted negatively with applied fungicides; row covers broke down 3-4 weeks after cages were deployed.

Live Beetles/plot

TRT	Material	Rate	May 30 (Pre)	June 5 (6 DAT)	June 13 (14 DAT)	June 19 (20 DAT)	July 3 (Pre 1)	July 8 (4 DAT)	July 12 (8 DAT)	July 25 (PRE 1)	July 29 (3 DAT)
1	UTC	---	12.3	9.3	3.3	0.5	0.8	5.3 ab	3.8 ab	3.3	2.8 cd
2	Admire Pro (drip) Assail + Induce (foliar)	5.3 oz	11.3	7.8	2.3	0.5	1.5	0 b	1.5 b	3.0	0.3 d
3	Sivanto (drip) Sivanto (foliar)	28 fl oz/A 14 fl oz/A	9.8	13.8	5.8	1.5	3.8	1.5 ab	0.8 b	3.3	1 cd
4	Beleaf (foliar)	4.28 fl oz/A	11	4.8	2.8	1.3	2.3	6.5 a	2.3 b	4.3	3.8 bcd
5	Experimental	---	7.8	10.3	4.3	0.5	3.5	0.3 b	1.5 b	2.5	0.5 d
7	Grandevo (foliar)	3 lbs/A	9.8	11	2.3	0.5	4.3	5.5 ab	5 ab	7.8	6.3 abc
8	Nemasys (*Steinernema feltiae*, drip)	50 million IJ/1,100 ft^2	12.3	9.3	4.3	0.5	3.0	4.8 ab	7 a	5.3	3.8 bcd
9	Larvanem (*Heterorhabditis bacteriophora*, drip)	50 million IJ/1,100 ft^2	16.8	8.5	3.5	0.8	1.5	7.0 a	6.8 a	3.0	9.3 ab
10	Nemasys + Larvanem	25 + 25 million IJ/1,100 ft^2	9.5	2	3.3	1.0	2.5	5.3 ab	5 ab	2.8	10.3 a
	ANOVA		*NS*	*NS*	*NS*	*NS*	*NS*	*F = 4.46, df = 8,27, P = 0.002*	*F = 2.53, df = 8, 27, P = 0.034*	*NS*	*F = 9.87, df = 8, 27, P <0.001*

Induce was added to all foliar applications at a rate of 0.5 pints/100 gallons water.

Dead Beetles

TRT	Material	Rate	May 30 (Pre)	June 5 (6 DAT)	June 13	June 19	July 3 (Pre 1)	July 8 (4 DAT)	July 12 (8 DAT)	July 25 (PRE 1)	July 29 (3 DAT)
1	UTC	---			0	0	0.5	0	3.5	1	0
2	Admire Pro (drip) Assail + Induce (foliar)	5.3 oz			1	0.3	0.5	0	0.8	2.3	0.8
3	Sivanto (drip) Sivanto (foliar)	28 fl oz/A 14 fl oz/A			1	0	0	0	0.5	2.3	0.8
4	Beleaf (foliar)	4.28 fl oz/A			0	0.5	0	2	1	2	0
5	Experimental	---			0.3	0.3	0.3	1	1.3	1.5	0
7	Grandevo (foliar)	3 lbs/A			0.3	0	0.5	3	6.3	4	0.3
8	Nemasys (drip)	50 million IJ/1,100 ft^2			0	0	0	1.8	5	1.5	0
9	Larvanem (drip)	50 million IJ/1,100 ft^2			0	0.3	0	5.3	4	2.3	0.3
10	Nemasys + Larvanem	25 + 25 million IJ/1,100 ft^2			0.3	0	0.5	2.8	4.3	1.3	0
	ANOVA				*F = 2.91, df = 8, 27, P = 0.018*	*NS*	*NS*	*F = 5.17, df = 8,27, P = 0.001*	*F = 2.85, df = 8,27, P = 0.020*	*NS*	*NS*

Flower Feeding

TRT	Material	Rate	June 13	July 3 (Pre 1)	July 8 (4DAT	12 July (8DAT)	25 July (Pre 1)	July 29 (3 DAT)
1	UTC	---	3.8	0.8	0 b	3.5 ab	1.0	2.3 ab
2	Admire Pro (drip) Assail (foliar)	 5.3 oz	2.3	0.3	0 b	0.8 ab	2.3	0.3 b
3	Sivanto (drip) Sivanto (foliar)	28 fl oz/A 14 fl oz/A	6.5	0.3	0 b	0.5 b	2.3	0.8 b
4	Beleaf (foliar)	4.28 fl oz/A	5.8	0.3	2.0 ab	1.0 ab	2.0	2.3 ab
5	Experimental	---	4.5	1.3	1.0 b	1.3 ab	1.5	0.3 b
7	Grandevo (foliar)	3 lbs/A	10	0.5	3.0 ab	6.3 a	4.0	3.8 ab
8	Nemasys (drip)	50 million IJ/1,100 ft^2	1.8	0.5	1.8 ab	5.0 ab	1.5	3.3 ab
9	Larvanem (drip)	50 million IJ/1,100 ft^2	1.3	0.5	5.3 a	4.0 ab	2.3	5.3 a
10	Nemasys + Larvanem	25 + 25 million IJ/1,100 ft^2	3.3	2.3	2.8 ab	4.3 ab	1.3	6 a
	ANOVA		*NS*	*NS*	*F = 5.17, df = 8, 27, P = 0.001*	*F* = 3.78, df = 8, 27, P = 0.004*	*NS*	*F = 6.1, df = 8,27, P <0.001*

*Data were log x + 0.1 transformed. Presented are backtransformed means.

Harvest Data

Melons were harvested from middle row of each plot on 30 July and 14 August, graded for cosmetic insect injury (rind feeding greater than 2.5 cm diameter considered unacceptable), and Brix measured from 1-3 melons per plot. Data analyzed with ANOVA.

July 30

TRT	Material	n melons	Weight (kg)	Average Weight (kg)	% Rind feeding	% Ground feeding	% Acceptable	Brix
1	UTC	6.3	38.6	6.1	14.1	18.9	81.1	10.5
2	Admire Pro (drip) Assail (foliar)	5.0	32.5	6.5	8.1	34.3	85.5	10.9
3	Sivanto (drip) Sivanto (foliar)	7.0	46.4	6.6	17.1	28.4	93.7	11.4
4	Beleaf (foliar)	5.5	37.2	6.8	14.6	18.8	87.5	11.1
5	Experimental	5.7	35.9	6.3	0	31.4	95.3	11.1
7	Grandevo (foliar)	7.0	45.1	6.5	16.9	23.2	85.9	11.1
8	Nemasys (drip)	6.0	37.8	6.4	3.7	15.7	96.3	10.9
9	Larvanem (drip)	5.8	37.3	6.7	0	31.0	96.4	11.1
10	Nemasys + Larvanem	5.0	32.8	6.6	27.3	25.9	70.5	11.4
	ANOVA	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*

14 August

TRT	Material	n melons	Weight (kg)	Average Weight (kg)	% Rind feeding	% Ground feeding	% Acceptable	Brix
1	UTC	4.3	26.5	6.2	19.6	20.5	96.4	10.8
2	Admire Pro (drip) Assail (foliar)	5.5	37.2	6.8	12.1	3.6	95.0	10.3
3	Sivanto (drip) Sivanto (foliar)	4.5	30.0	6.4	14.2	27.5	86.7	10.3
4	Beleaf (foliar)	6.0	43.3	7.6	9.4	44.8		10.9
5	Experimental	6.3	41.3	6.4	7.8	12.1	100	10.7
7	Grandevo (foliar)	5.5	41.5	7.5	23.6	20.0	90.0	10.2
8	Nemasys (drip)	5.3	40.8	7.8	9.2	20.0	95.0	10.6
9	Larvanem (drip)	4.3	27.6	6.6	8.3	15.0	100	10.4
10	Nemasys + Larvanem	3.8	26.6	7.2	41.1	22.3	87.5	10.3
	ANOVA	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*

