Delaware Field and Vegetable Crop Insect Pest Management Trials 2020

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The purpose of this book is to disseminate insect, mite, and mollusk efficacy and field survey 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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Peas 2020 Seedcorn Maggot

Location: Carvel REC, Georgetown, DE
NW Annex 1 Fallow
Variety: 'Jumpstart'
Planting Date: 16 March
Experimental Design: Randomized complete block design with 8 treatments, 4 replicates;
Treatment Method: Seed commercially treated by seed dealer or by Dr. Alan Taylor's lab at Cornell. Diazinon was broadcast to the soil 5 d pre plant using a 9' boom equipped with 6, 8004 nozzles calibrated to deliver 20 GPA at 42 PSI. Capture and Torac were applied at planting.
Plot size: 9 rows x 17'
Row Spacing: 8"
Plant Spacing: 250 pounds/ acre; 3,072 seeds per pound
Sample Size: 4 rows x 6'
Data Analysis: ANOVA; Tukey-Kramer HSD means separation

Notes: Fallow weedy ground was tilled and 6 tons/acre of poultry manure spread 6 days prior to planting. Moistened 'Ol Roy' dog food was spread over plots after planting at rates of 256 g per row each 1 day after planting.
UTC, Capture, Torac, and Diazinon plots did not have a fungicide on the seed. All other seed treatments had Apron XL + Maxim. Lorsban was applied by Brotherton Seed Co., Inc. Entrust, Cruiser, and Fortenza applied by Dr. Alan Taylor (Cornell) using a Hege large bowl seed coater.

TRT	Material	Rate	Stand Counts (24 row-ft)		
			April 5	**April 16**	**May 8**
1	UTC		4.25 ± 2.0 b	0.25 ± 0.25 b	0 b
2	Cruiser	0.074 mg a.i./seed	38.0 ± 13.0 b	18.0 ± 8.8 b	11.5 ± 6.2 b
3	Lorsban	0.11 mg a.i./seed	33.8 ± 11.4 b	30.0 ± 10.1 b	28.5 ± 9.9 b
4	Entrust	0.25 mg a.i./seed	35.3 ± 10.0 b	34.3 ± 11.2 b	28.0 ± 8.0 b
5	Fortenza	0.22 mg a.i/seed	41.0 ± 17.7 b	30.5 ± 15.5 b	20.5 ± 12.1 b
6	Capture LFR	6.8 fl oz	21.8 ± 4.2 b	5.3 ± 2.3 b	3.3 ± 2.6 b
7	Torac	21 fl oz	10.0 ± 5.0 b	2.8 ± 2.4 b	2.8 ± 2.4 b
8	Diazinon*	3 qts	98.8 ± 14.5 a	108.5 ± 15.3 a	99.3 ± 10.3 a
ANOVA			P <0.001 F = 6.91; df = 7, 24	P <0.001 F = 12.38; df = 7, 24	P <0.001 F = 17.98; df = 7, 24

Each plot should have had ~ 216 seeds in the sampled area.

*Diazinon was applied on 11 March; all other soil treatments were applied on 16 March.

Please note the Capture LFR label directions are for banding over the row or apply in a band over an open furrow, not broadcast unless controlling for armyworm and cutworm.

The below picture was taken 8 May after first generation seed corn maggot emerged from soil. All the dark specks on the soil surface are adult seedcorn maggot.

Sweet Corn 2020 CEW 1

Location: Carvel REC, Field
Variety: 'Obsession' and 'Obsession II'
Planting Date: June 25
Experimental Design: Randomized complete block design with 3 treatments and 4 replicates within the blocks of 'Obsession' and 'Obsession II.' Only one block of each variety was planted.
Plot size: 2 rows x 20', 60" between plots cut in at first silk 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 36 PSI.

Harvest Date: Aug-25
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
1	UTC	---	---
2	Warrior	1.92 fl. oz/A	8/5, 8/11, 8/15, 8/19, 8/23
3	Warrior + Heligen	1.92 fl. oz/A 2.4 fl. oz/A	8/5, 8/11, 8/15, 8/19, 8/23

Induce was added to all treatments at a rate of 1 pint/100 gallons spray volume. Treatments were made according to nearby pheromone trap capture.

Pheromone trap capture. Pheromone trap placed adjacent to sweet corn.

Date	Moths	Date	Moths
August 5	9	August 13	9
August 8	5	August 15	4
August 9	7	August 24 (3 nights)	15
August 10	1	August 26	14
August 11	7	August 31 (3 nights)	36
August 12	3	September 11 (10 nights)	36

Blacklight trap capture

Date	Moths	Date	Moths
August 6	0	September 3	0
August 10	0	September 7	1
August 13	1	September 10	1
August 17	0		
August 20	0		
August 24	4		
August 27	3		
August 31	0		

TRT	Worms per 25 ears				
	Small CEW	Med CEW	Large CEW	Dead	Total*
'Obsession'					
1	4.0 ± 0.7	5.0 ± 1.2 a	9.8 ± 1.0 a	0.5 ± 0.3	28.0 ± 1.8 a
2	2.5 ± 1.0	2.3 ± 0.8 ab	3.3 ± 1.2 b	2.3 ± 0.9	11.8 ± 1.3 b
3	2.0 ± 0.8	1.3 ± 0.6 b	3.8 ± 0.6 b	0.8 ± 0.3	10 ± 1.5 b
ANOVA	*NS*	*P = 0.036*	*P = 0.002*	*NS*	*P < 0.001*
'Obsession II'					
1	11.5 ± 2.7 a	10.3 ± 1.3 a	5.5 ± 2.1	1.0 ± 0.6	28.5 ± 3.2 a
2	3.0 ± 0.7 b	1.5 ± 0.6 b	1.8 ± 0.5	2.3 ± 1.2	8.8 ± 2.0 b
3	3.7 ± 1.5 ab	2.7 ± 1.2 b	1.7 ± 0.7	1.0 ± 0.6	9.3 ± 0.9 b
ANOVA	*P = 0.22*	*P = 0.001*	*NS*	*NS*	*P = 0.001*

*includes exit holes

TRT	% Clean ears	% Clean + tip ears	% Damaged ears	# sap beetle damaged kernels	# stink bug damaged kernels
'Obsession'					
1	3.3 ± 2.2 b	19.3 ± 2.5 b	80.7 ± 2.5 a	2.3 ± 2.3	136.5 ± 41.8 a
2	50.1 ± 3.6 a	72.7 ± 3.6 a	27.3 ± 5.2 b	0	15.0 ± 5.3 b
3	47.9 ± 4.6 a	71.5 ± 2.3 a	28.5 ± 2.3 b	0	3.0 ± 3.0 b
ANOVA	*P < 0.001*	*P < 0.001*	*P < 0.001*	*NS*	*P = 0.007*
'Obsession II'					
1	18.7 ± 2.1 b	65.0 ± 9.0 b	35.0 ± 9.0	8.0 ± 3.6	428.5 ± 60.2 a
2	65.9 ± 8.9 a	88.0 ± 3.2 a	12.0 ± 3.2	0	18.0 ± 10.6 b
3	65.3 ± 2.7 a	89.3 ± 3.5 a	10.7 ± 3.5	1.0 ± 1.0	13.7 ± 7.5 b
ANOVA	*P = 0.001*	*P = 0.043*	*P = 0.043*	*NS*	*P <0.001*

Sweet Corn 2020 CEW 2

Location: Carvel REC, Georgetown
Variety: 'Overland'
Planting Date: June 25
Experimental Design: Randomized complete block design with 14 treatments and 4 replicates.
Plot size: 2 rows x 23', 60" between plots.
Row Spacing: 30"
Seeding Rate: 24,000/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 36 PSI.

Harvest Date: Aug 31
Sample Size: 25 ears/plot
Data Analysis: ANOVA; Tukey-Kramer HSD means separation

Application Rates and Dates:

TRT	Material	Rate	Application Dates	App. No.
1	UTC	---	---	
2	Besiege	10.0 fl. oz/A	8/9, 8/17, 8/25	A, C, E
	Warrior	1.92 fl. oz/A	8/12, 8/21, 8/28	B, D, F
3	Elevest	9.6 fl. oz/A	8/9, 8/17, 8/25	A, C, E
	Warrior	1.92 fl. oz/A	8/12, 8/21, 8/28	B, D, F
4	Radiant + Warrior	6 fl. oz/A 1.92 fl. oz/A	8/9, 8/12, 8/17, 8/21, 8/25, 8/28	A-F
5	Lannate + Warrior	1 pt/A 1.92 fl. oz/A	8/9, 8/12, 8/17, 8/21, 8/25, 8/28	A-F
6	Warrior	1.92 fl. oz/A	8/9, 8/12, 8/17, 8/21, 8/25, 8/28	A-F
7	Baythroid	2.8 fl. oz/A	8/9, 8/12, 8/17, 8/21, 8/25, 8/28	A-F
8	Brigade	6.4 fl. oz/A	8/9, 8/12, 8/17, 8/21, 8/25, 8/28	A-F
9	Warrior + NuFilm	1.92 fl. oz/A 0.2% v/v	8/9, 8/12, 8/17, 8/21, 8/25, 8/28	A-F
10	Warrior + LI700	1.92 fl. 0z/A 0.4% v/v	8/9, 8/12, 8/17, 8/21, 8/25, 8/28	A-F

11	Heligen	1.6 fl oz/A	8/4, 8/9, 8/12, 8/17, 8/21, 8/25, 8/28	A', A-F
12	Heligen	2.4 fl oz/A	8/4, 8/9, 8/12, 8/17, 8/21, 8/25, 8/28	A', A-F
13	Heligen	2.4 fl oz/A	8/4, 8/9, 8/12, 8/21	A', A, B, D
	Warrior	1.92 fl oz/A	8/17, 8/25, 8/28	C, E, F
14	Carbaryl	1.5 pts/A	8/9, 8/12, 8/17, 8/21, 8/25, 8/28	A-F

Induce was added to all treatments at a rate of 1 pint/100 gallons spray volume unless other adjuvant noted. Treatments were made according to nearby pheromone trap capture. Treatments initiated at 10% first silk; A' treatments initiated at full tassel but before silking.

TRT	**Worms per 25 ears**				
	Small CEW	**Med CEW**	**Large CEW**	**Dead**	**Total***
1	0.8 ± 0.8	1.0 ± 0.6	6.0 ± 1.7 a	2.0 ± 0.8	28.3 ± 1.7 a
2	0.5 ± 0.3	0.3 ± 0.3	1.0 ± 0.6 b	0.8 ± 0.5	5.5 ± 1.2 e
3	0	0.3 ± 0.3	0 b	0	3.0 ± **0.9 e**
4	0	0	0.3 ± 0.3 b	0.3 ± 0.3	3.0 ± 1.0 e
5	1.3 ± 0.6	3.0 ± 1.1	3.0 ± 1.0 ab	0.3 ± 0.3	15.5 ± 1.7 bcd
6	0.3 ± 0.3	1.3 ± 1.3	1.5 ± 0.5 b	0	9.0 ± 2.3 de
7	0	0.3 ± 0.3	0 b	0.8 ± 0.5	5.0 ± 0.7 e
8	0.8 ± 0.5	1.0 ± 0.6	1.0 ± 0 b	0.8 ± 0.5	10.5 ± 1.0 de
9	0.5 ± 0.3	2.3 ± 1.0	1.3 ± 0.6 b	1.3 ± 0.3	14.8 ± 2.1 cd
10	1.3 ± 0.6	1.3 ± 0.8	2.3 ± 1.0 ab	0.8 ± 0.8	11.8 ± 2.1 de
11	1.0 ± 0.6	2.0 ± 1.5	2.3 ± 0.9 ab	3.7 ± 2.2	24.7 ± 1.2 ab
12	2.5 ± 0.9	1.3 ± 0.9	2.5 ± 0.5 ab	4.0 ± 3.0	23.5 ± 2.9 abc
13	0.8 ± 0.8	0.8 ± 0.3	0 b	3.8 ± 1.4	22.8 ± 2.5 abc
14	1.5 ± 0.6	1.5 ± 1.2	2.0 ± 1.7 ab	2.0 ± 1.2	23.0 ± 1.3 abc
ANOVA	*NS*	*NS*	*P = 0.001*	*NS*	*P < 0.001*

*includes exit holes. FAW comprised 3.7% of total confirmed worms.

TRT	% Clean ears	% Clean + tip ears	% Damaged ears	# sap beetle damaged kernels	# stink bug damaged kernels
1	2.0 ± 2.0 d	10.0 ± 8.7 d	90.0 ± 8.7 a	144.3 ± 58.0	284.3 ± 48.4 ab
2	77.3 ± 4.7 a	82.3 ± 5.9 ab	17.7 ± 5.9 cd	108.5 ± 54.5	146.8 ± 53.6 ab
3	86.8 ± 4.2 a	94.9 ± 2.0 a	5.1 ± 2.0 d	257.5 ± 112.1	41.8 ± 18.0 b
4	84.8 ± 4.1 a	90.0 ± 4.7 ab	10.0 ± 4.7 cd	31.5 ± 18.7	139.3 ± 58.8 ab
5	40.5 ± 4.8 bc	56.7 ± 7.4 bc	43.3 ± 7.4 bc	190.3 ± 103.3	200.5 ± 81.8 ab
6	64.1 ± 9.1 ab	78.0 ± 3.4 ab	22.0 ± 3.4 cd	103.5 ± 97.9	66.0 ± 19.7 b
7	78.8 ± 2.4 a	82.9 ± 3.7 ab	17.1 ± 3.7 cd	200.8 ± 69.6	222.3 ± 72.1 ab
8	62.0 ± 2.6 ab	72.0 ± 4.3 ab	28.0 ± 4.3 cd	21.0 ± 19.4	15.3 ± 6.8 b
9	40.5 ± 5.4 bc	53.6 ± 4.8 bc	46.4 ± 4.8 bc	129.5 ± 96.3	108.8 ± 30.7 ab
10	61.9 ± 5.1 ab	71.2 ± 4.2 ab	28.8 ± 4.2 cd	80.8 ± 62.7	132.8 ± 47.0 ab
11	4 ± 2.3 d	16.0 ± 10.1 cd	84.0 ± 10.1 ab	480.3 ± 197.5	302.3 ± 68.1 ab
12	16.1 ± 10.7 cd	32.3 ± 12.9 cd	67.8 ± 12.9 ab	275.3 ± 121.2	252.5 ± 93.3 ab
13	16.5 ± 6.1 cd	24.1 ± 12.0 cd	75.9 ± 12.0 ab	293.5 ± 106.8	119.8 ± 32.1 ab
14	15.2 ± 2.9 cd	28.3 ± 12.0 cd	71.7 ± 12.0 ab	285.8 ± 52.4	345.5 ± 65.8 a
ANOVA	*P < 0.001*	*P < 0.001*	*P < 0.001*	*NS*	*P = 0.002*

Sweet Corn 2020 CEW 3

Location: Lewes, DE
Variety: 'Temptress'
Planting Date:
Experimental Design: Randomized complete block design with 7 treatments and 4 replicates.
Plot size: 2 rows x 23', 60" between plots.
Row Spacing: 30"
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 36 PSI.

Harvest Date: Sept 8
Sample Size: 25 ears/plot
Data Analysis: ANOVA; Tukey-Kramer HSD means separation

Application Rates and Dates:

TRT	Material	Rate	Application Dates	App. No.
1	UTC	---	---	
2	Besiege	10.0 fl. oz/A	8/18, 8/24, 8/30	1, 3, 5
	Warrior	1.92 fl. oz/A	8/21, 8/27, 9/2	2, 4, 6
3	Elevest	9.6 fl. oz/A	8/18, 8/24, 8/30	1, 3, 5
	Warrior	1.92 fl. oz/A	8/21, 8/27, 9/2	2, 4, 6
4	Warrior	1.92 fl. oz/A	8/18, 8/21, 8/24, 8/27, 9/2	1-6
5	Baythroid	2.8 fl. oz/A	8/18, 8/21, 8/24, 8/27, 9/2	1-6
6	Heligen	2.4 fl oz/A	8/18, 8/21, 8/24, 8/27, 9/2	1-6
7	Warrior + Heligen	1.92 fl. oz/A 2.4 fl. oz/A	8/18, 8/21, 8/24, 8/27, 9/2	1-6

Induce was added to all treatments at a rate of 1 pint/100 gallons spray volume. Treatments were made according to nearby pheromone trap capture. Treatments initiated at 10% first silk.

Pheromone Trap capture

Date	Moths/night
August 20	27

August 24	24.5
August 27	37.3
August 31	16
September 3	21
September 7	7

TRT	Worms per 25 ears				
	Small CEW	Med CEW	Large CEW	Dead	Total*
1	3.5 ± 1.2 a	5.3 ± 2.3	9.3 ± 1.4 a	1.5 ± 0.5 ab	27.3 ± 1.6
2	0.3 ± 0.3 b	0.3 ± 0.3	0.5 ± 0.5 b	0.5 ± 0.3 b	1.8 ± 0.9
3	0.5 ± 0.5 b	0	0.5 ± 0.3 b	0.5 ± 0.5 b	1.3 ± 0.3
4	0.3 ± 0.3 b	1.5 ± 0.6	0.3 ± 0.3 b	0 b	6.8 ± 1.7
5	0 b	0.8 ± 0.5	1.5 ± 0.6 b	0 b	5.0 ± 1.5
6	1.5 ± 0.6 ab	4.3 ± 2.0	10.0 ± 1.9 a	3.8 ± 1.4 a	23.8 ± 1.8
7	0.3 ± 0.3 b	1.0 ± 1.0	1.3 ± 0.3 b	0 b	7.0 ± 2.0
ANOVA	*P = 0.003*	*P = 0.043*	*P <0.001*	*P = 0.003*	*P <0.001*

*includes exit holes

TRT	% Clean ears	% Clean + tip ears	% Damaged ears	# sap beetle damaged kernels	# stink bug damaged kernels
1	1.0 ± 1.0 c	34.3 ± 5.1 b	65.8 ± 5.1 a	6.0 ± 4.0	0
2	87.0 ± 4.1 ab	97.0 ± 1.0 a	3.0 ± 1.0 b	0.8 ± 0.8	0
3	92.9 ± 1.9 a	95.9 ± 1.6 a	4.1 ± 1.6 b	0	0
4	73.6 ± 7.1 ab	86.8 ± 2.0 a	13.2 ± 2.0 b	8.3 ± 5.9	0
5	78.0 ± 7.0 ab	83.0 ± 5.3 a	17.0 ± 5.3 b	0	0
6	4.1 ± 2.4 c	42.6 ± 12.7 b	57.4 ± 12.7 a	2.8 ± 1.7	0
7	63.7 ± 8.7 b	83.5 ± 3.0 a	16.5 ± 3.0 b	0	0.3 ± 0.3
ANOVA	*P < 0.001*	*P < 0.001*	*P < 0.001*	*NS*	*NS*

Sweet Corn 2020 CEW 4

Location: Carvel REC, Georgetown
Variety: 'Overland'
Planting Date:
Experimental Design: Randomized complete block design with 14 treatments and 4 replicates.
Plot size: 2 rows x 23', 60" between plots.
Row Spacing: 30"
Seeding Rate: 24,000/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 36 PSI.