Season Total

TRT	Material	n melons	Weight (kg)	Average Weight (kg)	% Rind feeding	% Ground feeding	% Acceptable
1	UTC	10.5	65.1	6.2	18.5 ab	22.8	85.7
2	Admire Pro (drip) Assail (foliar)	10.5	69.7	6.7	10.9 ab	15.8	91.8
3	Sivanto (drip) Sivanto (foliar)	11.5	76.4	6.7	15.9 ab	30.0	89.8
4	Beleaf (foliar)	11.5	80.5	7.1	11.3 ab	26.5	98.5
5	Experimental	11.3	74.6	6.5	5.2 b	21.8	97.2
7	Grandevo (foliar)	12.5	86.7	6.9	20.5 ab	20.9	87.2
8	Nemasys (drip)	11.3	78.7	7.0	7.8 ab	22.2	94.1
9	Larvanem (drip)	10.0	64.9	6.7	4.2 b	22.9	97.9
10	Nemasys + Larvanem	8.8	59.4	6.8	29.5 a	25.4	73.6
	ANOVA	*NS*	*NS*	*NS*	*P = 0.008*	*NS*	*NS*

Emergence cages were placed over 3 plants per plot in treatments 1, 2, 3, 5, 8, 9, 10 on 14 June. First generation beetles observed in field on 26 June. Traps were checked on June 28, July 3, July 8, July 15, and July 25. Trap condition deteriorated rapidly after July 15. Below are sum totals per treatment. No significant differences were observed among treatments.

TRT	Total emerged beetles/ treatment plot
1	2.5
2	0.5
3	3.5
5	2.5
8	4.5
9	3.3
10	3.0

Watermelon 2019 Cucumber Beetle Efficacy Trial 2

Location: LESREC, Salisbury, MD
Variety: 'Road Trip'
'Wingman' pollinizer
Planting Date: 9 May
Experimental Design: Randomized complete block design with 8 treatments and 4 replicates
Plot size: 3 rows x 18'
Treatment Method: Drip treatments delivered by opening plastic and gently pouring 2,000 mL insecticide solution over 1.5' of the center of the bed on either side of the watermelon plant. Foliar treatments delivered using a CO_2- pressurized backpack sprayer with a 6.6' boom equipped with 4 D4 tips and #45 cores delivering 50 GPA at 70 PSI.
Treatment Dates: 31 May, 15 June, July 4, 26 July
Harvest Date: July 29

Number of beetles/ length of row 2.

TRT	13 DAT1		5 DAT1		2 DAT2		6 DAT2		12 DAT2		17 DAT2		4 DAT3		8 DAT3		3 DAT4	
	Live	**Dead**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**	**Live**	**Dead**
UTC	12.8	0.5 b	4.5	0	5.8	0.3 b	0.4	0.2	8.3	0.3	2.5	0.8	10.0	1.3	0.3	0	4.5 a	1.8
Conv.	16.3	7.3 a	0.8	0.5	2.0	34.3 a	0	0	6.2	2.6	8.5	1.5	5.4	1.0	0.3	0	1.3 b	5.0
Harvanta	15.3	1.8 b	2.8	2.5	1.3	6.8 b	0	0	6.0	2.3	2.0	0.5	3.0	0.7	0.5	0	3.8 ab	2.8
ANOVA	*NS*	*P = 0.001*	*NS*	*NS*	*NS*	*P = 0.001*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*P = 0.019*	*NS*

Conventional = Assail (5.3 oz/a), Assail (5.3 oz/a), Assail (5.3 oz/a), Mustang Maxx (4.0 fl oz/a).
Harvanta applied at 16.4 fl oz/a. Please note only 3 applications are allowed by label.
Beetles averaged 0.6/ft on 29 May

Harvested melons taken from row 2.

TRT	Harvest melon weight	N	% Ground Scar	% Rind Scar	Acceptable?
UTC	7.4	26	26.9	26.9 b	88.5 ab
Conventional	6.8	38	34.2	63.2 a	65.8 b
Harvanta	7.9	26	44.0	52.0 ab	92.0 a
ANOVA	*P = 0.058*		*NS*	*P = 0.016*	*P = 0.016*

Watermelon 2019 Cucumber Beetle Behavior 1

Location: Carvel REC, Field 38
Variety: 'Road Trip'
'Wingman' pollinizer
'Blue Hubbard' winter squash on outermost rows
Planting Date: 9 May
Plot size: 12 rows x 190' with a center drive row. 10 rows of melons, 2 rows of Hubbard
Row Spacing: 7'
Plant Spacing: 3'
Treatment Method: Squash was treated with 8 oz of an Admire Pro solution, 4.5 mls per 3 gallons of water at transplanting. A foliar Assail application (5.3 oz/A) was applied by CO_2 pressurized backpack sprayer fitted with 2 D2 nozzles and #25 cores calibrated to deliver 40 GPA at 41 PSI on 6 June and 21 June.

Trap location: row 1 and 12, ends of rows 2-10
Trap Deploy date: 10 May
Trap spacing: 15'
Trap notes: every 4th trap was a 'ghost trap' consisting of insecticide-treated netting (1.5' x 3') designed to kill beetles that landed on it (6 ghost traps total).
Lures replaced: 31 May, 27 June

Study Description: The purpose was to examine 'Blue Hubbard' as a trap crop for striped cucumber beetles and cucumber beetle traps constructed out of milk jugs to further intercept beetles before they moved into the watermelon. Watermelons in field 2 (mite threshold study; additional melons planted behind) served as a 'check' plot. Melons examined on August 7.

Sampling: Number of alive and dead striped cucumber beetles on 20 'Blue Hubbard' and on various numbers of watermelon plants inside the block and on various numbers of watermelon plants in Field 2. Reported are number of beetles per plant.

Study notes: 'Blue Hubbard' were far more attractive to striped cucumber beetles than watermelon, and it was possible to kill large numbers of beetles by only treated the squash early. However, first generation beetles (present in July) were much less active on 'Hubbard.' Relative to the number of beetles on the plants, jug traps were slightly better on first generation beetles than overwintering beetles. Beetle arrival in Field 38 was 2 weeks behind Field 38. At harvest, 46 melons were examined for rind feeding in this block. 12 had rind feeding (26.1%); 10 had ground-spot scarring (21.7%); and 10 were considered unacceptable (21.7%). Melons from the mite threshold study, Field 2, were harvested on August 5. Of 234 melons, 29 had rind feeding (12.4%), 60 had ground spot scarring (25.6%), and 12 were considered unacceptable (5.1%).

Date	No. jug traps	Striped Cucumber Beetles/ jug trap	Beetles/ ghost trap	Striped cucumber beetles/ Hubbard		Striped cucumber beetles/ watermelon		Field 2 dates	Striped cucumber beetles/ watermelon
				Alive	Dead	Alive	Dead		
20 May	28	0	0	0	0	0	0	20 May	1.81
29-May	28	0	0	0	0	0	0	30 May	1.53
6-Jun	---			1.76	0.41	---	---		
13-Jun	20	0.75	0.666667	1.45	4.65	0.6	0	13 June	0.41
19-Jun	22	0.86	0.333333	3.75	0.95	0.26	0	19 June	0.06
27-Jun	---		1.833333	0.4	0.2	0.2	0		
3-Jul	18	0.55	0.67	0	0.45	0.24	0	3 July	0.1
12-Jul	22	0.18	0.166667	0.5	0.7	0.25	0.05	12 July	0.48
25-Jul	22	1.04	0.166667	0.35	0.1	0.55	0	25 July	0.41
6 Aug	18	0.5	0						

Watermelon 2019 Cucumber Beetle Behavior 2

Location: Georgetown Rt 404
Variety: 'Joyride' and '7187', pollinizer 'Stargazer' and 'Premium'
Planting Date: May 2-5, May 12 - 18
Trap Deploy Date: 3 May
Trap Spacing: 30'
Lure Replaced: 31 May
'Casperita' Planting Date: 6 May, on end of row
'Casperita' Seeding Date: 4 April

Notes: Squash was treated with 8 oz of an Admire Pro solution, 4.5 mls per 3 gallons of water at transplanting. A foliar Assail application (5.3 oz/A) was applied by CO_2 pressurized backpack sprayer fitted with 2 D2 nozzles and #25 cores calibrated to deliver 40 GPA at 41 PSI on 6 June.