Harvest Date: 10 September
Sample Size: 25 ears/plot
Data Analysis: ANOVA; Tukey-Kramer HSD means separation

Application Rates and Dates:

TRT	Material	Rate	Application Dates	App. No.
1	UTC	---	---	
2	Besiege	10.0 fl. oz/A	8/24, 8/30, 9/5	A, C, E
	Warrior	1.92 fl. oz/A	8/27, 9/2, 9/8	B, D, F
3	Elevest	9.6 fl. oz/A	8/24, 8/30, 9/5	A, C, E
	Warrior	1.92 fl. oz/A	8/27, 9/2, 9/8	B, D, F
4	Warrior	1.92 fl. oz/A	8/24, 8/27, 8/30, 9/2, 9/5, 9/8	A-F
5	Baythroid	2.8 fl. oz/A	8/24, 8/27, 8/30, 9/2, 9/5, 9/8	A-F
6	Brigade	6.4 fl. oz/A	8/24, 8/27, 8/30, 9/2, 9/5, 9/8	A-F
7	Heligen	1.6 fl oz/A	8/24, 8/27, 8/30, 9/2, 9/5, 9/8	A-F
8	Heligen	2.4 fl oz/A	8/24, 8/27, 8/30, 9/2, 9/5, 9/8	A-F
9	Heligen	2.4 fl oz/A	8/24, 8/27	A, B
	Warrior	1.92 fl oz/A	8/30, 9/2, 9/5, 9/8	D-F
10	Radiant + Warrior	6 fl. oz/A 1.92 fl. oz/A	8/24, 8/27, 8/30, 9/2, 9/5, 9/8	A-F

Induce was added to all treatments at a rate of 1 pint/100 gallons spray volume unless other adjuvant noted. Treatments initiated at 75% first silk.

TRT	Worms per 25 ears				
	Small CEW	**Med CEW**	**Large CEW**	**Dead**	**Total***
1	6.0 ± 1.4 a	14.8 ± 1.3 a	12.0 ± 0.7 a	1.0 ± 1.0 b	39.5 ± 2.7 a
2	0.5 ± 0.5 c	1.8 ± 0.5 bc	0.5 ± 0.3 c	0.3 ± 0.3 b	7.3 ± 1.3 c
3	0.5 ± 0.3 c	1.0 ± 0.7 c	0.3 ± 0.3 c	0.5 ± 0.3 b	**7.0** ± 1.7 c
4	1.3 ± 0.6 bc	1.0 ± 0.4 c	1.3 ± 0.8 c	1.3 ± 0.9 ab	13.5 ± 2.5 c
5	0.5 ± 0.3 c	1.8 ± 0.9 bc	1.5 ± 0.3 c	0.3 ± 0.3 b	9.3 ± 1.8 c
6	0.5 ± 0.5 c	2.0 ± 0.7 bc	0.5 ± 0.3 c	0.5 ± 0.3 b	13.3 ± 1.1 c
7	4.0 ± 0.6 ab	6.0 ± 1.5 b	8.0 ±1.7 b	2.3 ± 1.0 ab	30.8 ± 0.5 b
8	6.8 ± 0.9 a	5.5 ± 1.6 bc	8.5 ± 0.6 ab	2.0 ± 0.4 ab	33.5 ± 1.2 ab
9	0.8 ± 0.8 bc	3.8 ± 1.4 bc	6.8 ± 1.3 b	4.8 ± 1.5 a	26.8 ± 1.5 b
10	0.5 ± 0.3 c	1.0 ± 0.4 c	1.0 c	0.8 ± 0.3 b	8.5 ± 1.5 c
ANOVA	*P <0.001 F = 13.46; df = 9, 30*	*P <0.001 F = 16.96; df = 9, 30*	*P <0.001 F = 28.83; df = 9, 30*	*P = 0.007 F = 3.24; df = 9, 30*	*P <0.001 F = 52.58; df = 9, 30*

*includes exit holes and 'missing' worms. 'Missing' means ears that were fed upon by a worm smaller than a 6th instar, but the worm was not present at sampling.

TRT	% Clean ears	% Clean + tip ears	% Damaged ears	# sap beetle damaged kernels	# stink bug damaged kernels
1	0 c	15.0 ± 4.1 c	85.0 ± 4.1 a	13.0 ± 4.0	0
2	71.8 ± 5.6 a	91.9 ± 1.7 ab	8.1 ± 1.7 bc	9.3 ± 6.8	0
3	72.0 ± 6.7 a	93.0 ± 4.1 a	7.0 ± 4.1 c	4.3 ± 4.3	0
4	41.7 ± 6.6 b	69.1 ± 8.0 b	30.9 ± 8.0 b	5.5 ± 5.5	4.0 ± 4.0
5	64.0 ± 7.1 ab	84.0 ± 1.6 ab	16.0 ± 1.6 bc	0	0
6	46.0 ± 7.4 b	80.0 ± 6.9 ab	20.0 ± 6.9 bc	0.8 ± 0.8	0
7	2.0 ± 2.0 c	28.0 ± 4.3 c	72.0 ± 4.3 a	10.5 ± 7.1	6.3 ± 4.0
8	0 c	22.6 ± 3.8 c	77.4 ± 3.8 a	6.5 ± 2.7	3.0 ± 3.0
9	4.0 ± 1.6 c	37.7 ± 7.1 c	62.3 ± 7.1 a	19.0 ± 15.3	0.3 ± 0.3
10	62.7 ± 4.0 ab	84.2 ± 2.9 ab	15.8 ± 2.9 bc	0	0
ANOVA	*P <0.001 F = 40.22; df = 9, 30*	P <0.001 F = 40.84; df = 9, 30	P <0.001 F = 40.84; df = 9, 30	*P = 0.498 F = 0.95; df = 9, 30*	*P = 0.314 F = 1.23; df = 9, 30*

Sweet Corn 2020 Sentinel Plot CEW Bt Susceptibility

Location: Carvel REC, Field 31 East
Variety: See Table
Planting Date: 16 July
Experimental Design: Randomized complete block design with 5 varieties, 4 replicates
Plot size: 4 rows x 25'; minimum 5' alley between plots. Two large alleys separated Sh2 from Se/SH2 corn.
Row Spacing: 30"
Seeding Rate: 24,000 seeds/A

Harvest Date: 22 September
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 damaged kernels	Area Damaged (cm^2)
Obsession	Sh2	---	5.3 ± 2.5 b	34.3 ± 11.6 b	65.7 ± 11.6 a	26.5 ± 12.4	7.8 ± 1.6 a
Obsession II	Sh2	Cry1A.105 + Cry2Ab2	18.6 ± 6.5 b	63.5 ± 11.1 b	36.5 ± 11.1 a	11.8 ± 5.0	4.6 ± 1.5 ab
Providence	SE, Sh2	---	3.6 ± 3.6 b	49.0 ± 6.7 b	51.0 ± 6.7 a	20.0 ± 4.8	6.9 ± 1.2 a
BC0805 Attribute	SE, Sh2	Cry1Ab	17.4 ± 4.4 b	66.7 ± 5.2 ab	33.3 ± 5.2 ab	0	3.9 ± 0.7 ab
Remedy Attribute II	SE, Sh2	Cry1Ab + Vip3A	100 a	100 a	0 b	0.8 ± 0.8	0 b
ANOVA			*P < 0.001 F = 100.1; df = 4, 15*	*P = 0.001 F = 9.13; df = 4, 15*	*P = 0.001 F = 9.13; df = 4, 15*	*P = 0.037 F = 3.36; df = 4, 15*	*P = 0.002 F = 6.79; df = 5, 15*

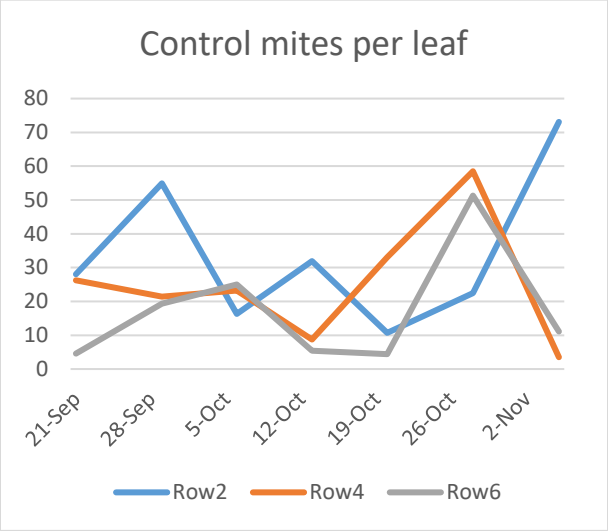
Variety	No. worms (instars) / ear							
	2nd	3rd	4th	5th	6th	Exits	Total	Median
Obsession	0.40	0.31	0.13	0.24	0.11	0.25	1.5	4th instar
Obsession II	0.40	0.27	0.17	0.08	0.01	0.11	1.1	3rd instar
Providence	0.38	0.42	0.27	0.18	0.11	0.33	1.7	4th instar
BC0805 Attribute	0.41	0.44	0.18	0.12	0.07	0.11	1.4	3rd instar

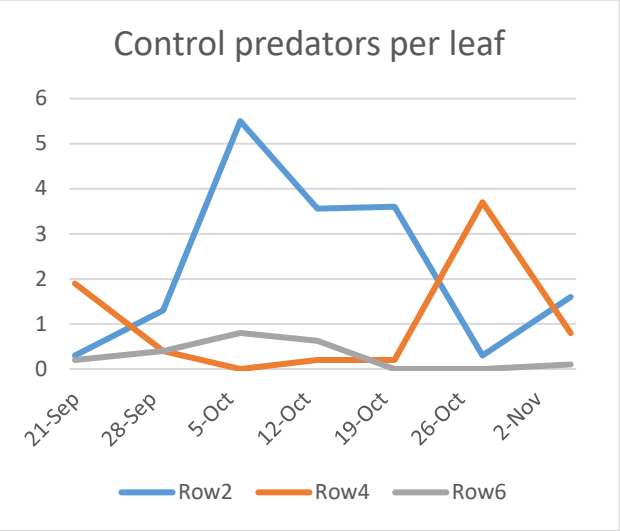
Notes: No worms were recovered from Remedy (Attribute II, Cry1ab + Vip3A). A single fall armyworm, consisting of 0.3% of worm complex, was detected in a Providence (non-Bt) ear. A single European Corn Borer was detected in a non-Bt ear.

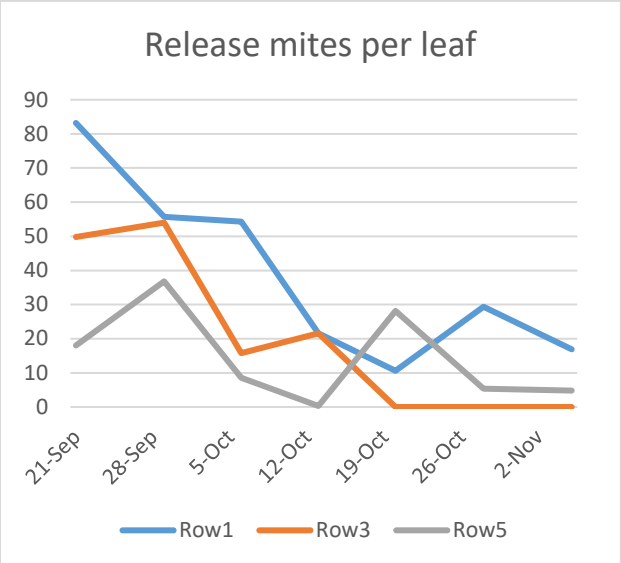
Hemp 2020 Predatory Mite Evaluation

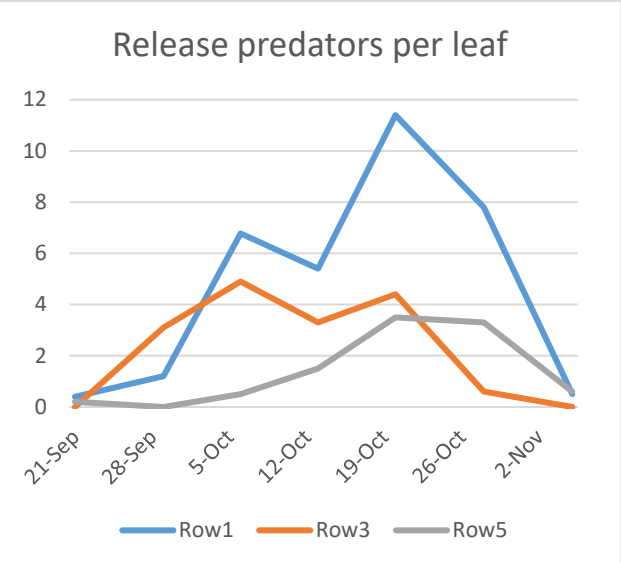
An indoor hemp operation was infested with spider mites. A spider mite population gradient existed among the 7 rows, with spider mites greatest in row 1 and least in row 7. Approximately 2,000 P. persimilis were released on each of rows 1, 3, and 5 on 14 September. Rows 2, 4, and 6 were sampled as check rows. At each sample date, 10 upper canopy hemp leaves were sampled for mites. Two weeks after release, spider mite populations were declining while predatory mite populations were increasing or plateauing. Spider mites on check rows generally increased for approximately 4 more weeks after predator mite release, until predators had migrated over or were spread to check rows in low numbers by workers.

Row 4, 5, 6, and 7 were treated with Mammoth about two weeks after predators were deployed.









Watermelon 2020 Striped Cucumber Beetle

Location: LESREC, Salisbury, MD
Variety: 'Road Trip'
'Wingman' pollinizer
Seeding Date: April 13
Transplant Date: 13 May
Experimental Design: Randomized complete block design with 6treatments and 4 replicates
Plot size: 4 rows x 30' (trts 2, 3, 7)
3 rows x 30' (trts 1, 4, 5, 6)
Treatment Method: Chemigation was done using a CO_2-pressurized tank connected to a manifold that was connected to a second drip tape that was installed at the time of plastic lay in the same manner as the primary drip tape. The manifold allowed for all rows in a plot to be treated at the same time. Drip tape was primed and flushed with 3 gallons of water at each interval. Three gallons of insecticide/nematode solution were injected per plot.
Foliar treatments were delivered using a CO_2-pressurized backpack sprayer with a 13.6' boom equipped with 8 D4 tips and #45 cores delivering 50 GPA at 62 PSI.
Treatment Dates: 10 June (trts 2, 3 (foliar), 7);
18 June (trts 3 (soil), 6), June 20 (trts 4, 5)
15 July (trts 2, 3, 7 foliar)
Cages Deployed: 18 June on all treatments except for treatment 7. Cages were constructed from 50 gallon nursery pots, fiberglass screening, hot glue, calking, and garden ties. Each cage covered one plant, three cages were deployed per plot. Cages were checked on 8 July, 15 July, 23 July and 5 August.
Sample Size: 5 plants (June)
Harvest Date: 24 July, 5 August; all melons from center row

TRT	Material	Rate	Application Type	Application Date
1	UTC	---		
2	Admire Pro Assail	10.5 fl oz 5.3 oz	Chemigation Foliar	10 June 15 July
3	Experimental	3.43 fl oz 6.85 fl oz	Foliar Chemigation	10 June, 15 July; 18 June
4	NemAttack (S. carpocapsae)	50 million IJ/1,100 ft^2	Chemigation	20 June
5	NemaSeek (H. bacteriophora)	50 million IJ/1,100 ft^2	Chemigation	20 June
6	NemAttack + NemaSeek	25 + 25 million IJ/1,100 ft^2	Chemigation	18 June
7	Harvanta	16.4 fl oz	Foliar	10 June 15 July

TRT	1 d PRE	2 DAT			8 DAT			14 DAT (24 June)		
	Beetles	Dead	Down	Alive	Dead	Down	Alive	Dead	Down	Alive
1	20.7 ± 2.4	0 c	0 c	24.0 ± 6.1	3.3 ± 3.3	0.7 ± 0.7	9.3 ± 2.9	0.3 ± 0.3 b	0	6.7 ± 2.7
2	32.0 ± 3.2	23.7 ± 1.2 a	14.7 ± 1.5 a	7.3 ± 1.2	2.0 ± 2.0	2.0 ± 1.5	6.7 ± 0.7	10.7 ± 1.9 a	2.7 ± 1.5	4.0
3	31.3 ± 13.4	12.7 ± 1.8 b	1.7 ± 0.9 bc	6.3 ± 1.5	1.3 ± 1.3	0	5.0 ± 2.1	0.3 ± 0.3 b	0	5.0 ± 2.5
4	31.7 ± 5.6	0 c	0 c	21.7 ± 8.7	0.3 ± 0.3	0	6.0 ± 1.5	0 b	0	2.7 ± 1.2
5	40.7 ± 13.8	0.3 ± 0.3 c	0 c	28.0 ± 5.9	0.7 ± 0.7	0	10.7 ± 5.0	0.3 ± 0.3 b	0.3 ± 0.3	5.3 ± 2.6
6	34.7 ± 10.7	0.3 ± 0.3 c	0.3 ± 0.3 c	28.3 ± 9.5	0.3 ± 0.3	0	8.3 ± 1.9	0.3 ± 0.3 b	0	7.0 ± 2.6
7	25.7 ± 2.7	12.7 ± 4.7 b	5.0 ± 1.2 b	32.3 ± 9.5	3.0 ± 1.2	0	11.7 ± 2.8	2.0 ± 2.0 b	0	4.7 ± 1.5
ANOVA	*P = 0.778 F = 0.53; df = 6, 14*	*P <0.001 F = 23.23; df = 6, 14*	*P <0.001 F = 47.37; df = 6, 14*	*P = 0.098 F = 2.26; df = 6, 14*	*P = 0.746 F = 0.57; df = 6, 14*	*P = 0.268 F = 1.44; df = 6, 14*	*P = 0.574 F = 0.82; df = 6, 14*	*P <0.001 F = 13.34 df = 6, 14*	*P = 0.037 F = 3.12; df = 6, 14*	*P = 0.796 F = 0.50; df = 6, 14*