Sampling Method: Each squash plant and 5 adjacent watermelon plants were visually examined for live and dead striped cucumber beetles. On the opposite end of the watermelon field, 5 plants at the end of the rows were examined for cucumber beetles.

Date	# Traps	Striped Cucumber Beetles/ Trap	Spotted Cucumber Beetles/ Trap
14 May	40	0	0.05
23 May	40	0.1	0
31 May	39	0.78	0.18
12 June	40	0.48	0.025
26 June	40	0	0.025

Date	'Casperita'		Adjacent watermelon		Far watermelon	
	Striped cucumber beetle		Striped cucumber beetle		Striped cucumber beetle	
	Alive	Dead	Alive	Dead	Alive	Dead
23 May	0.09	3.35	0.2	0.01	1.99	0
31 May	14.83	0	1.12	0	2.61	0
12 June	2.29	6.34	0.86	0.29	0.15	0
26 June	1.60	1.38	0.79	0.06	0.6	0.18

Notes: Experiment terminated June 26 due to rapid senescence/death of 'Casperita' squash. Cause was never conclusively determined, but appeared to be partially environmental.

Watermelon 2019 Cucumber Beetle Behavior 3

Field: Georgetown, Tyndall Rd
Variety: Captivation and Fascination
Pollenizer: Stargazer
Planting Date: 5 May
Trap Deploy Date: 9 May
Trap spacing: 28'
Lure Replaced: May 31, June 27

'Casperita' Planting Date: 9 May

Notes: Squash was treated with 8 oz of an Admire Pro solution, 4.5 mls per 3 gallons of water at transplanting. A foliar Assail application (5.3 oz/A) was applied by CO_2 pressurized backpack sprayer fitted with 2 D2 nozzles and #25 cores calibrated to deliver 40 GPA at 41 PSI on 6, 13, and 27 June.

An independent consultant felt that the squash helped disrupt early season migration but had no effect on later populations or distribution.

Sampling Method: Each squash plant and 7 adjacent watermelon plants were visually examined for live and dead striped cucumber beetles. On the opposite end of the watermelon field, 5 plants were examined for cucumber beetles.

Date	# Traps	Striped Cucumber Beetles/ Trap	Spotted Cucumber Beetles/ Trap
17 May	33	0.12	0.03
22 May	40	0.025	0.05
31 May	40	0.1	0
12 June	39	0.025	0.03
26 June	40	0.025	0.05
29 July	40	0.025	0.05

Date	Per 'Casperita'		Per Adjacent watermelon		Per Far watermelon	
	Alive	Dead	Alive	Dead	Alive	Dead
22 May	2.80	0.01	0.32	0	0.38	0
31 May	0.69	0	0.02	0	---	---
12 June	0.25	0.67	0.04	0.02	0.015	0.01
26 June	0.60	0.51	0.02	0.03	0.05	0.02

A rind feeding assessment was conducted on 29 July. Near the 'Casperita' 5 out of 15 (33.3%) had rind feeding. Interior, away from the squash, 3 out of 15 had rind feeding (20%). On the far side of the field, interior, 2 out of 15 (13.3%) had rind feeding, and on the far edge of the field

away from ‘Casperita’ squash, 3 out of 15 (20%) had rind feeding. Winter squash did not appear to impact rind feeding.

Beetle distribution was very localized. For example, on May 22, all 268 striped cucumber beetles observed on the far watermelon plants were on 7 of the 100 rows examined. Very few beetles were ever observed on squash planted on the open edge of the field; most were present on squash planted next to a small strip of woods.

Watermelon 2019 Aphid 1

Location: Carvel REC, Field 38
Variety: 'Road Trip'
'Wingman' pollinizer
Planting Date: 10 May
Experimental Design: 3 treatments and 3 replicates
Plot size: 1 row x 15'
Row Spacing: 7'
Plant Spacing: 3'
Treatment Method: CO_2- pressurized backpack sprayer with a 6.6' boom equipped with 4 D4 tips and #45 cores delivering 50 GPA at 70 PSI.
Treatment Dates: 21 August
Sample Size: 10 leaves
Analysis: Data log x + 0.1 transformed, ANOVA; Tukey-Kramer HSD means separation

TRT	Material	Rate	Aphids/ 10 leaves			
			0d PRE	2 DAT	7 DAT	14 DAT
1	UTC	---	16.3	14.7	30.3 a	6.0 a
2	Sivanto HL + Induce	7 fl oz/A 1 pt/100 gal	16.0	1.0	0 b	7.7 a
3	Sefina	3 fl oz/A	22.3	10.3	0.3 b	0 b
ANOVA			*NS*	*NS*	*P = 0.001*	*P = 0.001*

Watermelon 2019 Aphid Trial 2

Location: LESREC, Salisbury, MD
Variety: 'Road Trip'
'Wingman' pollinizer
Planting Date: 9 May
Experimental Design: Randomized complete block design with 8 treatments and 4 replicates
Plot size: 1 row x 18'
Treatment Method: Soil treatments delivered by opening plastic and slowly pouring 2,000 mL insecticide solution over 1.5' of the center of the bed on either side of the watermelon plant. Foliar treatments delivered using a CO_2-pressurized backpack sprayer with a 6.6' boom equipped with 4 D4 tips and #45 cores delivering 50 GPA at 70 PSI.
Treatment Dates: 30 August
Sample Size: 10 leaves
Aphid species: All melon aphids

TRT	Material	Rate
1	UTC	---
2	Sivanto Prime (soil)	28 fl oz/A (2.3 mL/plant)
3	Sivanto HL (soil)	14 fl oz/A (1.14 mL/plant)
4	Sivanto Prime (foliar)	14 fl oz/A
5	Sivanto HL (foliar)*	7 fl oz/A
6	Beleaf	2 oz/A
7	Sefina	3 fl oz/A
8	Harvanta	10.9 fl oz/A

*Induce was added at a rate of 0.5 pint/100 gal

Aphids per 10 leaves

TRT	1 d (Pre)	4 DAT	10 DAT	14 DAT
1	59.5	49.5 a	24.8 a	0.5
2	36.0	24.0 ab	23.8 a	5.3
3	66.5	35.3 a	13.5 ab	0.8
4	51.0	2.8 ab	10.0 ab	1.8
5	35.0	0.5 b	9.0 ab	2.0
6	61.8	1.0 ab	2.3 b	2.0
7	38.3	0.5 b	0 b	0
8	56.3	22.5 ab	6.8 ab	4.0
ANOVA	*NS*	*P = 0.004**	*P = 0.004*	*NS*

*Aphid data log transformed prior to analysis. Presented are backtransformed means.

Early Season and Mid-Season Moth Trapping

True Armyworm and Black Cutworm. Pheromone traps (universal moth bucket traps) were deployed throughout the season to monitor true armyworm, black cutworm, and western bean cutworm flight activity. True armyworm is a potential small grain and seedling corn pest, especially when corn is planted green or into a weedy field. Black cutworm is a potential corn and soybean pest, especially when planted into a weedy field.

Location	10 April		17 April		24 April		1 May		7 May		14 May		22 May		29 May	
	TAW	BCW	TAW	BCW	TAW	BCW	TAW	BCW	TAW	BCW	TAW	BCW	TAW	BCW	TAW	BCW
Willards, MD	8	18	1	5	3	5	3	7	2	5	0	12	1	1	0	4
Salisbury, MD	1	2	1	5	0	10	0	37	0	9	1	14	0	3	0	16
Laurel	14	22	6	19	2	16	0	44	1	17	1	48	0	23	0	54
Seaford	8	37	52	49	---	34	17	54	7	7	5	9	3	3	0	16
Bridgeville	14	3	34	12	19	26	1	21	0	5	0	---	0	---	0	1
Sudlersville, MD	---	---	0	1	2	2	1	5	0	36	0	2	0	5		
Harrington	2	0	6	7	---	---	3	39	0	22	1	12	1	5	0	18
Pearson's Corner	0	0	1	3	4	3	3	7	1	22	0	11	1	0	0	3
Kenton	14	1	23	3	24	7	17	17	2	10	1	18	0	2	0	3
Little Creek	50	3	61	31	---	38	3	39	1	66	2	93	2	16	5	16

Dates are approximate for when most of the traps were checked in that week. Individual trap check dates may differ by one or two days at most.

Western Bean Cutworm. Western bean cutworm is a significant corn pest in the eastern corn belt and arrived in PA in the mid-2000's. Its status in Delaware will be periodically assessed using pheromone traps. Localities which have economic populations of WBC report hundreds of moths per week in pheromone traps. WBC pheromone traps (Universal Moth Bucket Trap type) deployed June 18 in Lewes, Milton, Georgetown, Seaford, Greenwood, Harrington, Felton, Wyoming. Pheromone replaced July 11. Only 1 moth was trapped in Lewes on 15 July. Traps ran until July 26, checked weekly.

Wheat 2019 BYDV

Location:	Carvel REC, Field 11 (Georgetown) Wye Mills REC, Field H-05 (Wye)
Variety:	'Dyna-Gro 9750'
Planting Date:	October 10 (Georgetown) October 23 (Wye)
Experimental Design:	Split plot design with 2 main plot factors and 2 subplot factors, 8 replicates (Georgetown, aphid data-Wye); 4 subplot factors and 4 reps each (Wye, yield data).
Plot size:	10' x 23' Georgetown 9.75' x 18' Wye
Row Spacing:	7.5"
Treatment Method:	CO_2 pressurized backpack sprayer with a 10' boom equipped with 6 8004 nozzles calibrated to deliver 20 GPA at 28 PSI.
Treatment Date:	Fall treatments: November 29 (Wye), November 30 (Georgetown) Spring treatments May 10 (Wye); Georgetown was not treated in spring.
Harvest Area:	9' x 23'
Harvest Date:	22 June Georgetown 24 June Wye
Samples:	3 1-row-ft sections per plot; number of symptomatic flag leaves per center 5 rows of each plot; BYDV ratings taken on May 22 (Georgetown) and May 10 (Wye)
Data Analysis:	Split plot ANOVA, SAS

Notes: Foliar Warrior treatments were applied at the 1.92 fl oz/A rate. Seed treated with Virock 5 oz/cwt + Foothold or just Foothold. Warrior was applied on November

Georgetown

Seed TRT	Foliar App.	24 Oct	31 Oct	8 Nov	14 Nov	20 Nov	29 Nov	7 Dec	8 Feb	13 March	2 April	12 April	19 April	26 April	Test Weight	Yield	Leaves/ 5 rows
F, IST	---	0	0.1	0.8	2.0	2.4	0.5	3.9	3.8 b	1.3 b	1.6	20.6 b	98.5	56.9	55.7	16.0	1.3
F, IST	Fall	0.3	0.3	1.3	1.1	1.9	1.0	0	0.1 c	0 b	1.0	9.6 b	43.1	34.8	55.5	16.1	0.9
F	---	1.1	0.1	2.1	3.3	7.1	1.9	3	15.5 a	10.1 a	18.5	167.5 a	289.1	78.4	56.0	15.4	3.6
F	Fall	1.0	0.8	3.0	4.8	5.3	2.3	0	0.1 c	0.6 b	2.1	25.3 b	96.4	69.1	55.8	15.7	3.4
Seed Trt		*NS*	*NS*	*P = 0.034*	*P = 0.006*	*P = 0.007*	*NS*	*NS*	*P = 0.036*	*P = 0.014*	*NS*	*P = 0.036*	*P = 0.045*	*NS*	*P = 0.038*	*NS*	*P = 0.027*
Foliar App		*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*P <0.001*	*P <0.001*	*P = 0.001*	*P = 0.046*	*P = 0.029*	*P = 0.026*	*NS*	*P = 0.009*	*NS*	*NS*
*Seed*Foliar*		*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*P = 0.022*	*P = 0.008*	*NS*	*P = 0.056*	*NS*	*NS*	*NS*	*NS*	*NS*

Wye

Seed TRT	Foliar App.	Nov 29	Dec 6	Feb 8	March 15	March 27	April 5	April 12	April 19	April 26	May 2	May 10	Test Wght	Yield	Leaves/ 5 rows
F, IST	---	0.5	0.3	0.1	1.1	0.3	1.9	16.9	72.9	83.9	8.3	1.5	56.8	10.6	3.1
F, IST	Fall	0.8	0	0	0.5	0	1.9	11.3	37.8	43.3	8.4	1.5	57.4	10.6	3.3
F, IST	Spring												56.3	11.0	
F, IST	Fall Spring												57.0	10.7	
F	---	2.4	1.8	1.8	1.8	1.4	11.6	50.8	271.3	248.1	17.6	1.1	56.3	9.8	1.8
F	Fall	1.5	0	0	0	0.4	3.8	16.6	84.4	162.8	8.6	0.8	55.7	10.1	1.1
F	Spring												56.2	10.2	
F	Fall Spring												56.5	10.7	
Seed Trt			*NS*	*NS*	*NS*	*NS*	*P = 0.039*	*NS*	*NS*	*P = 0.016*	*NS*	*NS*	*NS*	*NS*	*P = 0.048*
Foliar App			*P = 0.015*	*NS*	*P = 0.021*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*
*Seed*Foliar*			*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*

Wheat 2019 Aphids

Location: Harrington, DE
Variety: 'Agrimax 363'
Planting Date: 22 October 2018
Experimental Design: Randomized complete block design with 2 treatments and 4 replicates
Plot size: 20' x 20'
Row Spacing: 7"
Treatment Method: CO_2 pressurized backpack sprayer with a 10' boom equipped with 6 XR 8004 nozzles calibrated to deliver 20 GPA at 28 PSI.
Treatment Date: 22 April
Sample Size: 1 row ft
Harvest Date: 17 June
Harvest Method: Hand-harvest
Harvest Area: 14 rows x 20'
Data Analysis: T-test

TRT	April 22 (PRE)			April 25 (3 DAT)			May 2 (10 DAT)			Test Wght	Yield (lbs)
	EGA	BCOA	Total	EGA	BCOA	Total	EGA	BCOA	Total		
Warrior II 1.92 fl oz/a	326.5	90.8	417.3	50.5	14.0	64.5	1.0	0.8	1.8	57.5	6.5 b
UTC	252.5	62.8	315.3	354.3	103.8	458.0	9.0	0.5	9.5	56.5	7.7 a
T-test	*NS*	*NS*	*NS*	*P = 0.002*	*NS*	*P = 0.007*	*NS*	*NS*	*NS*		*P = 0.045*

Barley 2019 Aphids

Location: Greenwood, DE
Variety: 'Violetta'
Planting Date: 4 October 2018
Experimental Design: Randomized complete block design with 5 treatments and 4 replicates
Plot size: 10' x 20'
Row Spacing: 7"
Treatment Method: CO_2 pressurized backpack sprayer with a 10' boom equipped with 6 XR 8004 nozzles calibrated to deliver 20 GPA at 28 PSI.
Treatment Date: 11 April
Sample Size: 1 row ft
Data Analysis: ANOVA; Tukey-Kramer HSD means separation
T-test for quality analysis between TRT 1 and TRT 5

Notes: 1 pound samples analyzed by MSU's Malting Barley Quality Lab. DON was less than 0.3 for all but one sample (II-1, 0.5).