TRT	0 d PRE (15 July)		2 DAT (17 July)				8 DAT (23 July)				Total Cage Emergence
	Alive	Proportion flower feeding	Dead	Down	Alive	Flower feeding	Dead	Down	Alive	Flower feeding	
1	19.0 ± 1.7	0.65 ± 0.06	0 b	0	13.0 ± 3.2	0.28 ± 0.09	0	0	3.0 ± 1.5	0.11 ± 0.11	11.0 6.2
2	12.0 ± 5.0	0.41 ± 0.21	12.7 ± 6.4 a	1.3 ± 1.3	0.7 ± 0.3	0	11.3 ± 10.8	0.3 ± 0.3	1.0 ± 1.0	0.06 ± 0.06	3.7 ± 0.9
3	12.0 ± 5.5	0.50 ± 0.26	6.3 ± 3.4 ab	0.3 ± 0.3	0	0	2.3 ± 2.3	0.7 ± 0.7	0.3 ± 0.3	0	2.7 ± 0.9
4	14.3 ± 9.8	0.39 ± 0.06	0.3 ± 0.3 b	0.3 ± 0.3	5.0 ± 3.6	0.2 ± 0.2	0	0	13.3 ± 22.2	0.094 ± 0.06	5.3 ± 2.8
5	18.3 ± 3.9	0.50 ± 0.13	0 b	0	19.3 ± 8.3	0.36 ± 0.19	0	0	22.0 ± 10.5	0.38 ± 0.21	23.3 ± 6.4
6	22.3 ± 8.3	0.48 ± 0.15	0 b	0	28.7 ± 14.0	0.21 ± 0.05	0	0	24.0 ± 12.7	0.13 ± 0.06	18.3 ± 8.7
7	19.7 ± 8.2	0.73 ± 0.20	3.7 ± 1.2 b	5.7 ± 5.7	11.7 ± 5.0	0.18 ± 0.12	0	0	2.7 ± 2.7	0	
ANOVA	*P = 0.906 F = 0.34; df = 6, 13*	*P = 0.744 F = 0.58; df = 6, 13*	*P = 0.041 F = 3.02; df = 6, 14*	*P = 0.534 F = 0.88; df = 6, 14*	*P = 0.081 F = 2.43; df = 6, 14*	*P = 0.349 F = 1.23; df = 6, 14*	*P = 0.453 F = 1.02; df = 6, 14*	*P = 0.543 F = 0.87; df = 6, 14*	*P = 0.212 F = 1.63; df = 6, 14*		*P = 0.080 F = 3.61; df = 5, 12*

TRT	# melons	Melon weight	# w/ rind feeding*	# rejects	# rejects (severe)	# groundspot feeding	TOTAL rejects
1	14.0 ± 1.0	110.4 ± 8.9	7.0 ± 1.5 a	3.3 ± 0.9	2.3 ± 0.9	3.3 ± 0.9	4.0 ± 1.0
2	13.3 ± 2.0	106.9 ± 15.2	2.0 ± 1.0 b	1.3 ± 0.3	1.3 ± 0.3	1.7 ± 0.7	1.3 ± 0.3
3	15.0 ± 1.0	120.9 ± 6.9	1.7 ± 0.3 b	1.0 ± 0.6	0.3 ± 0.3	1.0 ± 0.6	1.0 ± 0.6
4	15.0 ± 0.6	117.7 ± 2.5	4.7 ± 1.8 ab	2.7 ± 1.7	0.3 ± 0.3	3.7 ± 0.9	3 ± 1.5
5	12.7 ± 0.7	97.5 ± 7.0	6.3 ± 1.5 a	3.0 ± 1.5	2.0 ± 1.5	2.3 ± 1.3	3.7 ± 2.2
6	12.3 ± 1.8	100.2 ± 17.3	4.7 ± 0.7 ab	2.0 ± 1.0	1.3 ± 0.3	2.7 ± 1.2	3.0 ± 2.0
7	13.7 ± 1.8	110.4 ± 10.2	2.7 ± 0.9 b	1.0 ± 0.6	0.3 ± 0.3	2.3 ± 0.3	1.3 ± 0.3
ANOVA	*P = 0.739 F = 0.582; df = 6, 14*	*P = 0.707 F = 0.63; df = 6, 14*	*P = 0.037 F = 3.12; df = 6, 14*	*P = 0.547 F = 0.86; df = 6, 14*	*P = 0.306 F = 1.33; df = 6, 14*	*P = 0.441 F = 1.04; df = 6, 14*	*P = 0.562 F = 0.836; df = 6, 14*

No significant treatment differences were detected among harvest metrics at each individual evaluation, thus, harvest data was combined for this analysis.

*mean separation with student's t.

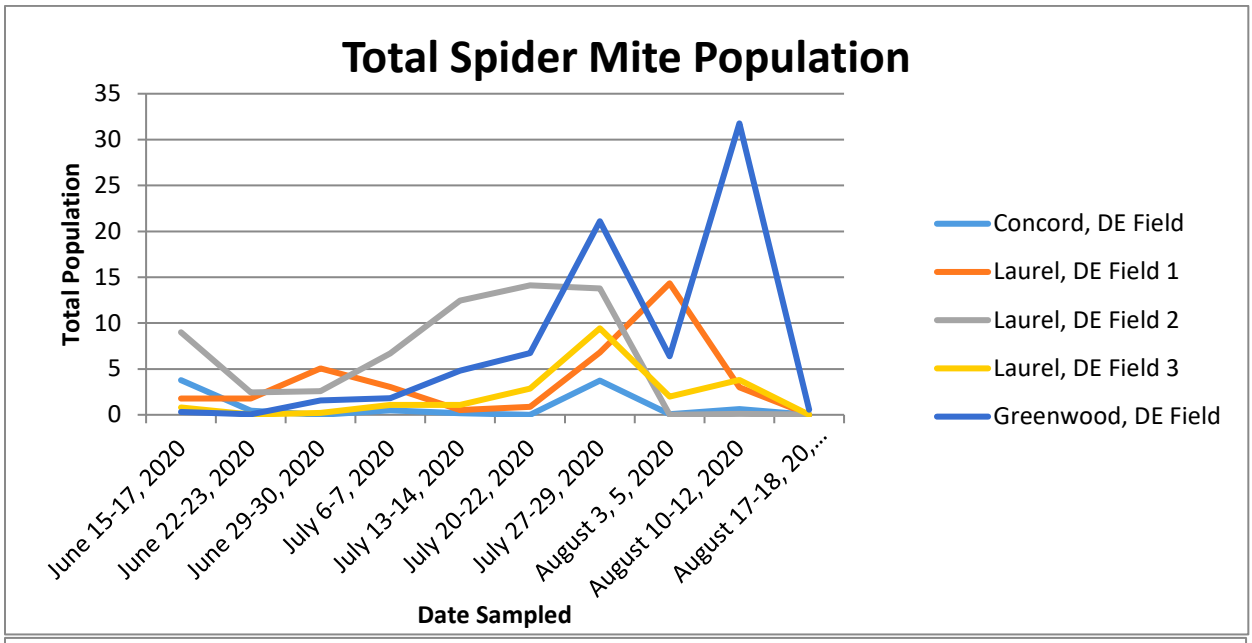
Cucumber beetle bioassays 2020

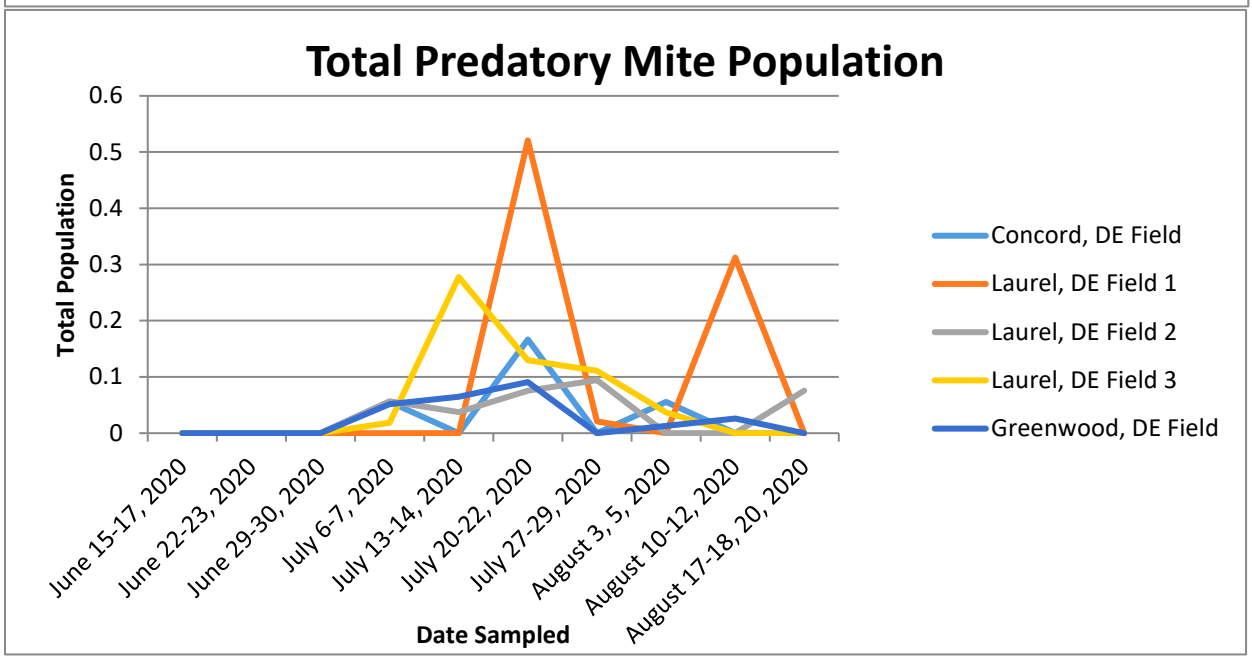
Five cucumber beetles were placed on watermelon leaves dipped in insecticide solutions and placed inside a 9cm petri dish. Dishes were held in an environmental chamber at 21.1C, 76% Rh 12:12 L:D and evaluated at regular intervals for mortality. Only beetles that were moving normally and behaving normally (as compared to the untreated check) were counted as alive. All treatments were replicated 5 times. Leaves were replaced with fresh, untreated leaves at 72 h.

TRT	**fl oz/gal**	**24h**	**72h**	**96h**	**120h**	**144h**
UTC	---	5.0	5.0	5.0	4.6 ± 0.2	4.8 ± 0.2
Sivanto Prime	0.56	1.4 ± 0.2	2.5 ± 1.0	1.6 ± 0.7	1.6 ± 0.7	1.4 ± 0.5
	0.28	2.2 ± 0.6	1.0 ± 0.5	0.6 ± 0.4	1.6 ± 0.2	1.6 ± 0.2
	0.14	1.4 ± 0.5	0.5 ± 0.3	0.6 ± 0.4	1.0 ± 0.4	1.0 ± 0.4
Experimental	0.14	0.2 ± 0.2	0.2 ± 0.2	0	0	0
	0.07	0.4 ± 0.2	0.2 ± 0.2	0.2 ± 0.2	0.2 ± 0.2	0.4 ± 0.2
	0.035	1.8 ± 0.4	1.2 ± 0.6	1.0 ± 0.4	0.8 ± 0.4	0.6 ± 0.4
Brigade	0.12	0	0	0	0	0
	0.05	0	0	0	0	0.4 ± 0.4

Watermelon 2020 Spider Mite Survey

Procedure: 5 crown leaves per stop; 1 stop per acre. The same locations in the field were sampled weekly. Mites were counted with the aid of an Optivisor 3.5x





Watermelon 2020 Two Spotted Spider Mite

Location: Carvel REC, Georgetown, DE
Field no. 11
Variety: 'Road Trip'
'Wingman' pollinizer
Seeding Date: April 24
Transplant Date: 5 June
Experimental Design: Randomized complete block design with 6treatments and 4 replicates
Plot size: 2 row x 21'
Treatment Method: Foliar treatments were delivered using a CO_2-pressurized backpack sprayer with a 13.6' boom equipped with 8 D4 tips and #45 cores delivering 50 GPA at 62 PSI.
Treatment Date: 2 July
Sample Size: 10 crown leaves

TRT	Material	Rate
1	UTC	---
2	Portal	16.0 fl oz
3	Portal Exponent	16.0 fl oz 8.0 fl oz
4	Agri-Mek	2.6 fl oz
5	Zeal	5.0 fl oz
6	Banter	14.0 fl oz

Induce was added at a rate of 2.25 pts/100 gal spray volume to all treatments

	Mobile mites per leaf			
TRT	**0 d PRE**	**6 DAT**	**12 DAT**	**20 DAT**
1	86.5 ± 29.3 a	92.6 ± 26.4 a	66.8 ± 23.4 a	8.5 ± 3.3
2	20.3 ± 5.8 b	18.6 ± 6.8 b	11.6 ± 6.7 b	6.8 ± 3.7
3	50.0 ± 17.6 ab	24.8 ± 15.3 b	18.3 ± 9.3 ab	5.0 ± 1.8
4	44.2 ± 7.2 ab	2.7 ± 1.1 b	0.6 ± 0.4 b	4.1 ± 3.5
5	15.5 ± 3.7 b	10.4 ± 4.7 b	8.2 ± 5.1 b	10.1 ± 7.3
6	40.2 ± 13.1 ab	16.5 ± 11.1 b	18.8 ± 5.9 ab	1.7 ± 0.5
ANOVA	P = 0.056 F = 2.67; df = 5, 18	P = 0.006 F = 5.00; df = 5, 16	P = 0.008 F = 4.51; df = 5, 18	P = 0.703 F = 0.60; df = 5, 18

Watermelon 2020 Aphids

Location:	Carvel REC, Georgetown, DE Field no. 11
Variety:	'Road Trip' 'Wingman' pollinizer
Seeding Date:	April 24
Transplant Date:	5 June
Experimental Design:	Randomized complete block design with 12 treatments and 4 replicates
Plot size:	1 row x 21'
Treatment Method:	Plots for soil applications were first prepared by cutting the main dripline and inserting drip couplings with shutoff valves at the beginning and end of a plot. Plots were injected with 2L of water prior to injecting 3,785 mL of insecticide solution, and followed by 2L of water. After all injections were completed, shutoff valves were reopened. Injections were delivered using a CO_2-pressurized tank at 15 PSI. Foliar treatments were delivered using a CO_2-pressurized backpack sprayer with a 6.7' boom equipped with 4 D4 tips and #45 cores delivering 50 GPA at 78 PSI.
Treatment Dates:	21 August (foliar 1), 22 August (soil 1) 4 Sept. (foliar 2 and soil 2)
Sample Size:	10 leaves
Aphid species:	All melon aphids
Notes:	Aphid populations fairly low, highly aggregated when clusters found. Hippodamia convergens present in high numbers even after two Permethrin and one Mustang Maxx applications via backpack sprayer in the 3 weeks prior to trial treatment installation.

TRT	Material	Rate	Application Type
1	UTC	---	
2	Experimental	4.01 fl oz	Foliar
3	Experimental DyneAmic 0.25% v/v	4.01 fl oz	Foliar
4	Experimental Hasten 0.25% v/v	4.01 fl oz	Foliar
5	Experimental DyneAmic 0.25% v/v	6.02 fl oz	Foliar
6	Experimenal DyneAmic 0.25% v/v	8.03 fl oz	Foliar
7	Actara DyneAmic 0.25% v/v	2 oz	Foliar
8	Sivanto HL DyneAmic 0.25% v/v	5.5 fl oz	Foliar
9	Sivanto HL	10.5 fl oz	Soil
10	PQZ DyneAmic 0.25% v/v	2.39 fl oz	Foliar
11	Sivanto Prime	28 fl oz	Soil
12	Sivanto HL	14 fl oz	Soil

Aphids per 10 leaves

TRT	1 d PRE (Aug 20)	7 DAT1 (Aug 27)	14 DAT1 (3 Sept) 1d PRE2	7 DAT2 (11 Sept)	13 DAT2 (17 Sept)
1	16.5 ± 10.5	12.8 ± 2.3 a	23.8 ± 5.8 a	13.3 ± 1.9 a	2.3 ± 1.3
2	14.3 ± 2.1	9.3 ± 5.8 ab	7.5 ± 3.5 ab	2.3 ± 1.4 c	6.5 ± 3.3
3	12.5 ± 5.3	0.5 ± 0.5 b	2.0 ± 0.7 b	0.8 ± 0.5 c	0.3 ± 0.3
4	17.5 ± 3.4	0.3 ± 0.3 b	6.3 ± 2.2 ab	0.5 ± 0.3 c	2.0 ± 1.2
5	11.3 ± 3.7	1.0 ab	6.3 ± 3.1 ab	0 c	0.3 ± 0.3
6	10.5 ± 3.2	2.8 ± 2.1 ab	2.8 ± 1.8 b	0.3 ± 0.3 c	0.3 ± 0.3
7	13.0 ± 3.8	1.3 ± 0.8 ab	7.8 ± 2.0 ab	1.8 ± 0.8 c	6.5 ± 3.1
8	10.0 ± 6.9	1.0 ± 0.4 ab	16.8 ± 10.3 ab	1.8 ± 0.3 c	1.8 ± 1.4
9	14.5 ± 4.7	6.8 ± 5.8 ab	10.3 ± 1.7 ab	3.0 ± 0.6 bc	4.0 ± 1.9
10	10.3 ± 2.3	1.8 ± 0.9 ab	7.3 ± 3.7 ab	2.0 ± 1.4 c	2.0 ± 0.8
11	15.7 ± 3.0	8.0 ± 2.9 ab	9.8 ± 4.0 ab	2.3 ± 1.0 c	12.5 ± 6.3
12	15.8 ± 8.1	13.3 ± 5.5 ab	17.5 ± 5.2 ab	12.7 ± 4.1 ab	4.0 ± 2.3
ANOVA	*P = 0.973* *F = 0.3322; df = 11, 35*	*P = 0.003* *F = 3.298; df = 11, 36*	*P = 0.021* *F = 2.46; df = 11, 36*	*P <0.001* *F = 8.65; df = 11, 35*	*P = 0.057* *F = 2.01; df = 11, 35*

Sqrt (x + 0.01) transformed for analysis. Presented are untransformed means and standard errors.

Watermelon 2020 Two Spotted Spider Mite Threshold

Location: Carvel REC, Georgetown, DE
Field no. 11
Variety: 'Road Trip'
'Wingman' pollinizer
Seeding Date: April 24
Transplant Date: 5 June
Experimental Design: Randomized complete block design with 6treatments and 4 replicates
Plot size: 2 row x 24;' 6 seedless, 3 pollinizer plants per row
Treatment Method: Foliar treatments were delivered using a CO_2-pressurized backpack sprayer with a 13.6' boom equipped with 8 D4 tips and #45 cores delivering 50 GPA at 62 PSI.
Treatment Date: 2 July
Sample Size: 10 crown leaves

TRT 1 Agri-Mek June 16; Portal July 14
TRT 2 Portal June 16; July 14
TRT 3 Oberon July 14
All applications were made using a CO2 pressurized backpack sprayer fitted with 8 D5-45 nozzles calibrated to deliver 50 GPA.

All Plots: Carbaryl June 30; Warrior 24
July 21: Assail at 5.3 oz, Radiant at 6

Treatments

TRT	Target	Season average mites/leaf
1	0	2.9 ± 1.0 b
2	0.5	3.6 ± 0.7 b
3	20	9.6 ± 1.2 a
ANOVA		*P = 0.002* *F = 13.63; df = 2, 9*

Mites Per Leaf

TRT	June 11*	June 25	July 2	July 9*	July 22*	August 10*	CMD*
1	3.5 ± 0.4	0.4 ± 0.1	12.9 ± 6.8	2.2 ± 1.0 b	0.5 ± 0.2 ab	0.3 ± 0.2	129.2 ± 47.7 b
2	2.4 ± 0.4	0.2 ± 0.0	10.0 ± 1.5	11.0 ± 6.3 ab	0.2 ± 0.1 b	1.0 ± 0.5	170.4 ± 32.0 ab
3	5.2 ± 1.6	0.5 ± 0.1	13.3 ± 8.0	37.7 ± 6.8 b	1.3 ± 0.4 a	2.0 ± 0.6	462.2 ± 50.0 a
ANOVA	*P = 0.119* *F = 2.73;* *df = 2, 9*	*P = 0.219* *F = 1.81;* *df = 2, 9*	*P = 0.917* *F = 0.09;* *df = 2, 9*	*P = 0.002* *F = 12.7;* *df = 2, 9*	*P = 0.035* *F = 5.26;* *df = 2, 8*	*P = 0.076* *F = 3.48;* *df = 2, 9*	*P = 0.009* *F = 8.26;* *df = 2, 9*

August 6 Harvest

TRT	N	Average weight	Average Brix
1	3.8 ± 0.3	8.11 ± 0.51	10.6 ± 0.4
2	7.8 ± 2.6	7.17 ± 0.59	10.4 ± 0.1
3	4.0 ± 0.7	7.89 ± 0.24	10.4 ± 0.1
ANOVA	*P = 0.183* *F = 2.07; df = 2,9*	*P = 0.377* *F = 1.09; df = 2, 9*	*P = 0.898* *F = 0.11; df = 2,9*

August 20 Harvest

TRT	N	Average weight	Average Brix
1	26.3 ± 4.6	7.22 ± 0.25	11.1 ± 0.2
2	21.8 ± 3.4	7.38 ± 0.31	11.1 ± 0.2
3	19.0 ± 1.6	7.09 ± 0.25	11.3 ± 0.2
ANOVA	*P = 0.358* *F = 1.16; df = 2, 9*	*P = 0.7834* *F = 0.25; df = 2, 8*	*P = 0.693* *F = 0.38; df = 2, 8*

September 14 Harvest

TRT	N	Average weight	Average Brix
1	16.5 ± 2.7	7.81 ± 0.25	11.0 ± 0.1
2	16.3 ± 0.9	8.08 ± 0.26	10.7 ± 0.1
3	13.5 ± 2.6	7.61 ± 0.16	10.6 ± 0.2
ANOVA	*P = 0.594* *F = 0.55; df = 2, 9*	*P = 0.391* *F = 1.05; df = 2, 9*	*P = 0.268* *F = 1.53; df = 2, 9*

Season Total

TRT	N	Average weight	Average Brix
1	46.5 ± 5.2	7.53 ± 0.25	11.0 ± 0.1
2	45.8 ± 2.2	7.52 ± 0.16	10.9 ± 0.1
3	36.5 ± 1.9	7.49 ± 0.15	11.0 ± 0.1
ANOVA	*P = 0.125* *F = 2.64*	*P = 0.987* *F = 0.01; df = 2, 9*	*P = 0.819* *F = 0.20; df = 2, 9*

Tomato 2020 Lepidopteran Pests

Location: Carvel REC, Georgetown, DE
Field no. 11
Variety: 'Red Deuce'
Planting Date: 18 June
Experimental Design: Randomized complete block design with 7 treatments, 4 replicates;
Treatment Method: CO_2-pressurized backpack sprayer with single-row boom held sideways equipped with 3 D2 tips and #45 cores delivering 45 GPA at 46 PSI. Each side of the row was sprayed, and solution was mixed for 90 GPA.
Plot size: 1 row x 38'
Row Spacing: 7'
Plant Spacing: 1.5'
Sample Size: 25 ripe tomatoes/plot/harvest (first harvest had fewer tomatoes)
Application Dates: August 3, August 10, August 18, August 24, Sept 1, Sept 9
Data Analysis: ANOVA; Tukey-Kramer HSD means separation

TRT	Material	Rate
1	UTC	---
2	Proclaim Opti	3.2 oz
3	Proclaim Opti	4.8 oz
4	Besiege	7 fl oz
5	Radiant	7 fl oz
6	Coragen	5 fl oz
7	Intrepid	10 fl oz

All treatments included LI-700 at 0.1% v/v

No phytotoxicity was observed with any treatment at any evaluation date.

Season

TRT	n harvested	n. stink bug	Weight SB (kg)	n. Leps	Weight Leps (kg)	n marketable	Weight mrktbl (kg)
1	107.5 ± 0.6	10.0 ± 1.6	2.5 ± 0.4	5.5 ± 2.2	1.0 ± 0.4	10.8 ± 2.5	2.3 ± 0.4
2	105.5 ± 0.9	6.5 ± 1.0	1.6 ± 0.3	1.5 ± 0.5	0.4 ± 0.1	14.5 ± 0.9	3.1 ± 0.3
3	102.3 ± 0.8	7.8 ± 1.4	1.9 ± 0.3	1.5 ± 0.9	0.2 ± 0.1	15.8 ± 3.4	3.2 ± 0.6
4	105.3 ± 2.4	5.8 ± 1.3	1.4 ± 0.3	1.0 ± 0.9	0.2 ± 0.1	12.8 ± 2.5	2.8 ± 0.6
5	106.3 ± 1.5	9.3 ± 1.0	2.2 ± 0.2	1.8 ± 1.4	0.3 ± 0.2	10.0 ± 1.8	2.1 ± 0.2
6	108.3 ± 1.4	12.3 ± 2.7	2.6 ± 0.7	2.0 ± 0.4	0.5 ± 0.1	13.8 ± 2.2	3.0 ± 0.5
7	106.0 ± 2.1	7.3 ± 2.2	1.6 ± 0.5	2.3 ± 1.3	0.4 ± 0.3	11.3 ± 2.5	2.5 ± 0.5
Anova	*P = 0.205 F = 1.57; df = 6, 21*	*P = 0.151 F = 1.79; df = 6, 21*	*P = 0.295 F = 1.31; df = 6, 21*	*P = 0.219 F = 1.52; df = 6, 21*	*P = 0.234 F = 1.48; df = 6, 21*	*P = 0.572 F = 0.81; df = 6, 21*	*P = 0.590 F = 0.79; df = 6, 21*

August 24

TRT	n harvested	n. stink bug	Weight SB (kg)	n. Leps	Weight Leps (kg)	n marketable	Weight mrktbl (kg)
1	6.8 ± 1.4	0.3 ± 0.3	0.05 ± 0.05	1.0 ± 0.7	0.1 ± 0.1	0.5 ± 0.3	0.21 ± 0.12
2	2.3 ± 1.1	0	0	0.3 ± 0.3	0.04 ± 0.04	0	0
3	2.3 ± 0.8	0	0	0.5 ± 0.3	0.05 ± 0.04	0	0
4	5.5 ± 1.0	0.3 ± 0.3	0.1 ± 0.1	0	0	0.8 ± 0.5	0.3 ± 0.2
5	4.8 ± 1.5	1.0 ± 0.6	0.2 ± 0.1	0.8 ± 0.8	0.1 ± 0.1	0.3 ± 0.3	0.04 ± 0.04
6	4.3 ± 0.8	0.3 ± 0.3	0.04 ± 0.04	0.5 ± 0.5	0.1 ± 0.1	0.5 ± 0.5	0.04 ± 0.04
7	4.3 ± 1.9	0	0	0.3 ± 0.3	0.1 ± 0.1	0.3 ± 0.3	0.05 ± 0.05
Anova		*P = 0.175 F = 1.68; df = 6, 21*	*P = 0.177 F = 1.67; df = 6, 21*	*P = 0.786 F = 0.52; df = 6, 21*	*P = 0.904 F = 0.35; df = 6, 21*	*P = 0.589 F = 0.78; df = 6, 21*	*P = 0.138 F = 1.85; df = 6, 21*

Sept 1

TRT	n harvested	n. stink bug	Weight SB (kg)	n. Leps	Weight Leps (kg)	n marketable	Weight mrktbl (kg)
1	25	5.0 1.6	1.2 ± 0.4	0.5 ± 0.3	0.1 ± 0.1	0.3 ± 0.3	0.1 ± 0.1
2	25	2.0 ± 0.8	0.5 ± 0.2	0.8 ± 0.3	0.2 ± 0.1	1.5 ± 0.6	0.5 ± 0.2
3	25	1.5 ± 0.9	0.5 ± 0.3	0	0	2.8 ± 0.9	0.7 ± 0.2
4	25	2.0	0.5 ± 0.1	0.5 ± 0.5	0.1 ± 0.1	2.3 ± 1.3	0.5 ± 0.3
5	25	4.5 ± 0.6	1.2 ± 0.2	0.8 ± 0.5	0.2 ± 0.1	1.8 ± 0.5	0.4 ± 0.1
6	25	2.8 ± 0.9	0.7 ± 0.3	0.8 ± 0.5	0.2 ± 0.1	0.8 ± 0.5	0.2 ± 0.1
7	25	2.3 ± 1.4	0.6 ± 0.3	1.0 ± 0.7	0.2 ± 0.2	0.5 ± 0.5	0.1 ± 0.1
Anova		*P = 0.148 F = 1.80; df = 6, 21*	*P = 0.212 F = 1.55; df = 6, 21*	*P = 0.784 F = 0.523; df = 6, 21*	*P = 0.729 F = 0.598; df = 6, 21*	*P = 0.196 F = 1.60; df = 6, 21*	*P = 0.203 F = 1.58; df = 6, 21*

Sept 9

TRT	n harvested	n. stink bug	Weight SB (kg)	n. Leps	Weight Leps (kg)	n marketable	Weight mrktbl (kg)
1	25	2.0 ± 0.7 ab	0.7 ± 0.2	0.8 ± 0.8	0.2 ± 0.2	2.0 ± 0.4	0.5 ± 0.1
2	25	2.0 ± 0.7 ab	0.5 ± 0.2	0.5 ± 0.3	0.1 ± 0.1	1.3 ± 0.3	0.4 ± 0.04
3	25	3.3 ± 0.5 ab	0.8 ± 0.1	0	0	1.5 ± 1.0	0.4 ± 0.2
4	25	1.3 ± 0.5 ab	0.4 ± 0.1	0	0	1.3 ± 0.5	0.4 ± 0.1
5	25	1.5 ± 0.3 ab	0.4 ± 0.1	0.3 ± 0.3	0.04 ± 0.04	1.5 ± 0.9	0.4 ± 0.3
6	25	4.8 ± 2.9 a	1.0 ± 0.4	0.3 ± 0.3	0.1 ± 0.1	1.5 ± 0.3	0.4 ± 0.1
7	25	1.0 ± 0.6 b	0.2 ± 0.1	0.3 ± 0.3	0.03 ± 0.03	1.0 ± 0.7	0.2 ± 0.1
Anova		*P = 0.024 F = 3.11; df = 6, 21*	*P = 0.124 F = 1.92; df = 6, 21*	*P = 0.727 F = 0.60; df = 6, 21*	*P = 0.632 F = 0.729; df = 6, 21*	*P = 0.952 F = 0.254; df = 6, 21*	*P = 0.919 F = 0.32; df = 6, 21*

September 16

TRT	n harvested	n. stink bug	Weight SB (kg)	n. Leps	Weight Leps (kg)	n marketable	Weight mrktbl (kg)
1	25.8 ± 0.9	2.0 ± 0.7	0.4 ± 0.2	0	0	2.3 ± 1.9	0.4 ± 0.4
2	26 ± 0.4	2.3 ± 0.8	0.6 ± 0.2	0	0	3.0 ± 0.9	0.6 ± 0.2
3	24.5 ± 0.5	1.5 ± 0.5	0.3 ± 0.1	0	0	4.5 ± 1.0	0.8 ± 0.2
4	25 ± 2.1	1.3 ± 0.6	0.3 ± 0.2	0.3 ± 0.3	0.03 ± 0.03	1.5 ± 0.6	0.3 ± 0.1
5	25.8 ± 0.5	1.3 ± 0.5	0.3 ± 0.1	0	0	1.0	0.2 ± 0.03
6	26 ± 0.6	4.0 ± 0.7	0.7 ± 0.2	0	0	3.5 ± 0.9	0.7 ± 0.2
7	26.3 ± 0.9	2.8 ± 0.6	0.6 ± 0.1	0	0	1.5 ± 0.6	0.4 ± 0.2
Anova		*P = 0.062 F = 2.41; df = 6, 21*	*P = 0.411 F = 1.07; df = 6, 21*	*P = 0.451 F = 1.0; df = 6, 21*	*P = 0.451 F = 1.0; df = 6, 21*	*P = 0.203 F = 1.58; df = 6, 21*	*P = 0.340 F = 1.21; df = 6, 21*

Sept 23

TRT	n harvested	n. stink bug	Weight SB (kg)	n. Leps	Weight Leps (kg)	n marketable	Weight mrktbl (kg)
1	25	0.8 ± 0.5	0.2 ± 0.1	3.3 ± 0.6 a	0.6 ± 0.1 a	5.8 ± 0.9	1.1 ± 0.1
2	27.3 ± 0.5	0.3 ± 0.3	0.04 ± 0.04	0 b	0 b	8.8 ± 1.1	1.6 ± 0.3
3	25.5 ± 0.3	1.5 ± 0.6	0.2 ± 0.1	1.0 ± 0.7 b	0.2 ± 0.1 b	7.0 ± 2.0	1.3 ± 0.4
4	24.8 ± 0.3	1.0 ± 0.7	0.2 ± 0.1	0.3 ± 0.3 b	0.1 ± 0.1 b	7.0 ± 1.3	1.4 ± 0.2
5	25.8 ± 0.5	1.0 ± 0.4	0.2 ± 0.1	0 b	0 b	5.5 ± 2.3	1.0 ± 0.4
6	28.0 ± 1.4	0.5 ± 0.5	0.1 ± 0.1	0.5 ± 0.3 b	0.1 ± 0.05 b	7.5 ± 0.9	1.6 ± 0.3
7	25.5 ± 0.6	1.3 ± 0.5	0.3 ± 0.1	0.8 ± 0.5 b	0.1 ± 0.1 b	8.0 ± 2.0	1.7 ± 0.4
Anova		*P = 0.655 F = 0.697; df = 6, 21*	*P = 0.736 F = 0.59; df = 6, 21*	*P < 0.001 F = 7.08; df = 6, 21*	*P < 0.001 F = 8.03; df = 6, 21*	*P = 0.772 F = 0.54; df = 6, 21*	*P = 0.593 F = 0.783; df = 6, 21*

Lima Bean 2020 Thrips

Location: Carvel REC, Georgetown, DE
Variety: 'Cypress'
Planting Date: 16 July
Experimental Design: Randomized complete block design with 8 treatments, 4 replicates;
Treatment Method: Foliar treatments were delivered using a CO_2-pressurized backpack sprayer with a 9' boom equipped with 6, 8004 nozzles calibrated to deliver 20 GPA at 42 PSI.
Plot size: 4 rows x 15'
Row Spacing: 30"
Sample Size: 10 flowers
Data Analysis: ANOVA; Tukey-Kramer HSD means separation

TRT	Material	Rate
1	UTC	---
2	Radiant	8 fl oz
3	Radiant	6 fl oz
4	Radiant + Transform	6 fl oz 1.5 oz
5	Radiant + Transform	6 fl oz 2.25 oz
6	Sivanto HL	5.5 fl oz
7	Besiege	7.5 fl oz
8	Torac	21 fl oz

TRT	1 d PRE 6 August	3 DAT 10 August	7 DAT 14 August	17 DAT 24 August
1	22.0 ± 4.2	11.5 ± 1.8 a	19.0 ± 4.1	3.3 ± 1.3
2	18.8 ± 4.2	7.0 ± 1.0 abc	16.8 ± 1.7	3.8 ± 1.1
3	20.5 ± 6.0	4.5 ± 1.6 bc	8.3 ± 2.4	1.8 ± 0.5
4	23.3 ± 5.6	4.8 ± 1.4 bc	17.0 ± 2.7	1.8 ± 0.5
5	24.5 ± 5.8	6.0 ± 0.7 abc	9.5 ± 3.9	1.5 ± 0.3
6	22.5 ± 4.4	8.5 ± 2.2 ab	17.3 ± 5.0	3.5 ± 1.6
7	25.3 ± 8.8	2.0 ± 0.6 c	6.3 ± 1.1	1.8 ± 0.5
8	19.5 ± 4.3	2.5 ± 0.6 bc	8.0 ± 4.0	3.8 ± 0.3
ANOVA	P = 0.999 F = 0.17; df = 7, 24	P = 0.001 F = 5.26; df = 7, 24	P = 0.055 F = 2.37; df = 7, 24	P = 0.278 F = 1.33; df = 7, 24