TRT	Material	Rate
1	UTC	---
2	Baythroid XL	2.1 fl oz/A
3	Endigo	3.5 fl oz/A
4	Sivanto Prime	7.0 fl oz/A
5	Warrior II	1.92 fl oz/A

TRT	0 d PRE		4 DAT		7 DAT		14 DAT	
	EGA	BCOA	EGA	BCOA	EGA	BCOA	EGA	BCOA
1	66.6	179.6 ab	218.5 a	98.5 a	410.0 a	100.3 a	14.8	171.8
2	116.3	298.6 a	23.3 b	25.8 ab	22.8 c	21.8 b	6.5	11.3
3	69.4	245.8 ab	6.0 b	1.0 b	11.5 c	0.3 b	0	4.8
4	106.8	98.8 b	142.8 a	21.5 ab	242.3 b	4.8 b	3.5	54.5
5	84.8	146.6 ab	2.8 b	27.8 ab	0.3 c	19.5 b	7.0	1.3
ANOVA	*NS*	*P = 0.010*	*P <0.001*	*P = 0.016*	*P <0.001*	*P = 0.001*	*NS*	*NS*

TRT	Test Weight	Adj. Yield (lbs)	% Protein	Moisture	Plump %	Thin %	Energy 4ml	Energy 8 ml	Capacity	RVA
1	43.5	3.97	11.6	13.3	92.4	0.9	62.5	27.0	80.0	154.8
2	46.4	5.09								158.8
3	42.4	4.78								
4	44.7	4.73								
5	43.9	4.72	11.3	13.2	92.3	0.7	64.8	29.8	83.5	
ANOVA	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Sorghum 2019 Sugarcane Aphid 1

Location: Georgetown, DE
Variety: DeKalb '3816'
Planting Date: 1 June
Experimental Design: Randomized complete block design with 6 treatments and 4 replicates
Plot size: 10' x 20'
Row Spacing: 30"
Treatment Method: CO_2 pressurized backpack sprayer with a 10' boom equipped with 6 XR 8004 nozzles calibrated to deliver 20 GPA at 28 PSI.
Treatment Date: 11 September
Sample Size: 5 flag leaves and 5 lower canopy +2 leaves
Data Analysis: ANOVA; Tukey-Kramer HSD means separation

Notes: Plots experienced droughty conditions causing rapid leaf senescence, by 14 DAT, few green leaves were available for sampling. Drought conditions could have influenced Lorsban and Dimethoate activity. However, these two products have been inconsistent in numerous university trials from across the Southeast.

TRT	Material	Rate
1	UTC	---
2	Sivanto Prime	3 fl oz/A
3	Sivanto Prime	5 fl oz/A
4	Sivanto Prime	7 fl oz/A
5	Lorsban 4E	1 pt/A
6	Dimethoate 400	1 pt/A

TRT	11 Sept (0d PRE)		2 DAT		7 DAT		14 DAT	
	Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper
1	471.8	327.3	349.5 a	483.0 a	692.5 a	1338.0 a	1.0 b	0 b
2	227.8	318.3	21.0 b	21.5 b	0.8 b	0.8 b	0 b	0 b
3	279.8	178.5	15.3 b	3.8 b	0.3 b	0.3 b	0 b	0 b
4	644.5	342.0	6.5 b	1.8 b	0.5 b	0.5 b	0 b	0 b
5	550.8	688.8	162.3 ab	143.8 ab	666.3 a	148.8 ab	1177.0 a	67.0 ab
6	447.8	493.5	83.8 b	40.3 b	223.0 ab	123.5 ab	394.3 ab	65.5 a
ANOVA	*NS*	*NS*	*P = 0.001*	*P = 0.018*	*P = 0.004*	*P = 0.023*	*P = 0.016**	*P = 0.016**

Sorghum 2019 Sugarcane Aphid 2

Location: Georgetown, DE
Variety: DeKalb '3816'
Planting Date: 1 June
Experimental Design: Randomized complete block design with 6 treatments and 4 replicates
Plot size: 10' x 20'
Row Spacing: 30"
Treatment Method: CO_2 pressurized backpack sprayer with a 10' boom equipped with 6 XR 8004 nozzles calibrated to deliver 20 GPA at 28 PSI.
Treatment Date: 18 September
Sample Size: 5 flag leaves and 5 lower canopy +2 leaves
Data Analysis: T-test

Notes: Induce was added to Transform spray based on recommendation from southern entomologists

TRT	**Rate**	**0d PRE**		**2 DAT**		**7 DAT**		**14 DAT**	
		Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper
UTC	---	1202.3	791.0	2395.5	1292.0	1697.8	700.0	1052.3	352.5
Transform	0.75 oz/a	1479.7	989.3	1221.3	264.7	2.0	0.3	0	0
T-test		*NS*	*NS*	*NS*	*NS*	*P = 0.008*	*P = 0.049*	*P = 0.029**	*P = 0.029**

*Log (x + 0.1) transformed

Sorghum 2019 CEW

Location: Ellendale, DE
Variety: ---
Planting Date: 1 June
Experimental Design: Randomized complete block design with 10 treatments and 4 replicates
Plot size: 10' x 50'
Row Spacing: 15"
Treatment Method: CO_2 pressurized backpack sprayer with a 10' boom equipped with 6 nozzles (see table for more details).
Treatment Date: 20 August
Sample Size: 25 heads beaten into a bucket per plot
Data Analysis: ANOVA; Tukey-Kramer HSD means separation; Treatments 2 and 3 compared using T-test, Treatments 2, 3, 4 compared using ANOVA

Notes: No significant differences among treatments 2, 3, and 4 total worm count (Application parameters differed, Warrior II low rate; ANOVA) at any sampling date. No significant differences between treatments 2 and 3 (Low volume vs High volume, Warrior II low rate; T-test), although numerically more worms were present in TRT 2 samples 2 DAT.

TRT	Material	Rate	Application Notes	0-d PRE				2 DAT				6 DAT			
				Small	Med.	Large	Total	Small	Med.	Large	Total	Small	Med.	Large	Total
1	UTC	---		7.5	4.3	3.3	15	4.0	4.0a	3.3a	11.3a	0	0.3	0.5ab	0.8ab
2	Warrior II	1.28 fl oz/A	XR 8002, 15 PSI, 9.5 GPA	6.8	6.0	1.8	14.5	2.8	4.3a	1.3ab	8.3ab	0	0.5	1.0a	1.5a
3	Warrior II	1.28 fl oz/A	XR8002, 60 PSI, 22.4 GPA	9.5	5.8	1.0	16.3	1.5	2.3ab	1.8ab	5.5ab	0.3	0.8	0	1.0ab
4	Warrior II	1.28 fl oz/A	Banded, 8002E, 72 PSI, 20 GPA	6.8	5.3	1.5	13.5	2.3	2.3ab	2.0ab	6.5ab	0.5	0.3	0b	0.8ab
6	Warrior II	1.92 fl oz/A	XR11004, 28 PSI, 20 GPA	5.0	4.3	3.0	12.3	1.3	1.8ab	1.3ab	4.3ab	0.3	0.8	0.5ab	1.5a
7	Baythroid XL	2.8 fl oz/A	XR11004, 28 PSI, 20 GPA	6.3	7.8	2.8	16.8	1.0	0.3b	0.3b	1.5b	0	0.3	0.3b	0.5ab
8	Prevathon	17 fl oz/A	XR11004, 28 PSI, 20 GPA	8.3	5.3	2.5	16.0	0.5	1.0b	0.3b	1.8b	0	0	0b	0.0b
9	Besiege	8 fl oz/A	XR11004, 28 PSI, 20 GPA	8.3	4.8	1.0	14.0	0.3	0.3b	0.0b	0.5b	0	0	0b	0.0b
10	Lannate	1.1 pts/A	XR11004, 28 PSI, 20 GPA	9.3	5.5	1.3	16.0	3.3	0.8b	1.5ab	5.5ab	0.3	0.3	0.3ab	0.8ab
11	Carbaryl	1.5 qts/A	XR11004, 28 PSI, 20 GPA	4.5	7.5	2.0	14.0	0.5	0.0b	0.3b	0.8b	0	0.3	0b	0.3ab
	ANOVA			*NS*	*NS*	*NS*	*NS*	*NS*	*P<0.001*	*P = 0.016*	*P = 0.001*	*NS*	*NS*	*P = 0.033*	*P = 0.005*

Soybean 2019 Slugs

Location: Harbeson, DE
Variety: Asgrow '46x6'
Planting Date: 27 May
Experimental Design: Randomized complete block design with 4 treatments and 4 replicates
Plot size: 20' x 20'
Row Spacing: 15"
Treatment Method: Scott's hand spreader
Treatment Date: 28 May
Sample Size: stand from 2 10-row-ft row sections
Data Analysis: ANOVA; Tukey-Kramer HSD means separation