Snap Bean 2020 Thrips

Location: Carvel REC, Georgetown, DE
Variety: 'Roma II'
Planting Date: 3 June
Experimental Design: Randomized complete block design with 8 treatments, 4 replicates;
Treatment Method: Foliar treatments were delivered using a CO_2-pressurized backpack sprayer with a 9' boom equipped with 6, 8004 nozzles calibrated to deliver 22.2 GPA at 42 PSI.
Plot size: 4 rows x 15'
Row Spacing: 30"
Sample Size: 10 flowers for thrips, 10 full expanded mid-upper canopy leaflets for leafhoppers
Data Analysis: ANOVA; Tukey-Kramer HSD means separation

TRT	Material	Rate
1	UTC	---
2	Radiant	6.7 fl oz
3	Radiant	8.9 fl oz
4	Radiant + Transform	6.7 fl oz 1.67 oz
5	Radiant + Transform	6.7 fl oz 2.5 oz
6	Sivanto HL	6.1 fl oz
7	Besiege	8.3 fl oz
8	Torac	23.3 fl oz

Potato Leafhopper

TRT	0d PRE 7 July	2 DAT July 9	11 DAT July 18
1	19.8 ± 2.8	28.3 ± 6.1 a	28.8 ± 5.5 a
2	14.0 ± 2.6	21.3 ± 5.2 a	22.8 ± 2.3 ab
3	13.8 ± 2.0	23.3 ± 5.1 a	29.3 ± 3.0 a
4	16.3 ± 4.2	22.0 ± 3.0 a	27.3 ± 5.2 a
5	13.5 ± 1.6	22.5 ± 2.8 a	30.8 ± 2.6 a
6	14.0 ± 3.7	17.3 ± 4.3 ab	23.0 ± 1.7 ab
7	11.3 ± 8.8	1.3 ± 0.6 b	10.0 ± 2.0 b
8	15.3 ± 4.9	17.5 ab	18.3 ± 3.0 ab
ANOVA	P = 0.812 F = 0.52; df = 7, 24	P = 0.006 F = 3.87; df = 7, 24	P = 0.005 F = 4.07; df = 7, 24

Thrips/10 flowers

TRT	0d PRE 7 July	2 DAT July 9	11 DAT July 18
1	31.5 ± 4.2	81.0 ± 16.2 ab	105.5 ± 15.8 a
2	39.0 ± 5.6	30.8 ± 8.9 bc	80.5 ± 4.8 ab
3	42.5 ± 6.2	45.0 ± 6.1 abc	80.8 ± 2.9 ab
4	42.5 ± 2.7	47.0 ± 15.4 abc	72.3 ± 2.1 ab
5	55.3 ± 6.5	54.5 ± 14.5 abc	64.0 ± 10.9 b
6	48.5 ± 2.8	94.0 ± 14.8 a	69.3 ± 5.9 ab
7	40.3 ± 6.7	17.0 ± 4.2 c	99.8 ± 7.3 ab
8	43.0 ± 4.5	74.3 ± 15.7 abc	83.8 ± 7.4 ab
ANOVA	P = 0.127 F = 1.83; df = 7, 24	P = 0.004 F = 4.16; df = 7, 24	P = 0.019 F = 3.05; df = 7, 24

Kale 2020

Location: Carvel REC, Georgetown, DE
Field 25-B
Variety: 'Black Magic'
Transplant Date: 10 June
Seeding Date: 24 April
Experimental Design: Randomized complete block design with 6 treatments and 4 replicates
Plot size: 2 rows x 15', row 1 treated, row 2 untreated guard; 30" between rows and 60" between plots
Plant Spacing: 1.5'
Treatment Method: CO_2-pressurized backpack sprayer with single-row boom equipped with 3 D2 tips and #45 cores delivering 45 GPA at 46 PSI.

Application Dates: Application 1: July 11; Application 2: July 18; Application 3: July 29
Sample Size: 5 plants/plot;
Data Analysis: ANOVA; Tukey-Kramer HSD means separation

TRT	Material	Rate
1	UTC	---
2	Experimental[I]	---
3	Coragen	6.0 fl. oz
4	Proclaim Opti	4.8 oz.
5	Torac	21.0 fl. oz
6	Experimental[B]	---

*All treatments except 1 (UTC) had Dyne-Amic at 0.25% v/v.

July 9 (2D PRE)

TRT	ICW	CL	DBM	Other	Total
1	0	0	1.3 ± 0.5	0	1.3 ± 0.5
2	0.8 ± 0.5	0	0.8 ± 0.5	0	1.5 ± 0.6
3	0.8 ± 0.8	0	2.0 ± 0.4	0	2.8 ± 0.9
4	0	0	1.0 ± 0.4	0	1.0 ± 0.4
5	0.3 ± 0.3	0	1.0 ± 0.4	0	1.5 ± 0.5
6	2.0 ± 1.7	0	1.0 ± 0.4	0	3.0 ± 1.4
ANOVA	*P = 0.487 F = 0.925; df = 5, 18*		*P = 0.434 F = 1.02; df = 5, 18*		*P = 0.373 F = 1.14; df = 5, 18,*

July 16 (5 DAT; 2 D PRE APP2)

TRT	ICW	CL	DBM	Other	Total
1	4.3 ± 1.3 a	5.3 ± 1.9 a	3.5 ± 1.9	0	13.0 ± 4.3 a
2	0 b	0 b	0	0	0 b
3	0 b	0 b	0.3 ± 0.3	0	0.3 ± 0.3 b
4	0.8 ± 0.8 ab	4.0 ± 2.3 ab	0	0	4.8 ± 2.8 ab
5	2.0 ± 1.4 ab	6.3 ± 2.1 a	0.8 ± 0.5	0	9.0 ± 2.0 ab
6	0.5 ± 0.5 ab	0 b	0	0	0.5 ± 0.5 b
ANOVA	*P = 0.020 F = 3.57; df = 5, 18*	*P =0.014 F = 3.89; df = 5, 18*	*P = 0.041 F = 2.94; df = 5, 18*		*P = 0.003 F = 5.68; df = 5, 18*

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July 21 (3 DAT)

TRT	ICW	CL	DBM	Other	Total
1	1.5 ± 1.5	9.3 ± 7.0	1.8 ± 0.6	0.3 ± 0.3	12.8 ± 9.2
2	0	0	0	0	0
3	0	0.3 ± 0.3	0.3 ± 0.3	0	0.5 ± 0.5
4	0.5 ± 0.3	1.0 ± 0.7	0.8 ± 0.8	0	2.3 ± 1.6
5	0.8 ± 0.5	5.0 ± 3.5	0	0	5.8 ± 4.0
6	0.3 ± 0.3	0	0.3 ± 0.3	0	0.5 ± 0.5
ANOVA	*P = 0.602 F = 0.74; df = 5, 18*	*P = 0.281 F = 1.37; df = 5, 18*	*P = 0.070 F = 2.49; df = 5, 18*	*P = 0.446 F = 1.00; df = 5, 18*	*P = 0.267 F = 1.41; df = 5, 18*

July 29 (11 DAT; Pre APP3)

TRT	ICW	CL	DBM	Other	Total
1	6.5 ± 2.7	2.8 ± 2.4	3.0 ± 1.2 a	0	12.3 ± 5.5
2	6.8 ± 1.9	0	0 b	0	6.8 ± 1.9
3	1.3 ± 0.5	0	0.3 ± 0.3 b	0	1.5 ± 0.3
4	5.5 ± 2.5	1.3 ± 0.6	0.8 ± 0.3 ab	0	7.5 ± 2.3
5	10.0 ± 6.0	7.0 ± 3.0	0.3 ± 0.3 b	0	17.3 ± 8.3
6	2.8 ± 1.5	1.0 ± 0.7	0.8 ± 0.5 ab	0	4.5 ± 1.5
ANOVA	*P = 0.420 F = 1.05; df = 5,18*	*P = 0.058 F = 2.64; df = 5, 18*	*P = 0.016 F = 3.81; df = 5, 18*		*P = 0.174 F = 1.75; df = 5, 18*

7.31 (2 DAT)

TRT	ICW	CL	DBM	Other	Total
1	16.0 ± 4.4 a	5.5 ± 2.6 ab	0.3 ± 0.3	0	21.8 ± 7.1 a
2	0.5 ± 0.3 b	0 b	0	0	0.5 ± 0.3 b
3	1.3 ± 0.6 b	0 b	0.3 ± 0.3	0	1.5 ± 0.5 b
4	0.8 ± 0.5 b	0.8 ± 0.5 ab	0	0	1.5 ± 0.5 b
5	8.8 ± 3.5 ab	7.8 ± 2.8 a	0	0	16.5 ± 5.8 ab
6	0.3 ± 0.3 b	0 b	0	0	0.3 ± 0.3 b
ANOVA	*P = 0.001 F = 7.84; df = 5, 18*	*P = 0.006 F = 4.70; df = 5, 18*	*P = 0.564 F = 0.80; df = 5, 18*		*P = 0.001 F = 6.39; df = 5, 18*

August 6 (7 DAT)

TRT	ICW	CL	DBM	Other	Total
1	16.3 ± 9.7	10.3 ± 3.4 a	1.3 ± 0.3	0	27.8 ± 12.4 a
2	0.5 ± 0.5	0.5 ± 0.5 ab	0	0	1.0 ± 1.0 ab
3	0	0 b	0	0	0 b
4	0.3 ± 0.3	1.0 ± 1.0 ab	0.3 ± 0.3	0	1.5 ± 1.2 ab
5	10.8 ± 4.2	8.0 ± 4.0 ab	1.0 ± 0.6	0	19.8 ± 7.3 ab
6	2.5 ± 1.7	1.8 ± 1.0 ab	0.5 ± 0.5	0	4.8 ± 2.4 ab
ANOVA	*P = 0.073 F = 2.46; df = 5, 18*	*P = 0.016 F = 3.81; df = 5, 18*	*P = 0.085 F = 2.33; df = 5, 18*		*P = 0.001 F = 6.39; df = 5, 18*

No phytotoxicity was observed with any treatment at any evaluation date.

Cabbage 2020

Location: Carvel REC, Georgetown, DE
Field 25-B
Variety: 'Ramada'
Transplant Date: 13 August
Seeding Date: 10 July
Experimental Design: Randomized complete block design with 14 treatments and 4 replicates
Plot size: 2 rows x 20', row 1 treated, row 2 untreated guard; 5' between rows
Plant Spacing: 1.9'
Treatment Method: CO_2-pressurized backpack sprayer with single-row boom equipped with 3 D2 tips and #45 cores delivering 45 GPA at 46 PSI.

Sept 24 application used a single row boom the outer two nozzles on drop tubes and oriented perpendicular to the ground to achieve maximum side-coverage, boom was fitted with 3 D2 tips and #45 cores delivering 45 GPA at 36 PSI.

Application Dates: Application 1 (trts 1-12) = 28 Aug 2PM
Application 1 (trts 13, 14) = 30 Aug 2PM
Application 2 = 11 Sept 10AM
Application 3 = 24 Sept 2PM
Application 4 = 15 October 2 PM
Harvest Date: 27 October
Sample Size: 5 plants/plot;
Data Analysis: ANOVA; Tukey-Kramer HSD means separation
TRTS 10, 11, and 12 were excluded from Lepidopteran data analysis, as the products used were not expected to result in worm suppression.

TRT	Material	Rate
1	UTC	---
2	Proclaim Opti	3.2 oz
3	Procaim Opti	4.8 oz
4	Radiant	8.0 fl oz
5	Coragen	6.0 fl oz
6	Intrepid	9.0 fl oz
7	Experimental	2.74 fl oz
8	Rimon	12.0 fl oz
9	Torac	21.0 fl oz
10	Sivanto HL Induce	7.0 fl oz 1.9 pts/100 gal
11	Sivanto HL Dyne-Amic	7.0 fl oz
12	Admire Pro	1.3 fl oz
13	Spear Lep Leprotect	2 pt 1 pt
14	Leprotect	1 pt

* Unless otherwise noted, all treatments applied with the addition of Dyne-Amic at 0.25% v/v.

*All plots except for trt 1, 10, 11, and 12 were treated with Actara due to harlequin bug presence and damage on 9 Sept.

**Trts 10, 11, and 12 were treated with Leprotect due to worm presence and damage on Sept. 4 and Sept. 11 and Sept. 24.

3 heads had aphids present at harvest, one each from trt 1, 7, and 8. Aphid-damaged heads are not considerable marketable, but were excluded from Lep damage ratings

Harvest Results

10 heads harvested/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.

TRT	% Marketable	Damage Rating
1	62.5 ± 4.8 b	2.4 ± 0.1 a
2	89.7 ± 8.2 ab	1.0 ± 0.3 bcd
3	94.7 ± 3.1 ab	0.7 ± 0.2 bcd
4	100 a	0.4 ± 0.04 d
5	92.5 ± 2.5 ab	0.6 ± 0.1 cd
6	82.5 ± 6.3 ab	1.3 ± 0.3 abcd
7	95.0 ± 2.9 ab	0.7 ± 0.1 bcd
8	100 a	0.4 ± 0.1 d
9	60.0 ± 9.1 b	1.9 ± 0.2 ab
10	80.9 ± 8.5	1.4 ± 0.4
11	80.0 ± 4.1	1.6 ± 0.1
12	57.5 ± 7.5	2.0 ± 0.1
13	70.0 ± 14.7 ab	1.7 ± 0.6 abc
14	67.5 ± 13.8 ab	1.9 ± 0.3 ab
ANOVA	P = 0.001 F = 4.37; df = 10, 33	P < 0.001 F = 7.10; df = 10, 33

1 Day PRE

TRT	ICW	CL	DBM	Other	Total	Harlequin Bugs	Aphids
1	7.5 ± 2.5	1.3 ± 0.5	0.3 ± 0.	0.8 ± 0.5	9.8 ± 2.8	0	3.0 ± 1.8
2	9.5 ± 1.3	0.3 ± 0.3	0	0.3 ± 0.3	10.0 ± 1.1	0	5.3 ± 4.3
3	6.3 ± 3.4	0.8 ± 0.5	0	0	7.0 ± 3.6	0	4.5 ± 4.5
4	10.0 ± 2.5	2.0 ± 1.2	0	0	12.0 ± 3.4	0	3.5 ± 2.1
5	5.0 ± 1.4	0	0.3 ± 0.3	0	5.3 ± 1.3	0	1.5 ± 0.9
6	5.5 ± 3.2	0.8 ± 0.8	0	0	6.3 ± 3.2	0	2.8 ± 2.8
7	7.3 ± 1.9	0.3 ± 0.3	0.3 ± 0.3	0	7.8 ± 2.2	0	0.5 ± 0.3
8	9.0 ± 3.8	0.5 ± 0.3	0	0.3 ± 0.3	9.8 ± 3.9	0	8.8 ± 3.8
9	5.0 ± 0.7	0.8 ± 0.5	0.3 ± 0.3	0.5 ± 0.5	6.5 ± 1.3	0	2.8 ± 2.4
10	3.8 ± 1.1	0.3 ± 0.3	0.3 ± 0.3	0	4.3 ± 1.4	0	0.3 ± 0.3
11	8.8 ± 3.0	2.0 ± 0.7	0	0.8 ± 0.8	11.5 ± 3.1	0	7.5 ± 5.5
12	5.8 ± 3.9	0.8 ± 0.3	0.5 ± 0.5	0.5 ± 0.5	7.5 ± 5.0	0	7.5 ± 7.5
13	7.0 ± 2.5	0.8 ± 0.5	0.5 ± 0.5	0	8.3 ± 3.1	0	0.5 ± 0.5
14	4.3 ± 2.0	1.0 ± 0.4	0	0.3 ± 0.3	5.5 ± 1.7	0	4.3 ± 2.7
ANOVA	*P = 0.784 F = 0.62; df = 10, 33*	*P = 0.476 F = 0.98; df = 10, 33*	*P = 0.761 F = 0.65; df = 10, 33*	*P = 0.426 F = 1.05; df = 10, 33*	*P = 0.765 F = 0.65; df = 10, 33*		*P = 0.714 F = 0.53; df = 4, 15*

*'Other' may include beet armyworm, fall armyworm, yellow-striped armyworm, corn earworm, cross striped cabbage worm, beet webworm, and an occasional unidentified worm.