TRT	**Rate (lbs/a)**	**June 4**		**June 13**
		Stand	**Injured**	**Stand**
UTC	---	38.8	19.0	49.5
Ferroxx	7.5	51.5	11.3	59.8
Ferroxx	10	47.5	8.0	53.5
Deadline	10	50.0	11.3	58.0
ANOVA		*P = 0.004*	*NS*	*NS*

Soybean 2019 CEW Test 1

Location: Carvel REC, Field 38
Variety: 'DG S43XS 27 RR2x/STS'
Planting Date: 27 June
Experimental Design: Randomized complete block design with 8 treatments and 4 replicates
Plot size: 10' x 50'
Row Spacing: 15"
Treatment Method: CO_2 pressurized backpack sprayer with a 10' boom equipped with 6 8004 nozzles calibrated to deliver 20 GPA at 28 PSI.
Treatment Date: 22 August
Sample Size: 20 sweeps per plot
Data Analysis: ANOVA; Tukey-Kramer HSD means separation

Notes: Green cloverworm ranged from 10 to 17. 4 DAT, GCW ranged from 0 (trt 2,3,4) 0.3 (trt 5), 0.5 (trt 7), 0.8 (trt 6, 8), and 8.8 (trt 1). 7 DAT, GCW ranged from 0 (trt 2,3,4), 0.3 (trt 7,8), 0.8 (trt 5), 1.0 (trt 6), to 7.0 (trt 1).

When analyzed separately, total worm counts in Brigade, Baythroid XL, and Warrior II plots did not differ significantly from each other at any sampling date.

Virus-infected worms were present in the field.

Using NCSU's corn earworm threshold calculator, ballpark thresholds per 15 and 20 sweeps for different treatments, assuming 10.23 application cost and regional estimates of product cost, 8.50/bu price, and 7-14" rows are as follows:

Prevathon	5.40/ 7.2
Intrepid	6.23/ 8.31
Steward	5.58/ 7.44
Warrior II	2.38/ 3.17
Besiege	4.76/ 6.3
Hero	3.63/ 4.84
Baythroid XL	2.29/ 3.05

TRT	Material	Rate	0 d PRE				4 DAT				7 DAT			
			Small	**Med**	**Large**	**Total**	**Small**	**Med**	**Large**	**Total**	**Small**	**Med**	**Large**	**Total**
1	UTC		3.5	3.5	2.3	9.3	3.3a	5.0a	2.0a	10.3a	0.3	0.8a	1.3a	2.3a
2	Brigade	6.4 fl oz/A	2.0	3.5	1.3	6.8	0.3b	0.3b	0b	0.5b	0	0	0b	0b
3	Prevathon	14 fl oz/A	3.5	1.8	1.0	6.3	0b	0.5b	0.8ab	1.3b	0	0	0.3b	0.3b
4	Steward	4.6 fl oz/A	0.8	2.0	0.5	3.3	0b	0.3b	0b	0.3b	0	0.3ab	0b	0.3b
5	Besiege	5 fl oz/A	3.5	2.0	0	5.5	0b	0.0b	0.3ab	0.3b	0	0	0b	0b
6	Baythroid XL	2.8 fl oz/A	2.5	2.3	0.5	5.3	0b	0.0b	0b	0b	0	0	0b	0b
7	Warrior II	1.92 fl oz/A	4.3	4.3	1.5	10.0	0.3b	0.3b	0b	0.5b	0	0.3ab	0b	0.3b
8	Intrepid	6 fl oz/A	2.8	3.5	0.8	7.0	1.3ab	0.5b	0.3ab	2.0b	0.3	0.8a	0b	1.0ab
	ANOVA		*NS*	*NS*	*NS*	*NS*	*P = 0.005*	*P = 0.002*	*P = 0.015*	*P <0.001*	*NS*	*P = 0.011*	*P = 0.001*	*P<0.001*

Soybean 2019 CEW Test 2

Location: Carvel REC, Field 38
Variety: 'DG S43XS 27 RR2x/STS'
Planting Date: 27 June
Experimental Design: Randomized complete block design with 8 treatments and 4 replicates
Plot size: 10' x 50'
Row Spacing: 15"
Treatment Method: CO_2 pressurized backpack sprayer with a 10' boom equipped with 6 8004 nozzles calibrated to deliver 20 GPA at 28 PSI.
Treatment Date: 22 August
Sample Size: 20 sweeps per plot
Harvest Area: 9' x 22'
Harvest Date: Oct 26
Data Analysis: ANOVA; Tukey-Kramer HSD means separation

TRT	Material	Rate
1	UTC	
2	Hero	10.3 fl oz/A
3	Radiant	3 fl oz/A
4	Prevathon	20 fl oz/A
5	Steward	11.3 fl oz/A
6	Proclaim*	3.4 oz/A

*Not labeled for soybean

TRT	0 d PRE				4 DAT				7 DAT				Yield	
	Small	**Med**	**Large**	**Total**	**Small**	**Med**	**Large**	**Total**	**Small**	**Med**	**Large**	**Total**	**Test Weight**	**Yield/ft**
1	4.3	2.8	0.3	7.3	1.0	3.3 a	1.3 a	5.5 a	0	1.0	1.8 a	2.8 a	49.2	0.25
2	4.5	3.3	0.8	8.5	0	0 b	0 b	0 b	0	0.3	0 b	0.3 b	48.6	0.25
3	5.0	4.3	1.8	11.0	0.5	0.5 ab	0.5 ab	1.5 ab	0	0	0 b	0 b	55.7	0.33
4	3.8	2.0	0.3	6.0	0.3	0 b	0 b	0.3 b	0	0	0.3 ab	0.3 b	55.9	0.33
5	5.8	3.5	0.5	9.8	0	0 b	0 b	0 b	0	0	0 b	0 b	54.3	0.29
6	4.0	2.3	0.3	6.5	1.3	1.8 ab	0.5 ab	3.5 ab	0.8	1.0	1.5 ab	3.3 a	55.3	0.34
ANOVA	*NS*	*NS*	*NS*	*NS*	*NS*	*P = 0.018*	*P = 0.018*	*P = 0.008*	*NS*	*P = 0.018*	*P = 0.003*	*P <0.001*	*P = 0.082*	*P = 0.072*

Soybean 2019 CEW Test 3

Location: Carvel REC, Field 38
Variety: DG S43XS 27 RR2x/STS
Planting Date: 27 June
Experimental Design: Randomized complete block design with 8 treatments and 4 replicates
Plot size: 10' x 50'
Row Spacing: 15"
Treatment Method: CO_2 pressurized backpack sprayer with a 10' boom equipped with 6 8004 nozzles calibrated to deliver 20 GPA at 28 PSI.
Treatment Date: 26 August
Sample Size: 20 sweeps per plot
Data Analysis: ANOVA; Tukey-Kramer HSD means separation

TRT	Material	Rate (per A)
1	UTC	---
2	Warrior II	0.96 fl oz
3	Warrior II Lannate	0.96 fl oz 0.4 pt
4	Warrior II Exponent	0.96 fl oz 1.2 fl oz

TRT	0 d PRE					2 DAT				
	Small	Med	Large	Total	GCW	Small	Med	Large	Total	GCW
1	2.0	2.8	1.0	5.8	8.8	2.0	1.8	0.3	4.0	8.3
2	2.3	2.8	1.8	6.8	17.3	1.5	1.0	0.8	3.3	6.5
3	2.3	0	0	2.3	0.3	0	0.3	0	0.3	0.3
4	3.5	2.3	0.3	6.0	14.0	1.3	1.0	0	2.3	1.3
ANOVA	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*

Soybean 2019 CEW Test 4

Location: Carvel REC, Field 38
Variety: DG S43XS 27 RR2x/STS
Planting Date: 27 June
Experimental Design: Randomized complete block design with 8 treatments and 4 replicates
Plot size: 10' x 50'
Row Spacing: 15"
Treatment Method: CO_2 pressurized backpack sprayer with a 10' boom equipped with 6 8004 nozzles calibrated to deliver 20 GPA at 28 PSI.
Treatment Date: 26 August
Sample Size: 20 sweeps per plot
Data Analysis: ANOVA; Tukey-Kramer HSD means separation