3 DAT1 (Aug 31, trt 1-12; Sept 2, trt 13, 14)

TRT	ICW	CL	DBM	Other	Total	Harlequin Bugs	Aphids
1	7.0 ± 5.4	0.5 ± 0.3	0.3 ± 0.3 b	1.3 ± 1.3	9.0 ± 6.7	0.5 ± 0.5	1.0 ± 1.0
2	0.5 ± 0.5	0	0 b	0	0.5 ± 0.5	0.5 ± 0.3	7.5 ± 4.3
3	0.5 ± 0.5	0	0 b	0	0.5 ± 0.5	0.3 ± 0.3	3.8 ± 2.4
4	1.8 ± 1.4	0	0 b	0.3 ± 0.3	2.0 ± 1.4	0	0.5 ± 0.5
5	0.8 ± 0.3	0	0 b	0	0.8 ± 0.3	0	19.3 ± 18.3
6	0.8 ± 0.5	0	0.3 ± 0.3 b	0	1.0 ± 0.4	0.5 ± 0.5	0
7	0	0	0 b	0	0	0	2.0 ± 2.0
8	2.8 ± 0.8	0.3 ± 0.3	0 b	0	3.0 ± 0.7	1.3	1.8 ± 0.9
9	2.3 ± 0.6	0	0 b	0.3 ± 0.3	2.5 ± 0.6	0.3 ± 0.3	0
10	3.5 ± 1.0	0.5 ± 0.3	0.5 ± 0.5 b	0	4.5 ± 0.6	0.3 ± 0.3	0
11	4.5 ± 1.7	0.3 ± 0.3	0.3 ± 0.3 b	0.3 ± 0.3	5.3 ± 1.8	3.0 ± 3.0	1.5 ± 1.2
12	3.5 ± 2.3	1.3 ± 0.8	0.8 ± 0.8 b	0	5.5 ± 2.6	1.0 ± 1.0	0.3 ± 0.3
13	1.3 ± 0.3	1.0 ± 0.7	2.0 ± 0.8 a	0	4.3 ± 1.4	0	7.3 ± 4.7
14	3.3 ± 1.5	0.8 ± 0.3	0.8 ± 0.8 ab	0.3 ± 0.3	5.0 ± 1.2	1.0 ± 1.0	9.5 ± 3.5
ANOVA	*P = 0.301 F = 1.24; df = 10, 33*	*P = 0.062 F = 2.03; df = 10, 33*	*P = 0.008 F = 3.03; df = 10, 33*	*P = 0.568 F = 0.87; df = 10, 33*	*P =0.174 F = 1.53; df = 10, 33*	*P =0.637 F =0.65; df = 4, 15*	*P = 0.48 F = 0.91; df = 4, 15*

2nd evaluation Post TRT 1 (5 DAT, trts 1-12; 7 DAT trt 13, 14)

TRT	ICW	CL	DBM	Other	Total	Harlequin Bugs*	Aphids*
1	9.8 ± 1.3 a	2.0 ± 1.4 ab	1.5 ± 1.2	0	13.3 ± 3.5 a	1.3 ± 0.6	23.0 ± 2.4 a
2	0.3 ± 0.3 b	0.8 ± 0.8 ab	0.8 ± 0.5	0	1.8 ± 0.6 b	7.0 ± 3.8	23.3 ± 6.4
3	1.5 ± 0.9 b	0 b	0	0	1.5 ± 0.9 b	0.5 ± 0.5	25.0 ± 7.0
4	0.3 ± 0.3 b	0.5 ± 0.5 ab	0.5 ± 0.3	0	1.3 ± 0.6 b	0.3 ± 0.3	8.5 ± 1.3
5	0.3 ± 0.3 b	0 b	1.3 ± 0.9	0	1.5 ± 0.9 b	1.5 ± 0.9	20.5 ± 11.9
6	4.0 ± 2.3 b	0.5 ± 0.5 ab	0.3 ± 0.3	0	4.8 ± 2.6 b	0.5 ± 0.3	7.3 ± 3.3
7	1.3 ± 0.8 b	0 b	0	0	1.3 ± 0.8 b	0.5 ± 0.5	13.5 ± 7.0
8	0.3 ± 0.3 b	1.0 ± 1.0 ab	0.8 ± 0.5	0	2.0 ± 1.1 b	3.5 ± 1.8	11.0 ± 8.8
9	2.8 ± 1.4 b	0 b	0.5 ± 0.5	0	3.3 ± 1.3 b	0.3 ± 0.3	2.8 ± 1.3 b
10	9.0 ± 2.2 ab	1.3 ± 0.8	1.8 ± 1.0	0	12.0 ± 1.9 ab	0.3 ± 0.3	4.8 ± 1.3 b
11	4.0 ± 1.5 abc	0.3 ± 0.3	1.5 ± 0.6	0	5.8 ± 1.9 abc	0.8 ± 0.8	2.0 ± 1.4 b
12	11.0 ± 3.1 a	1.8 ± 1.2	1.0 ± 0.7	0	13.8 ± 3.8 a	0.8 ± 0.8	4.8 ± 1.3 b
13	3.0 ± 1.4 b	1.5 ± 1.0 ab	0	0.3 ± 0.3	4.8 ± 1.0 b	7.3 ± 6.9	6.5 ± 2.6
14	2.8 ± 1.0 b	3.8 ± 1.0 a	0.5 ± 0.5	0	7.0 ± 2.0 ab	5.5 ± 2.8	37.3 ± 15.4
ANOVA	*P <0.001 F = 6.30; df = 10, 33*	*P = 0.028 F = 2.42; df = 10, 33*	*P = 0.632 F = 0.80; df = 10, 33*	*P = 0.463 F = 1.00; df = 10, 33*	*P <0.001 F =4.93; df = 10, 33*	*P = 0.715 F =0.53; df = 4, 15*	*P <0.001 F = 33.44; df = 4, 15*

*TRTS 1, 9, 10, 11, and 12 only were analyzed by ANOVA, as these treatments were expected to have some impact on aphids.

TRTS 10, 11, and 12 were excluded from Lepidopteran data analysis, as the products used were not expected to result in worm suppression.

3rd eval after DAT1 (13 DAT trt 1-12; 11 DAT trt 13, 14); PRE TRT2

TRT	ICW	CL	DBM	Other	Total	Harlequin Bugs	Aphids
1	8.8 ± 4.3	5.8 ± 1.5	0.3 ± 0.3	0.5 ± 0.3	15.3 ± 4.8	0.8 ± 0.8 b	33.8 ± 17.2
2	9.8 ± 3.3	3.3 ± 1.4	0	0	13.0 ± 4.6	0	3.3 ± 1.4
3	5.8 ± 2.2	6.8 ± 3.1	0.5 ± 0.5	0	13.0 ± 5.6	0	6.8 ± 2.5
4	7.8 ± 1.9	2.8 ± 1.4	0.5 ± 0.3	0.3 ± 0.3	11.3 ± 2.5	0.3 ± 0.3	2.8 ± 1.1
5	6.0 ± 2.9	2.3 ± 0.6	0.5 ± 0.3	0	8.8 ± 2.3	0	2.3 ± 1.3
6	4.5 ± 2.6	3.3 ± 1.4	1.3 ± 1.3	0.3 ± 0.3	9.3 ± 2.1	0	3.0 ± 1.5
7	8.8 ± 1.4	2.8 ± 1.5	0.3 ± 0.3	0.3 ± 0.3	12.0 ± 1.6	0	5.0 ± 4.0
8	7.5 ± 2.4	3.5 ± 0.6	0	0	11.0 ± 2.5	0.3 ± 0.3	10.3 ± 4.4
9	8.3 ± 0.8	1.5 ± 0.6	0.3 ± 0.3	0.5 ± 0.3	10.5 ± 1.0	0	1.3 ± 1.3
10	4.8 ± 0.9	3.0 ± 1.8	0	0.5 ± 0.3	8.3 ± 2.0	0.3 ± 0.3	10.5 ± 3.5
11	6.3 ± 2.3	4.8 ± 1.8	0.3 ± 0.3	0	11.3 ± 2.8	9.8 ± 4.8	8.8 ± 3.8
12	4.0 ± 1.6	6.0 ± 1.5	0.3 ± 0.3	0.3 ± 0.3	10.5 ± 1.3	1.8 ± 0.9	22.0 ± 12.8
13	6.8 ± 2.1	4.8 ± 1.3	0.3 ± 0.3	0	11.8 ± 3.0	0.3 ± 0.3	4.3 ± 1.5
14	5.3 ± 2.7	9.0 ± 3.4	0.3 ± 0.3	0	14.5 ± 6.1	0.3 ± 0.3	20.5 ± 16.6
ANOVA	*P = 0.928 F = 0.42; df = 10, 33*	*P = 0.164 F =1.56; df = 10, 33*	*P = 0.833 F =0.56; df = 10, 33*	*P = 0.286 F = 1.27; df = 10, 33*	*P = 0.975 F = 0.30; df = 10, 33*	*P = 0.058 F =3.30; df = 3, 12*	*P = 0.384 F =1.11 1.55; df = 3, 12*

4 DAT2

TRT	ICW	CL	DBM	Other	Total	Harlequin Bugs	Aphids
1	6.8 ± 2.7 a	8.5 ± 1.2 a	0.3 ± 0.3	0.5 ± 0.5	16.0 ± 4.0 b	2.5 ± 1.9	32.3 ± 13.6 a
2	0.3 ± 0.3 b	1.3 ± 0.8 c	0	0	1.5 ± 0.9 b	13.0 ± 13.0	10.8 ± 10.8
3	0 b	0.7 ± 0.7 c	0	0	0.7 ± 0.7 b	0	25.0 ± 21.5
4	0 b	0 c	0	0	0 b	0	0.8 ± 0.5
5	0 b	0 c	0	0	0 b	0.3 ± 0.3	19.3 ± 18.9
6	3.0 ± 0.8 ab	0.5 ± 0.3 c	0	0	3.5 ± 0.9 b	0	0
7	0.3 ± 0.3 b	0 c	0	0.3 ± 0.3	0.5 ± 0.5 b	0	0.5 ± 0.3
8	0.3 ± 0.3 b	2.3 ± 1.1 bc	0.3 ± 0.3	0.3 ± 0.3	3.0 ± 1.1 b	0	16.0 ± 15.7
9	3.5 ± 2.2 ab	4.3 ± 1.3 abc	0	0.3 ± 0.3	8.0 ± 0.5 ab	0	0
10	0.3 ± 0.3	2.5 ± 0.6	0	0.3 ± 0.3	3.0 ± 0.4	0	6.5 ± 6.5 ab
11	1.8 ± 0.5	3.0 ± 1.1	0	2.0 ± 2.0	6.8 ± 2.8	1.5 ± 1.5	0.8 ± 0.3 ab
12	1.0	4.8 ± 0.6	0	0	5.8 ± 0.6	1.8 ± 1.8	0.3 ± 0.3 b
13	0.5 ± 0.3 b	1.5 ± 0.6 c	0	0	2.0 ± 0.8 b	2.3 ± 2.3	17.5 ± 17.5
14	1.0 ± 0.6 b	6.0 ± 1.7 ab	0	0	7.0 ± 2.0 b	0	0.8 ± 0.8
ANOVA	*P = 0.003 F = 3.65; df = 10, 32*	*P <0.001 F =10.09; df = 10, 32*	*P = 0.57 F = 0.87; df = 10, 32*	*P = 0.707 F =0.71; df = 10, 32*	*P <0.001 F =7.61; df = 10, 32*	*P = 0.693 F =0.49; df = 3, 12*	*P = 0.034 F =4.03; df = 3, 12*

*Rep 4, trt 3 was not treated.

7 DAT2

TRT	ICW	CL	DBM	Other	Total	Harlequin Bugs	Aphids
1	2.8 ± 1.1 a	9.5 ± 0.6 a	0.5 ± 0.5	1.0 ± 0.7	13.8 ± 2.2 a	0.5 ± 0.5	166.3 ± 57.4 a
2	0 b	0.3 ± 0.3 c	0.3 ± 0.3	0	0.5 ± 0.3 d	2.0 ± 2.0	0.3 ± 0.3
3	0.3 ± 0.3 b	0 c	0	0	0.3 ± 0.3 d	1.3 ± 1.3	4.0 ± 3.5
4	0 b	0 c	0	0	0 d	0	1.3 ± 1.3
5	0 b	0 c	0	0	0 d	0.3 ± 0.3	2.0 ± 1.4
6	0.5 ± 0.5 b	1.0 ± 0.4 c	0.3 ± 0.3	0.3 ± 0.3	2.0 ± 0.4 cd	0.3 ± 0.3	1.8 ± 1.4
7	0 b	0 c	0	0.3 ± 0.3	0.3 ± 0.3 d	0	2.5 ± 1.8
8	0 b	1.0 ± 0.4 c	0.3 ± 0.3	0	1.3 ± 0.3 d	0	2.3 ± 2.3
9	2.0 ± 0.4 ab	3.5 ± 1.0 bc	0	1.0 ± 0.4	6.5 ± 0.9 bc	0	1.0 ± 0.7
10	1.0 ± 1.0	1.0 ± 0.4	0	0.8 ± 0.8	2.8 ± 1.4	0	3.3 ± 2.9 b
11	1.0 ± 0.4	3.8 ± 0.6	0.8 ± 0.5	1.8 ± 1.8	7.3 ± 2.4	0.5 ± 0.5	1.5 ± 1.5 b
12	0.3 ± 0.3	2.8 ± 1.1	0.3 ± 0.3	0.3 ± 0.3	3.5 ± 1.0	0.8 ± 0.8	0 b
13	0.3 ± 0.3 b	3.0 ± 1.8 c	0	0.8 ± 0.3	4.0 ± 1.8 cd	0	0.3 ± 0.3
14	0.5 ± 0.3 b	7.5 ± 1.6 ab	0.3 ± 0.3	0.8 ± 0.5	9.0 ± 1.4 ab	0.3 ± 0.3	0.3 ± 0.3
ANOVA	*P <0.001 F = 4.95; df = 10, 32*	*P <0.001 F =15.42; df = 10, 32*	*P = 0.785 F = 0.62; df = 10, 32*	*P = 0.116 F = 1.73; df = 10, 32*	*P <0.001 F = 19.89; df = 10, 32*	*P = 0.774 F =0.37; df = 3, 12*	*P = 0.003 F =8.20; df = 3, 12*

4 DAT3

TRT	ICW	CL	DBM	Other	Total	Harlequin Bugs	Aphids
1	1.8 ± 0.9 a	3.0 ± 0.0 a	0	0.3 ± 0.3	5.0 ± 0.9 a	0	216.5 ± 105.8
2	0 b	0 c	0	0	0	0.5 ± 0.5	0.5 ± 0.5
3	0 b	0.5 ± 0.3 c	0	1.8 ± 1.8	2.3 ± 1.9 ab	0	0
4	0 b	0 c	0	0	0 b	0	3.0 ± 3.0
5	0 b	0 c	0	0	0 b	0	0.3 ± 0.3
6	0.3 ± 0.3 b	0.3 ± 0.3 c	0	0	0.5 ± 0.3 b	0	0.5 ± 0.5
7	0 b	0 c	0	0	0	0	0
8	0.3 ± 0.3 b	0 c	0	0	0.3 ± 0.3 b	0	0.3 ± 0.3
9	0 b	1.0 ± 0.4 bc	0	0.3 ± 0.3	1.3 ± 0.5 b	0	0
10	0.5 ± 0.3	0	0	0.3 ± 0.3	0.8 ± 0.3	0	0
11	1.0 ± 0.7	0.3 ± 0.3	0	2.3 ± 1.4	3.5 ± 1.9	0	0
12	0.5 ± 0.5	0.8 ± 0.5	0	0.5 ± 0.3	1.8 ± 0.5	0.3 ± 0.3	0.3 ± 0.3
13	0 b	1.0 ± 0.7 bc	0	0.3 ± 0.3	1.3 ± 0.9	0	2.0 ± 1.2
14	0 b	2.3 ± 0.5 ab	0	0	2.5 ± 0.3	0	0
ANOVA	*P = 0.005 F = 3.22; df = 10, 33*	*P <0.001 F =; df = 13, 42*		*P = 0.537 F = 0.91; df = 10, 33*	*P = 0.001 F =4.53; df = 10, 33*	*P = 0.693 F =0.49; df = 3, 12*	*P = 0.031 F =4.18; df = 3, 12*

13 DAT2

TRT	ICW	CL	DBM	Other	Total	Harlequin Bugs	Aphids
1	4.8 ± 1.4 a	4.8 ± 2.1 a	0.5 ± 0.5	1.3 ± 0.5 a	11.3 ± 3.3 a	0.3 ± 0.3	265.0 ± 114.0
2	0.5 ± 0.5 b	0 b	0	0.3 ± 0.3 ab	0.8 ± 0.8 b	4.0 ± 2.8	1.0 ± 0.7
3	1.0 ± 0.6 b	0 b	0	0 b	1.0 ± 0.6 b	1.3 ± 0.7	0
4	0.3 ± 0.3 b	0 b	0	0 b	0.3 ± 0.3 b	0.5 ± 0.5	0.3 ± 0.3
5	0 b	0 b	0	0 b	0 b	0	0
6	0.5 ± 0.5 b	0.8 ± 0.5 ab	0	0.3 ± 0.3 ab	1.5 ± 0.6 b	0	0.3 ± 0.3
7	0 b	0 b	0	0 b	0 b	0	3.8 ± 3.8
8	0.3 ± 0.3 b	1.3 ± 0.3 ab	0.3 ± 0.3	0 b	1.8 ± 0.3 b	0	0.8 ± 0.8
9	1.0 ± 0.7 b	4.3 ± 1.8 ab	0	0.5 ± 0.3 ab	5.8 ± 2.6 ab	0.3 ± 0.3	0
10	0	0.8 ± 0.5	0	0.3 ± 0.3	1.0 ± 0.4	0	0.3 ± 0.3
11	0.5 ± 0.3	2.3 ± 1.0	0	1.3 ± 0.6	4.0 ± 0.6	0	0
12	0.5 ± 0.5	1.0 ± 0.6	0	1.8 ± 0.9	3.3 ± 0.9	3 ± 2.7	0.3 ± 0.3
13	0.5 ± 0.5 b	1.0 ± 0.7 ab	0	0 b	1.5 ± 0.6 b	0.8 ± 0.8	0
14	0.5 ± 0.5 b	2.3 ± 0.9 ab	0	0.3 ± 0.3 ab	3.0 ± 1.1 b	1.3 ± 0.9	0
ANOVA	*P = <0.001 F = 4.95; df = 10, 32*	*P =0.004 F = 3.43; df = 10, 32*	*P = 0.554 F = 0.89; df = 10, 32*	*P = 0.008 F = 3.03; df = 10, 32*	*P <0.001 F =5.94; df = 10, 32*	*P = 0.357 F =1.18; df = 3, 12*	*P = 0.014 F =5.39; df = 3, 12*

7 DAT3

TRT	ICW	CL	DBM	Other	Total	Harlequin Bugs	Aphids
1	0.5 ± 0.3 a	1.0 ± 0.6	1.0 ± 0.4	1.0 ± 0.4	3.5 ± 1.3 a	1.5 ± 1.5	589.8 ± 445.0
2	0 b	0	0 b	0	0 b	1.8 ± 1.0	8.3 ± 6.9
3	0 b	0	0 b	0.8 ± 0.8	0.8 ± 0.8 ab	0	0.3 ± 0.3
4	0 b	0	0 b	0	0	0	8.5 ± 7.5
5	0 b	0.3 ± 0.3	0 b	0.3 ± 0.3	0.5 ± 0.3 b	0	1.0 ± 0.4
6	0 b	0	0 b	0.5 ± 0.3	0.5 ± 0.3 b	0	0.5 ± 0.3
7	0 b	0	0 b	0.3 ± 0.3	0.3 ± 0.3 b	0	2.3 ± 2.3
8	0 b	0.5 ± 0.3	0 b	0.3 ± 0.3	0.8 ± 0.3 ab	0.5 ± 0.5	1.8 ± 0.9
9	0 b	0.8 ± 0.5	0 b	0.8 ± 0.5	1.5 ± 0.5 ab	0	0.3 ± 0.3
10	0	0	0	0.3 ± 0.3	0.3 ± 0.3	0	3.8 ± 3.4
11	0	0.3 ± 0.3	0	0.8 ± 0.8	1.0 ± 0.7	0	13.5 ± 6.66
12	0	0.5 ± 0.3	0.5 ± 0.5	0	1.0 ± 0.4	0.3 ± 0.3	1.5 ± 1.0
13	0 b	0.8 ± 0.5	0 b	0	0.8 ± 0.5 ab	0	0.8 ± 0.5
14	0 b	1.8 ± 0.9	0 b	0.3 ± 0.3	2.0 ± 0.7 ab	0	0.8 ± 0.3
ANOVA	*P = 0.008 F = 3.0; df = 10, 33*	*P = 0.050 F =2.13; df = 10, 33*	*P <0.001 F = 6.0; df = 10, 33*	*P = 0.466 F = 1.00; df = 10, 33*	*P = 0.005 F = 3.29; df = 10, 33*	*P = 0.473 F =0.89; df = 3, 12*	*P = 0.216 F =1.72; df = 3, 12*