TRT	Material	Rate
1	UTC	---
2	Denim	10 fl oz/A
3	Prevathon	14 fl oz/A

TRT	0 d PRE					2 DAT					4 DAT				
	Small	Med	Large	Total	GCW	Small	Med	Large	Total	GCW	Small	Med	Large	Total	GCW
1	2.3	3.0	3.0	8.3	3.0	1.8	2.8	3.5	8.0	4.5	0.5	0.5	1.8	2.8	2.3
2	2.5	3.8	2.0	8.3	2.0	3.0	3.5	0.5	7.0	0	0.3	2.0	0.5	2.8	0.3
3	3.0	5.0	1.0	9.0	2.3	2.0	2.8	1.5	6.3	0.5	0.3	0.8	0	1.0	0.3
ANOVA	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*

Soybean Dectes Foliar

Location: Harbeson, DE
Variety: CZ4308LL
Planting Date: 2 May
Experimental Design: Randomized design with 5 treatments and 4 replicates
Treatment Method: CO_2 pressurized backpack sprayer with a 10' boom equipped with 6 8004 nozzles calibrated to deliver 20 GPA at 31 PSI.
Treatment Date: 10 July
Plot Size: 4 rows x 25'
Row Spacing: 30"
Sample Size: 10 sweeps/plot; split 25 stems/plot
Stem Collection: 29 August
Data Analysis: ANOVA; Tukey-Kramer HSD means separation

TRT	Material	Rate
1	UTC	---
2	Prevathon	20 fl oz/A
3	Prevathon Brigade	20 fl oz/A 6.4 fl oz/A
4	Experimental	---
5	Brigade	6.4 fl oz/A
6	Prevathon Steward	14 fl oz/A 6 oz/A

Treatments 2, 3, and 4 had Cidewinder 0.5% v/v

TRT	%Dectes Signs	%Dectes Found	%Clean	No. Dectes per 10 sweeps			
				1 PRE	1 DAT	7 DAT	14 DAT
1	56.0 a	44.0 a	44.0 b	0.5	0.5	0.75	0.5
2	25.0 ab	22.0 ab	75.0 ab	0.75	0.25	0	0.5
3	26.0 ab	18.0 ab	74.0 ab	1.5	0.75	0	0.5
4	10.3 b	8.2 b	89.7 a	0.75	0	0	0.5
5	27.0 ab	17.0 ab	73.0 ab	0.75	0.25	0.25	0.75
6	12.0 b	10.0 b	88.0 a	1.0	0.5	0.25	0.5
ANVOA	*P = 0.005*	*P = 0.009*	*P = 0.005*	*NS*	*NS*	*NS*	*NS*

Sunflower 2019 Dectes In-Furrow 1

Location: Carvel REC, Dill Farm
Variety: Game Plan CL
Planting Date: 23 May
Experimental Design: Randomized design with 3 treatments and 4 replicates
Treatment Method: Monosem planter with in-furrow application via fertilizer drops delivering 9.2 GPA.
Plot Size: 4 rows x 15'
Row Spacing: 30"
Plant Population: 30,000/acre
Sample Size: visual counts on 1 row x plot length; split 25 stems/plot
Stem Collection: 13 September
Data Analysis: ANOVA; Tukey-Kramer HSD means separation

TRT	Material	Rate	% Dectes signs	% Dectes found	% Clean	31 July	Adjacent soybean	15 July
1	UTC	---	88.6	46.0	11.4	0.25	1 beetle/80 sweeps, located adjacent to sunflower	2.0
2	Coragen	5 fl oz/A	64.2	27.1	35.8	0.25		0.5
3	Coragen	7.5 fl oz/A	62.2	26.2	37.8	0		0.75
ANOVA			*NS*	*NS*	*NS*			

Sunflower 2019 Dectes In-Furrow 2

Location: Warrington Irrigation Research Farm
Variety: Game Plan CL
Planting Date: 7 May
Experimental Design: Randomized design with 3 treatments and 4 replicates
Treatment Method: Monosem planter with in-furrow application via fertilizer drops delivering 9.2 GPA.
Plot Size: 4 rows x 60'
Row Spacing: 30"
Plant Population: 32,000/acre (outer)
22,000/acre (inner)
Sample Size: visual counts on 1 row x plot length; split 25 stems/plot
Stem Collection: 13 September
Data Analysis: ANOVA; Tukey-Kramer HSD means separation

Notes: A discrepancy between planter computer and planter display was present at planting. It is possible but not definite that Coragen was gravity trickling through the line when planting the UTC. However, Dectes pressure was high and nearly every plant in the field was infested with a Dectes larva.

Overall

TRT	Material	Rate	% Dectes signs	% Dectes found	% Clean	9 July	17 July	24 July
1	UTC	---	99.0	78.0	1.0	8.0	3.0	1.5
2	Coragen	5 fl oz/A	95.0	71.9	5.0	9.0	8.75	1.25
3	Coragen	7.5 fl oz/A	97.0	79.5	3.0	8.0	6.0	3.0
ANOVA			NS	NS	NS	NS	NS	NS
Inner (22k plants)			96.0	76.8	4.0			
Outer edge (32k plants)			98.0	76.2	2.0			
ANOVA			*NS*	*NS*	*NS*	*NS*	*NS*	*NS*

Sunflower 2019 Dectes Foliar 1

Location: Staytonville, DE
Variety: Game Plan CL
Planting Date: 20 May
Experimental Design: Randomized design with 5 treatments and 4 replicates
Treatment Method: CO_2 pressurized backpack sprayer with a 10' boom equipped with 6 8004 nozzles calibrated to deliver 20 GPA at 28 PSI.
Treatment Date: 9 July
Plot Size: 4 rows x 20'
Row Spacing: 30"
Sample Size: visual counts on 1 row x plot length; split 25 stems/plot
Stem Collection: 29 August
Data Analysis: ANOVA; Tukey-Kramer HSD means separation

Notes: Treatment timed when Dectes first appeared in sunflower. Dectes population at Staytonville site was low and beetles came in during an extended period of time.

TRT	Material	Rate
1	UTC	---
2	Prevathon	20 fl oz/A
3	Prevathon Brigade	20 fl oz/A 6.4 fl oz/A
4	Experimental	---
5	Brigade	6.4 fl oz/A

Treatments 2, 3, and 4 had Cidewinder 0.5% v/v

TRT	%Dectes Signs	%Dectes Found	%Clean	0 PRE	2 DAT	8 DAT	15 DAT	22 DAT
1	38.4	15.8 b	61.6	0.25	0.25	0	0.25	0
2	15.2	9.1 ab	84.8	0	0	0	0	0
3	24.8	6.3 ab	75.2	0.25	0	0	0	0
4	32.3	5.1 ab	67.7	0.75	0	0	0	0
5	27.1	3.0 b	72.9	0	0.25	0	0	0
ANVOA	*NS*	*P = 0.035*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*

Sunflower Dectes Foliar 2

Location: Harbeson, DE
Variety: Game Plan CL
Planting Date: 7 May
Experimental Design: Randomized design with 5 treatments and 4 replicates
Treatment Method: CO_2 pressurized backpack sprayer with a 10' boom equipped with 6 8004 nozzles calibrated to deliver 20 GPA at 31 PSI.
Treatment Date: 9 July
Plot Size: 4 rows x 25'
Row Spacing: 30"
Sample Size: visual counts on 1 row x plot length; split 25 stems/plot
Stem Collection: 29 August
Data Analysis: ANOVA; Tukey-Kramer HSD means separation

TRT	Material	Rate
1	UTC	---
2	Prevathon	20 fl oz/A
3	Prevathon Brigade	20 fl oz/A 6.4 fl oz/A
4	Experimental	---
5	Brigade	6.4 fl oz/A

Treatments 2, 3, and 4 had Cidewinder 0.5% v/v

TRT	%Dectes Signs	%Dectes Found	%Clean	0 PRE	2 DAT	8 DAT	15 DAT
1	90.9 a	65.4 a	9.1 a	3.0	0.5	1.5 a	0
2	79.0 ab	42.0 ab	21.0 ab	2.75	0.5	0 b	0.25
3	58.3 b	37.1 ab	41.7 b	1.0	0.75	0.5 b	0
4	53.8 b	22.9 b	46.2 b	1.50	0	0 b	0
5	79.9 ab	45.7 ab	20.1 ab	1.25	0.25	0.25 b	0.25
ANOVA	*P = 0.004*	*P = 0.030*	*P = 0.004*	*P = 0.035*	*NS*	*P = 0.001*	*NS*

Misc. Observations

One corn field in Seaford was infested with wireworms. Half the field was planted with Poncho250 and the other half had Poncho500. May 16 P250 = 1.26% wireworm damage; P500 = 0; no significant difference (T-test).
On May 30, P250 = 1.62% wireworm damage; P500 = 1.08% wireworm damage; no significant difference (T-test).