14 DAT3

TRT	ICW	CL	DBM	Other	Total	Harlequin Bugs	Aphids
1	0.5 ± 0.3 a	0 b	0	0.5 ± 0.3	1.0 ± 0.4	0	2157.3 ± 1749.5
2	0 b	0 b	0	0.3 ± 0.3	0.3 ± 0.3	0.8 ± 0.8	46.0 ± 26.6
3	0 b	0 b	0	0	0	0.5 ± 0.5	1.3 ± 0.9
4	0 b	0 b	0	0.3 ± 0.3	0.3 ± 0.3	0.3 ± 0.3	52.3 ± 29.6
5	0 b	0 b	0	0	0	0.3 ± 0.3	4.8 ± 4.4
6	0 b	0.5 ± 0.3 ab	0	0	0.5 ± 0.3	0	29.3 ± 25.6
7	0 b	0 b	0	0	0	0	4.0 ± 2.8
8	0 b	0 b	0	0	0	1.0 ± 0.4	7.0 ± 4.7
9	0 b	0 b	0	0.3 ± 0.3	0.3 ± 0.3	0	2.5 ± 2.2
10	0	0.3 ± 0.3	0.5 ± 0.5	0.5 ± 0.5	0.8 ± 0.5	0	7.3 ± 5.7
11	0.5 ± 0.3	0	1.5 ± 0.6	1.5 ± 0.6	2.3 ± 0.5	0.5 ± 0.5	25.3 ± 22.3
12	0.5 ± 0.3	0.3 ± 0.3	0.3 ± 0.3	0.3 ± 0.3	1.3 ± 0.5	0	6.8 ± 3.6
13	0 b	0.8 ± 0.3 a	0	0.5 ± 0.3	1.3 ± 0.5	0	1.0 ± 1.0
14	0 b	0.8 ± 0.3 a	0	0	0.8 ± 0.3	0.3 ± 0.3	11.3 ± 3.3
ANOVA	*P = 0.008 F = 3.0; df = 10, 33*	*P <0.001 F = 5.34; df = 10, 33*		*P = 0.286 F = 1.27; df = 10, 33*	*P = 0.010 F = 2.90; df = 10, 33*	*P = 0.426 F =1.00; df = 3, 12*	*P = 0.264 F =1.50; df = 3, 12*

21 DAT3

TRT	ICW	CL	DBM	Other	Total	Harlequin Bugs	Aphids
1	0.5 ± 0.3	0	0.3 ± 0.3	1.3 ± 0.9	2.0 ± 1.0	0	370.8 ± 176.7 a
2	1.5 ± 1.5	0	0	0	1.5 ± 1.5	0.5 ± 0.5	25.3 ± 17.3
3	0.3 ± 0.3	0	0	0	0.3 ± 0.3	0	3.8 ± 2.8
4	0.5 ± 0.3	0	0	0	0.5 ± 0.3	0.3 ± 0.3	32.8 ± 16.1
5	0.3 ± 0.3	0	0	0	0.3 ± 0.3	0.8 ± 0.8	4.3 ± 3.3
6	0	0	0	0	0	0.3 ± 0.3	4.8 ± 2.6
7	0.8 ± 0.8	0	0	0	0.8 ± 0.8	0	3.5 ± 1.0
8	0.5 ± 0.5	0	0	0	0.5 ± 0.5	0	9.8 ± 3.6
9	0.5 ± 0.3	0.3 ± 0.3	0	0	0.8 ± 0.3	0	1.5 ± 1.0
10	1.0 ± 0.7	0	0	0.5 ± 0.3	1.5 ± 1.0	0	19.3 ± 14.5 b
11	0	0	0	0.5 ± 0.3	0.5 ± 0.3	0	34.3 ± 22.4 b
12	1.0 ± 0.4	0.6 ± 0.3	0.8 ± 0.8	0.5 ± 0.3	2.8 ± 1.5	0	3.0 ± 1.6 b
13	1.3 ± 0.9	0	0	0	1.3 ± 0.9	0.3 ± 0.3	6.3 ± 2.7
14	0.5 ± 0.3	0.3 ± 0.3	0	0	0.8 ± 0.5	0	2.0 ± 1.4
ANOVA	*P = 0.894 F = 0.476; df = 10, 33*	*P = 0.544 F = 0.90; df = 10, 33*	*P = 0.464 F = 1.00; df = 10, 33*	*P = 0.112 F = 1.74; df = 10, 33*	*P = 0.703 F = 0.72; df = 10, 33*	---	*P = 0.037 F = 3.90; df = 3, 12*

7 DAT4

TRT	ICW	CL	DBM	Other	Total	Harlequin Bugs	Aphids
1	2.3 ± 1.9	0	0.3 ± 0.3	0	2.5 ± 1.8	0	1566.8 ± 1331.3
2	0	0	0	0	0	0.3 ± 0.3	52.3 ± 28.2
3	0.3 ± 0.3	0	0.3 ± 0.3	0	0.5 ± 0.3	0.3 ± 0.3	12.8 ± 5.2
4	0	0	0	0	0	0	29.8 ± 15.5
5	0	0	0	0	0	0	23.5 ± 18.5
6	0	0	0	0	0	0	14.3 ± 6.3
7	0	0	0	0	0	0	4.3 ± 0.6
8	0	0	0	0	0	0	22.8 ± 17.0
9	0.3 ± 0.3	0.3 ± 0.3	0	0	0.5 ± 0.3	0.3 ± 0.3	6.0 ± 2.3
10	0	0	0	0.3 ± 0.3	0.3 ± 0.3	0	5.0 ± 2.9
11	0	0	0	0	0	0.3 ± 0.3	57.0 ± 19.9
12	0	0	1.0 ± 1.0	0.3 ± 0.3	1.3 ± 1.3	0.3 ± 0.3	14.3 ± 5.8
13	0	0	0	0.3 ± 0.3	0.3 ± 0.3	0	5.0 ± 3.8
14	0	0	0	0	0	0	16.3 ± 12.4
ANOVA	*P = 0.279 F = 1.28; df = 10, 33*	*P = 0.464 F = 1.00; df = 10, 33*	*P = 0.544 F = 0.90; df = 10, 33*	*P = 0.464 F = 1.00; df = 10, 33*	*P = 0.130 F = 1.67; df = 10, 33*	*P = 0.589 F = 0.67; df = 3, 12*	*P = 0.307 F = 1.34; df = 3, 12*

No phytotoxicity was observed with any treatment at any evaluation date.

Cabbage 2020 Aphids

Location: Carvel REC, Georgetown, DE
Field 25-B
Variety: 'Ramada'
Transplant Date: 13 August
Seeding Date: 10 July
Experimental Design: Randomized complete block design with 4 treatments and 4 replicates
Plot size: 1 rows x 20.' Plots consisted of guard rows from Lepidopteran treatments of Cabbage 2020 test. 5' between rows
Plant Spacing: 1.9'
Treatment Method: Single row boom fitted with 3 D2 nozzle tips and #45 cores delivering 45 GPA at 36 PSI. The outher two nozzles on were on drop tubes and oriented perpendicular to the ground to achieve maximum side-coverage.
Application Date: 20 October
Sample Size: 5 plants/plot;
Data Analysis: ANOVA; Tukey-Kramer HSD means separation

TRT	Material	Rate (per acre)
1	UTC	---
2	Sivanto HL Dyne-Amic	7.0 fl oz 0.25% v/v
3	Sivanto HL LI-700	7.0 fl oz 0.25% v/v
4	Endigo ZCX	4.5 fl oz

TRT	20-Oct (0d PRE)	7 DAT	14 DAT
1	612.8 ± 307.0	276.8 ± 81.9	161.0 ± 127.1
2	1390.0 ± 936.3	81.3 ± 33.2	363.5 ± 203.2
3	587.5 ± 257.3	282.3 ± 234.0	329.0 ± 259.3
4	507.0 ± 202.6	941.3 ± 903.2	319.0 ± 290.6
ANOVA	P = 0.608 F = 0.633; df = 3, 12	P = 0.602 F = 0.643; df = 3, 12	P = 0.924 F = 0.155; df = 3, 12

Strawberry 2020 Spider Mites (UVC)

Location: Carvel REC, Georgetown
Variety: 'Albion', 'Chandler', 'Flavorfest', and 'Sweet Charlie'
Transplanting Date: 13 Sept; Chandlers replanted 20 Sept.
Experimental Design: Two treated strips; each strip divided in half by underlying organic matter supplement at planting. Two untreated strips. Sampling was conducted from each subsection and counted as a replicate. Pseudoreplication ignored.
Plot size: 1 row x
Row Spacing: 7'
Plant spacing: double row of strawberries per bed,
Treatment Method: A Robot developed by TRIC Robotics shone UVC light on plots at night.
Treatments occurred with a 2-lamp configuration on March 29, April 2, April 5, and a partial treatment on April 9 and 13. New lamp configuration on April 14, full configuration operational on 19 April. Full treatments on April 25, 27, May 2, 7, 11, 15, 19, 24, 28; June 1, 6, and 10.

Sample Size: 10 leaflets / subplot
Data Analysis: ANOVA; Tukey-Kramer HSD means separation

Cumulative Mite Days

TRT	**Albion**	**Chandler**	**Flavorfest**	**Sweet Charlie**
UVC	3391.9 ± 373.8	1929.3 ± 374.0	303.0 ± 34.6	1483.5 ± 121.0
Check	5922.0 ± 594.5	8368.3 ± 2551.1	555.9 ± 74.4	2833.3 ± 321.6
T-test	*P = 0.015* *t = 3.60*	*P = 0.0844* *t = 2.50*	*P = 0.034* *t = 3.08*	*P = 0.019* *t = 3.93*

Albion

TRT	***Mobiles per leaflet***						
	6 April	**20 April**	**4 May**	**18 May**	**27 May**	**3 June**	**11 June**
UVC	23.5 ± 3.3	25.3 ± 6.9	50.4 ± 11.6	66.1 ± 9.9	112.0 ± 20.7	38.0 ± 14.9	12.1 ± 3.4
Check	43.1 ± 17.6	51.5 ± 20.7	119.9 ± 27.8	103.7 ± 14.8	194.2 ± 15.8	40.3 ± 11.5	9.6 ± 5.1
T-test	*P = 0.350* *t = 1.09*	*P = 0.302* *t = 1.20*	*P = 0.082* *t = 2.30*	*P = 0.086* *t = 2.11*	*P = 0.031* *t = 2.85*	*P = 0.910* *t = 0.18*	*P = 0.696* *t = 0.41*
Eggs per leaflet							
UVC	120.3 ± 6.3	89.3 ± 15.9	215.5 ± 26.2	358.8 ± 30.5	407.7 ± 33.8	50.3 ± 29.7	30.6 ± 7.8
Check	193.9 ± 55.0	172.4 ± 43.7	309.0 ± 40.4	405.2 ± 12.0	429.7 ± 66.5	71.0 ± 25.3	18.5 ± 8.8
T-test	*P = 0.273* *t = 1.33*	*P = 0.152* *t = 1.79*	*P = 0.108* *t = 1.94*	*P = 0.231* *t = 1.42*	*P = 0.778* *t = 0.30*	*P = 0.617* *t = 0.53*	*P = 0.344* *t = 1.03*
Predatory Mites							
UVC			0.13 ± 0.09	0.78 ± 0.35	2.30 ± 1.23		1.88 ± 0.54
Check			0.05 ± 0.03	1.3 ± 0.47	3.33 ± 1.03		1.50 ± 0.39
T-test			*P = 0.496* *t = 0.76*	*P = 0.452* *t = 0.81*	*P = 0.548* *t = 0.64*		*P = 0.594* *t = 0.57*

Chandler

TRT	***Mobiles per leaflet***						
	6 April	**20 April**	**4 May**	**18 May**	**27 May**	**3 June**	**11 June**
UVC	0.3 ± 0.2	0.2 ± 0.1	0.6 ± 0.2	2.6 ± 0.5	7.3 ± 2.3	6.8 ± 3.9	12.1 ± 3.4
Check	2.8 ± 1.8	1.4 ± 0.9	1.7 ± 1.0	14.9 ± 3.2	43.3 ± 20.8	21.3 ± 9.1	9.6 ± 5.1
T-test	*P = 0.243* *t = 1.44*	*P = 0.254* *t = 1.40*	*P = 0.373* *t = 1.04*	*P = 0.030* *t = 3.13*	*P = 0.182* *t = 1.72*	*P = 0.215* *t = 1.47*	*P = 0.696* *t = 0.41*
		Eggs per leaflet					
UVC	3.6 ± 2.0	1.8 ± 1.3	6.1 ± 2.3	39.7 ± 7.5	53.4 ± 13.5	33.0 ± 27.3	30.6 ± 7.8
Check	26.1 ± 14.6	6.8 ± 5.0	9.4 ± 5.4	85.5 ± 10.9	126.0 ± 25.6	42.8 ± 16.9	18.5 ± 8.8
T-test	*P = 0.222* *t = 1.52*	*P = 0.390* *t = 0.98*	*P = 0.612* *t = 0.550*	*P = 0.016* *t = 3.46*	*P = 0.059* *t = 2.50*	*P = 0.773* *t = 0.30*	*P = 0.344* *t = 1.03*
	Predatory Mites						
UVC			0	0.20 ± 0.12	0.15 ± 0.09		0.40 ± 0.15
Check			0	0.10 ± 0.07	0.28 ± 0.18		0.35 ± 0.10
T-test				*P = 0.512* *t = 0.71*	*P = 0.563* *t = 0.63*		*P = 0.79* *t = 0.285*

Flavorfest

TRT	***Mobiles per leaflet***						
	6 April	**20 April**	**4 May**	**18 May**	**27 May**	**3 June**	**11 June**
UVC	1.5 ± 0.8	1.2 ± 0.4	2.7 ± 0.7	7.6 ± 1.0	8.6 ± 2.7	4.8 ± 1.0	4.6 ± 3.3
Check	5.9 ± 2.1	2.7 ± 1.1	3.8 ± 0.3	11.7 ± 1.1	19.1 ± 7.5	8.3 ± 2.6	10.0 ± 5.7
T-test	*P = 0.122* *t = 1.98*	*P = 0.256* *t = 1.33*	*P = 0.247* *t = 1.37*	*P = 0.034* *t = 2.77*	*P = 0.263* *t = 1.31*	*P = 0.283* *t = 1.24*	*P = 0.454* *t = 0.813*
Eggs per leaflet							
UVC	8.8 ± 4.7	7.5 ± 4.6	22.4 ± 6.5	67.0 ± 8.4	63.6 ± 5.3	33.1 ± 7.3	16.0 ± 8.2
Check	29.8 ± 11.2	15.3 ± 5.2	26.2 ± 2.1	76.9 ± 1.8	71.9 ± 20.6	27.8 ± 9.5	38.8 ± 26.6
T-test	*P = 0.157* *t = 1.74*	*P = 0.308* *t = 1.11*	*P = 0.613* *t = 0.55*	*P = 0.328* *t = 1.15*	*P = 0.256* *t = 1.33*	*P = 0.687* *t = 0.42*	*P = 0.465* *t = 0.82*
Predatory Mites							
UVC			0.08 ± 0.05	0.56 ± 0.28	0.90 ± 0.09		0.38 ± 0.25
Check			0.03 ± 0.03	0.58 ± 0.24	0.95 ± 0.12		0.68 ± 0.28
T-test			*P = 0.401* *t = 0.93*	*P = 0.846* *t = 0.20*	*P = 0.751* *t = 0.33*		*P = 0.450* *t = 0.81*

Sweet Charlie

TRT	***Mobiles per leaflet***						
	6 April	**20 April**	**4 May**	**18 May**	**27 May**	**3 June**	**11 June**
UVC	0	0.2 ± 0.1	0.2 ± 0.0	2.9 ± 0.4	5.6 ± 1.0	3.2 ± 0.9	3.4 ± 1.3
Check	0.0 ± 0.0	0.2 ± 0.1	0.9 ± 0.3	3.5 ± 0.5	12.9 ± 1.8	3.6 ± 0.7	9.7 ± 3.3
T-test	*P = 0.391* *t = 1.00*	*P = 0.871* *t = 0.17*	*P = 0.123* *t = 2.10*	*P = 0.372* *t = 0.97*	*P = 0.016* *t = 3.62*	*P = 0.781* *t = 0.29*	*P = 0.152* *t = 1.78*
Eggs per leaflet							
UVC	0.1 ± 0.1	0.2 ± 0.2	2.3 ± 0.6	35.9 ± 8.4	50.1 ± 9.2	22.6 ± 3.2	7.7 ± 2.4
Check	0.4 ± 0.4	0.6 ± 0.4	4.9 ± 0.5	36.7 ± 6.2	60.0 ± 10.9	14.6 ± 4.4	27.0 ± 11.5
T-test	*P = 0.474* *t = 0.81*	*P = 0.443* *t = 0.85*	*P = 0.018* *t = 3.33*	*P = 0.942* *t = 0.08*	*P = 0.514* *t = 0.69*	*P = 0.193* *t = 1.49*	*P = 0.193* *t = 1.63*
Predatory Mites							
UVC			0	0.05 ± 0.05	0.15 ± 0.10		1.0 ± 0.31
Check			0	0.13 ± 0.13	0.35 ± 0.19		0.3 ± 0.06
T-test				*P = 0.608* *t = 0.56*	*P = 0.403* *t = 0.93*		*P = 0.106* *t = 2.23*

Soybean 2020 Grasshopper

Location: Bishopville, MD
Variety: 'P48A94PR'
Planting Date: 9 May
Experimental Design: Randomized complete block design with 8 treatments and 4 replicates
Plot size: 28' x 30'
Row Spacing: 15"
Treatment Method: CO_2 pressurized backpack sprayer with a 13.3' boom equipped with 8 nozzles calibrated to deliver 15 GPA at PSI.
Treatment Date: July 17
Sample Size: 15 sweeps
Data Analysis: ANOVA; Tukey-Kramer HSD means separation

TRT	Material	Rate
1	UTC	---
2	Dimethoate	1pt
3	Asana XL	5.8 fl oz (low GH rate)
4	Elevest MSO Concentrate with Leci-Tech	7.7 fl oz (mid-rate) 1% v/v (per Elevest's label)
5	Warrior	1.6 fl oz (mid-rate)
6	Prevathon MSO	8.0 fl oz (low GH rate) 1% v/v (per Prevathon's label)