Cucumber beetle first appearance: Laurel, 14 May
Slug eggs: May 6, Lewes
First Dectes on sunflower: June 27, Harbeson

Delaware in the year 2019

Pest	Acres Infested	% Acres Infested	Acres above ET	% Acres above ET	Acres Treated	% Acres Treated	# of apps/acres treated	Cost of 1 Insecticide	% loss per acre infested	# of apps per total soy acres	cost/acre	Overall % reduction	bushel lost per pest	Loss + Cost	Loss + Cost/acre	% Total Loss + Cost
Armyworm complex	13,714	9.0%	3,170	2.1%	440	0.3%	1	$8.50	0.25	0.003	$0.02	0.02%	1,352	$15,407	$0.10	0.5%
Banded Cucumber Beetle	0	0.0%	0	0.0%	0	0.0%	0	$0.00	0.00	0.000	$0.00	0.00%	0	$0	$0.00	0.0%
Bean Leaf Beetle	54,762	35.8%	10,600	6.9%	1,725	1.1%	1	$8.50	0.75	0.011	$0.10	0.27%	16,196	$154,432	$1.01	5.4%
Blister Beetle	50,000	32.7%	0	0.0%	0	0.0%	0	$0.00	0.00	0.000	$0.00	0.00%	0	$0	$0.00	0.0%
Corn Earworm	89,775	58.7%	45,770	29.9%	40,770	26.6%	1.1	$15.00	2.50	0.293	$4.40	1.47%	88,502	$1,436,481	$9.39	49.9%
Cutworms	240	0.2%	10	0.0%	0	0.0%	0	$0.00	2.50	0.000	$0.00	0.00%	237	$2,042	$0.01	0.1%
Dectes Stem Borer	18,850	12.3%	0	0.0%	0	0.0%	0	$0.00	0.75	0.000	$0.00	0.09%	5,575	$48,111	$0.31	1.7%
Garden Webworms	0	0.0%	0	0.0%	0	0.0%	0	$0.00	0.00	0.000	$0.00	0.00%	0	$0	$0.00	0.0%
Grape Colaspis	750	0.5%	0	0.0%	0	0.0%	0	$0.00	0.00	0.000	$0.00	0.00%	0	$0	$0.00	0.0%
Grasshopper	71,750	46.9%	2,145	1.4%	4,590	3.0%	1	$8.50	1.25	0.030	$0.26	0.59%	35,366	$344,227	$2.25	11.9%
Green Cloverworm	151,225	98.8%	5,870	3.8%	4,100	2.7%	1	$8.50	0.25	0.027	$0.23	0.25%	14,908	$163,507	$1.07	5.7%
Japanese Beetle	81,800	53.5%	0	0.0%	0	0.0%	0	$0.00	0.00	0.000	$0.00	0.00%	0	$0	$0.00	0.0%
Kudzu Bug	0	0.0%	0	0.0%	0	0.0%	0	$0.00	0.00	0.000	$0.00	0.00%	0	$0	$0.00	0.0%
Lesser Cornstalk Borer	0	0.0%	0	0.0%	0	0.0%	0	$0.00	0.00	0.000	$0.00	0.00%	0	$0	$0.00	0.0%
Mexican Bean Beetle	0	0.0%	0	0.0%	0	0.0%	0	$0.00	0.00	0.000	$0.00	0.00%	0	$0	$0.00	0.0%
Potato Leafhopper	65,000	42.5%	0	0.0%	0	0.0%	0	$0.00	0.00	0.000	$0.00	0.00%	0	$0	$0.00	0.0%
Saltmarsh Caterpillar	0	0.0%	0	0.0%	0	0.0%	0	$0.00	0.00	0.000	$0.00	0.00%	0	$0	$0.00	0.0%
Seedcorn maggot	5,000	3.3%	1,000	0.7%	0	0.0%	0	$0.00	0.70	0.000	$0.00	0.02%	1,380	$11,911	$0.08	0.4%
Slugs	20,000	13.1%	0	0.0%	0	0.0%	0	$0.00	0.50	0.000	$0.00	0.07%	3,943	$34,031	$0.22	1.2%
Soybean Aphid	39,750	26.0%	0	0.0%	0	0.0%	0	$0.00	0.00	0.000	$0.00	0.00%	0	$0	$0.00	0.0%
Soybean Looper	12,200	8.0%	1,500	1.0%	1,300	0.8%	1	$13.50	1.00	0.008	$0.11	0.08%	4,811	$59,067	$0.39	2.1%
Spider Mites	24,550	16.0%	7,700	5.0%	4,650	3.0%	1	$9.75	1.00	0.030	$0.30	0.16%	9,681	$128,883	$0.84	4.5%
Spotted Cucumber Beetle	0	0.0%	0	0.0%	0	0.0%	0	$0.00	0.00	0.000	$0.00	0.00%	0	$0	$0.00	0.0%
Stink Bugs (see box below)	63,050	41.2%	2,100	1.4%	1,200	0.8%	1	$8.50	1.50	0.008	$0.07	0.62%	37,294	$332,045	$2.17	11.5%
Threecornered Alfalfa Hopper	10,000	6.5%	0	0.0%	0	0.0%	0	$0.00	0.00	0.000	$0.00	0.00%	0	$0	$0.00	0.0%
Thrips	153,000	100.0%	0	0.0%	0	0.0%	0	$0.00	0.00	0.000	$0.00	0.00%	0	$0	$0.00	0.0%
Trochanter Mealybug	0	0.0%	0	0.0%	0	0.0%	0	$0.00	0.00	0.000	$0.00	0.00%	0	$0	$0.00	0.0%
Velvetbean Caterpillar	0	0.0%	0	0.0%	0	0.0%	0	$0.00	0.00	0.000	$0.00	0.00%	0	$0	$0.00	0.0%
Other	40	0.0%	0	0.0%	40	0.0%	1	$25.00	0.00	0.000	$0.01	0.00%	0	$1,000	$0.01	0.0%
Automatic (no insects)	0	0.0%	0	0.0%	75,000	49.0%	1	$2.00	0.00	0.490	$0.98	0.00%	0	$150,000	$0.98	5.2%

SUMMARY DATA

Data Input

State	DE
Year	2019
Total Acres	153,000
Yield/acre	38
Price/Bushel	$8.63
% Acres Scouted	70
Scouting Fee/scouted acre	$7.50
% Acres Insect Seed Trt.	25.382
Seed Trt Cost/treated ac	$5.50

Yield & Management Results

Total Bushels Harvested	5,814,000
Total Bushels Lost to Insects	219,245
Percent Yield Loss	3.63%
Yield w/o Insects	39.43
Ave. # Spray Applications	0.901
Seed Treated Acres	38,834
Scouted Acres	107,100

Economic Results

	Total	Per Acre
Foliar Insecticides Costs	$989,060	$6.46
Seed Treatment Costs	$213,589	$1.40
Scouting costs	$803,250	$5.25
Total Costs	$2,005,899	$13.11
Yield Lost to insects	$1,892,083	$12.37
Total Losses + Costs	$3,897,982	$25

Stink Bug Composition

Species	% of SB
Brown	46
Brown Marmorated	12
Green	42
Redbanded	0
Redshouldered	0
Southern Green	0
Total (make it 100%)	100