TRT	0 d PRE	3 DAT	7 DAT
1	4.5 ± 0.6	7.3 ± 0.8 a	6.3 ± 1.9 a
2	5.8 ± 1.0	1.8 ± 0.8 bc	1.0 ± 0.7 b
3	6.3 ± 1.8	5.8 ± 1.9 ab	4.0 ± 1.6 ab
4	5.5 ± 2.5	0.8 ± 0.5 c	0 b
5	8.3 ± 2.0	5.8 ± 1.3 ab	4.3 ± 0.3 ab
6	8.3 ± 1.8	3.5 ± 0.6 abc	1.5 ± 0.5 ab
ANOVA	P = 0.582 F = 0.77; df = 5, 17	P = 0.003 F = 5.49; df = 5, 18	P = 0.006 F = 4.81; df = 5, 18

Soybean 2020 Two Spotted Spider Mite

Location: Carvel REC, Georgetown, DE
Variety: 'CZ3930GTLL'
Planting Date:
Experimental Design: Randomized complete block design with 8 treatments and 4 replicates
Plot size: 10' x 25'
Row Spacing: 30"
Infestation Date: June 26, mites from pokeweed at A.D. watermelon field, Laurel DE
Treatment Method: CO_2 pressurized backpack sprayer with a 9' boom equipped with 6 8004 nozzles calibrated to deliver 20 GPA at 28 PSI.
Treatment Date: July 9; soybeans at R2
Sample Size: 10 upper canopy leaflets
Data Analysis: ANOVA; Tukey-Kramer HSD means separation
Harvest Date: 22 October; middle 2 rows, yield adjusted to 13% moisture

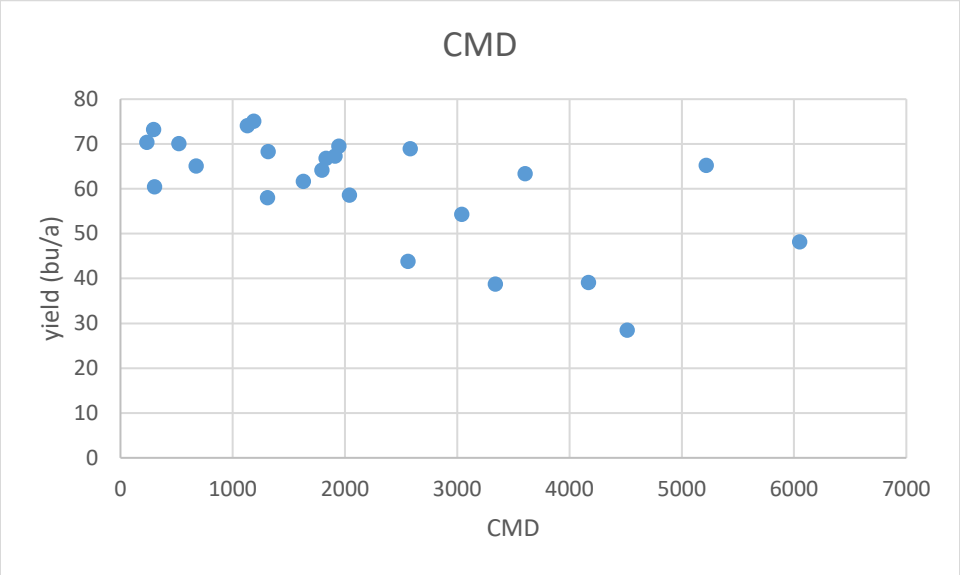
TRT	Material	Rate / A
1	UTC	---
2	Agri-Mek SC	2.6 fl oz
3	Zeal	5.0 fl oz
4	Lorsban	1.0 pt
5	Dimethoate 4EC	1.0 pt
6	Brigade	6.4 fl oz

Dyne-Amic was included with all sprays at a 0.25% v/v rate.

TRT	1d PRE	5 DAT (14 Jul)	14 DAT (22 Jul)	20 DAT (29 Jul)	Test Wght	Yield
1	14.6 ± 4.6	23.0 ± 6.9 a	96.1 ± 22.4 a	97.6 ± 24.8 a	54.2 ± 0.7	50.5 ± 10.0
2	6.7 ± 3.3	1.8 ± 1.1 b	1.9 ± 0.7 c	7.9 ± 1.5 b	54.1 ± 0.3	68.8 ± 2.9
3	24.5 ± 13.3	4.2 ± 1.1 ab	10.2 ± 3.9 b	13.6 ± 8.1 b	54.3 ± 0.3	67.3 ± 2.3
4	11.8 ± 3.4	3.4 ± 0.2 ab	18.5 ± 5.0 ab	117.4 ± 8.9 a	53.8 ± 0.2	63.1 ± 2.8
5	44.7 ± 17.6	7.5 ± 2.8 a	23.8 ± 5.7 ab	70.5 ± 24.0 a	54.2 ± 0.4	54.2 ± 7.6
6	7.1 ± 3.1	8.5 ± 1.7 a	35.0 ± 14.4 ab	69.8 ± 15.9 a	54.0 ± 0.5	59.5 ± 5.3
ANOVA	P = 0.203 F = 1.63; df = 5, 18	P = 0.001 F = 6.44; df = 5, 18	P < 0.001 F = 14.28; df = 5, 18	P < 0.001 F = 16.70; df = 5, 18	P = 0.971 F = 0.17; df = 5, 18	P = 0.237 F = 1.51; df = 5, 18

Data were log transformed for analysis; presented are backtransformed means.

When examining individual plot mite counts by treatment yield, there appears to be a relationship between cumulative mite days and yield. Regression Y = 118.001 + -7.78*ln(x). R^2 = 0.323; P = 0.004; F = 10.49, df = 1, 22.



Soybean 2020 CEW

Location: Firetower Rd, Dagsboro, DE
Variety: '41T65' Plenish
Planting Date: 13 July
Experimental Design: Randomized complete block design with 8 treatments and 4 replicates
Plot size: 20' x 50'
Row Spacing: 15"
Treatment Method: CO_2 pressurized backpack sprayer with a 9' boom equipped with 6 XR11003 nozzles calibrated to deliver 20 GPA at 25 PSI.
Treatment Date: 2 September
Sample Size: 2 sets of 15 sweeps per plot
Data Analysis: ANOVA; Tukey-Kramer HSD means separation

TRT	Material	Rate / A
1	UTC	---
2	Experimental	---
3	Denim	10.0 fl oz
4	Besiege	10 fl oz
5	Warrior II	1.92 fl oz
6	Baythroid XL	2.8 fl oz
7	Prevathon	14.0 fl oz
8	Coragen	5 fl oz

Soybean Looper

TRT	0d Pre (2 Sept)	2 DAT (4 Sept)	6 DAT (8 Sept)	14 DAT (16 Sept)	22 DAT (24 Sept)
1	0.8 ± 0.3	0.5 ± 0.5	4.8 ± 0.9 a	29.3 ± 6.7 a	47.3 ± 6.5 ab
2	1.8 ± 0.6	0.3 ± 0.3	0.5 ± 0.5 b	3.3 ± 1.7 c	17.0 ± 2.9 c
3	1.3 ± 0.8	0	0.3 ± 0.3 b	0.8 ± 0.5 c	4.3 ± 1.7 c
4	0	0.3 ± 0.3	2.0 ± 0.7 ab	11.8 ± 4.0 abc	21.0 ± 4.7 c
5	1.3 ± 0.6	0.8 ± 0.5	5.0 ± 0.9 a	25.5 ± 6.0 ab	60.0 ± 11.8 a
6	2.0 ± 0.4	0.8 ± 0.5	5.5 ± 1.5 a	28.5 ± 7.1 a	54.8 ± 1.1 a
7	0.5 ± 0.3	0.8 ± 0.5	0.8 ± 0.5 b	7.0 ± 1.5 bc	22.0 ± 2.9 bc
8	2.3 ± 0.5	1.0 ± 0.4	2.3 ± 0.8 ab	11.5 ± 2.7 abc	16.0 ± 4.5 c
ANOVA	P = 0.043 F = 2.52; df = 7, 24	P = 0.635 F = 0.748; df = 7, 24	P <0.001 F = 6.88; df = 7, 24	P <0.001 F = 6.63; df = 7, 24	P <0.001 F = 13.88; df = 7, 24

No phytotoxicity was observed with any treatment at any evaluation date.

Corn Earworm

TRT	9/2				9/4				9/8				9/16			9/24		
	Small	Med.	Large	Total	Small	Med.	Large	Total	Small	Med.	Large	Total	Small	Med.	Total	Small	Med.	Total
1	5.0 ± 1.1	0.8 ± 0.3	0.3 ± 0.3	6.0 ± 1.08	5.0 ± 1.3 a	0.8 ± 0.5	0 b	5.8 ± 1.4 a	2.5 ± 0.5 a	3.0 ± 1.1 a	0.5 ± 0.3	6.0 ± 1.0 a	2.3 ± 1.1 a	1.3 ± 0.5 a	3.5 ± 1.4	2.8 ± 1.4	0.5 ± 0.3 a	3.3 ± 1.6
2	5.8 ± 1.5	1.5 ± 0.9	0	7.3 ± 1.4	0 b	0.3 ± 0.3	0 b	0.3 ± 0.3 b	0.3 ± 0.3 b	0.5 ± 0.3 b	0	0.8 ± 0.5 b	0 b	0 b	0	0.3 ± 0.3	0 b	0.3 ± 0.3
3	7.8 ± 0.8	0.5 ± 0.5	0.3 ± 0.3	8.5 ± 0.6	1.3 ± 0.8 b	0	0 b	1.3 ± 0.8 b	0.3 ± 0.3 b	0.3 ± 0.3 b	0	0.5 ± 0.3 b	0 b	0 b	0	0	0 b	0
4	4.8 ± 0.8	1.8 ± 0.9	0	6.5 ± 0.6	0 b	0	0 b	0 b	0 b	0 b	0	0 b	0 b	0 b	0	0	0 b	0
5	6.0 ± 1.0	2.0 ± 0.7	0	8.0 ± 2.1	0 b	0	0.5 ± 0.3 a	0.5 ± 0.3 b	0.3 ± 0.3 b	0 b	0	0.3 ± 0.3 b	0 b	0 b	0	1.8 ± 1.8	0 b	1.8 ± 1.8
6	5.5 ± 0.6	2.0 ± 0.9	0.3 ± 0.3	7.8 ± 1.6	0 b	0.3 ± 0.3	0 b	0.3 ± 0.3 b	0 b	0 b	0	0 b	0.5 ± 0.3 ab	0 b	0.5 ± 0.3	0	0 b	0
7	4.5 ± 1.6	2.5 ± 1.6	0.5 ± 0.3	7.5 ± 2.8	0.8 ± 0.5 b	0	0 b	0.8 ± 0.5 b	0 b	0 b	0	0 b	0 b	0 b	0	0	0 b	0
8	5.8 ± 1.0	2.3 ± 1.6	0	8.0 ± 2.4	0 b	0	0 b	0 b	0 b	0 b	0	0 b	0 b	0 b	0	0	0 b	0
ANOVA	P = 0.636 F = 0.746; df = 7, 24	P = 0.831 F = 0.493; df = 7, 24	P = 0.441 F = 1.02; df = 7, 24	P = 0.975 F = 0.226; df = 7, 24	P <0.001 F = 9.76; df = 7, 24	P = 0.187 F = 1.59; df = 7, 24	P = 0.021 F = 3.00; df = 7, 24	P <0.001 F = 9.70; df = 7, 24	P <0.001 F = 13.37; df = 7, 24	P = 0.001 F = 6.58; df = 7, 24	P = 0.021 F = 3.0; df = 7, 24	P <0.001 F = 24.81; df = 7, 24	P = 0.007 F = 3.80; df = 7, 24	P <0.001 F = 6.82; df = 7, 24	P = 0.001 F = 5.54; df = 7, 24	P = 0.136 F = 1.79; df = 7, 24	P = 0.021 F = 3.0; df = 7, 24	P = 0.097 F = 2.0; df = 7, 24

No large worms on Sept 16 or Sept 24

Soybean 2020 Looper

Location: Firetower Rd, Dagsboro, DE
Variety: '41T65' Plenish
Planting Date: 13 July
Experimental Design: Randomized complete block design with 10 treatments and 4 replicates
Plot size: 9' x 25'
Row Spacing: 15"
Treatment Method: CO_2 pressurized backpack sprayer with a 9' boom equipped with 6 XR11003 nozzles calibrated to deliver 20 GPA at 25 PSI.
Treatment Date: 17 September
Sample Size: 15 sweeps per plot
Data Analysis: ANOVA; Tukey-Kramer HSD means separation

TRT	Material	Rate / A	0 d PRE (17 Sept)	4 DAT (21 Sept)	7 DAT (24 Sept)
1	UTC	---	12.8 ± 2.8	17.3 ± 2.9 a	23.8 ± 6.6 a
2	Radiant	4 fl oz	10.8 ± 1.9	4.3 ± 0.9 bcd	7.5 ± 3.0 ab
3	Intrepid Edge	5 fl oz	16.0 ± 4.7	7.8 ± 2.8 bcd	16.5 ± 7.6 ab
4	Intrepid	6 fl oz	13.3 ± 1.3	10.5 ± 0.6 ab	17.0 ± 5.3 ab
5	Steward	6.3 fl oz	11.5 ± 2.8	2.5 ± 0.6 cd	2.5 ± 1.4 b
6	Besiege	10 fl oz	11.5 ± 1.0	5.8 ± 1.3 bcd	8.8 ± 3.0 ab
7	Hero	10.3 fl oz	8.8 ± 1.4	1.8 ± 0.3 d	3.3 ± 1.3 ab
8	Prevathon	12 fl oz	16.0 ± 5.0	7.0 ± 1.4 bcd	11.0 ± 3.4 ab
9	Lorsban	20 fl oz	9.8 ± 2.1	10.3 ± 0.8 abc	9.8 ± 3.2 ab
10	Lannate	24 fl oz	12.0 ± 1.5	5.8 ± 2.2 bcd	10.0 ± 3.4 ab
ANOVA			P = 0.680 F = 0.728; df = 9, 30	P <0.001 F = 7.63; df = 9, 30	P = 0.042 F = 2.30; df = 9, 30

Sorghum 2020 Sugarcane Aphid Variety Trial

Location: Carvel REC, Georgetown, DE Fld 9-B
Planting Date: 16 July
Plot size: 4 rows x 30'
Row Spacing: 14"
Planter: Tye drill; 850 seeds per plot
Sample Size: 10 leaves per plot
Harvest Date: 2 December
Data Analysis: Split plot analysis with analysis of covariance in SAS JMP; plant stand was the covariant. Tukey's HSD post-hoc means comparisons.

Notes: Previous crop was malting barley. 80 lbs of Nitrogen was applied at planting in the form of 30% UAN. Lexar EZ was applied at 3 qt/A at planting. 2 qts/A of Nutrisync was applied twice at the beginning of September. Besiege was applied September 12 at 10 fl oz/A. Sorghum-sudangrass was planted around the plot as a cover crop and was also infested with sugarcane aphid. Sudangrass was mowed September 15.

Reps 2, 4, 6, and 8 were treated with Sivanto Prime at 4 fl oz on 1 October using a CO_2 pressurized backpack sprayer with a 9' boom equipped with 6 XR11003 nozzles calibrated to deliver 20 GPA at 25 PSI.

VIII	8	3	4	1	2	6	5	7
VII	8 84G62	3 DKS 37-07	4 DKS 36-07	1 DG57GC29	2 DKS 44-07	6 M71GR04	5 86P20	7 M60GB31
VI	5	8	6	4	7	3	1	2
V	5 86P20	8 84G62	6 M71GR04	4 DKS 36-07	7 M60GB31	3 DKS 37-07	1 DG57GC29	2 DKS 44-07
IV	3	6	7	5	1	2	4	8
III	3 DKS 37-07	6 M71GR04	7 M60GB31	5 86P20	1 DG57GC29	2 DKS 44-07	4 DKS 36-07	8 84G62
II	1	2	4	3	8	7	5	6
I	1 DG57GC29	2 DKS 44-07	4 DKS 36-07	3 DKS 37-07	8 84G62	7 M60GB31	5 86P20	6 M71GR04

*red indicates highly localized aphid hotspot with honeydew present on Sept 30

1. Dyna-Gro	DG 57GC29	4. DeKalb	DKS 36-07	**7. Dyna-Gro**	**M60GB31**
2. DeKalb	DKS 44-07	**5. Pioneer**	**86P20**	8. Pioneer	84G62
3. DeKalb	**DKS 37-07**	6. Dyna-Gro	M71GR04		

Bolded varieties have previously been identified as aphid tolerant. Source: https://www.sorghumcheckoff.com/news-and-media/newsroom/2017/02/27/2017-sugarcane-aphid-tolerant-hybrids/

Mean aphid counts/leaf, data from reps I, III, V, and VII

Variety	2 Sept	11 Sept	30 Sept
1	0.55	0.80	6.05
2	0.10	0.53	0.10
3	2.20	0	9.10
4	0.20	0.05	1.53
5	0.77	0.18	0.33
6	0.78	0.23	2.50
7	0.13	0.03	0.03
8	5.50	2.25	21.53

Variety	Stand Count (5 row ft)	Yield (Treated)	Yield (Untreated)	Yield (Overall)
1	27.0 ± 1.8 c	53.6 ± 4.0	58.5 ± 9.0	56.0 ± 11.5 ab
2	37.5 ± 2.5 abc	50.5 ± 9.2	55.6 ± 13.4	53.7 ± 6.7 ab
3	45.9 ± 4.4 a	36.9 ± 7.3	35.5 ± 10.7	37.4 ± 7.0 b
4	34.6 ± 2.6 abc	60.1 ± 10.2	68.0 ± 10.5	58.4 ± 7.1 a
5	47.6 ± 3.6 a	62.6 ± 4.2	63.7 ± 8.1	60.9 ± 7.4 a
6	29.8 ± 2.2 bc	51.7 ± 9.9	52.7 ± 9.7	52.7 ± 9.0 ab
7	44.4 ± 4.8 ab	17.5 ± 5.6	16.0 ± 5.3	15.2 ± 6.8 c
8	49.1 ± 3.4 a	32.1 ± 8.4	34.7 ± 12.7	33.4 ± 7.8 bc
ANOVA	P <0.001; F = 6.56; df = 7, 56 (not analyzed with the model; justification for inclusion as covariant)			

ANOVA Variety: P = 0.021; F = 2.79; df = 7, 7

ANOVA Treatment: P = 0.833; F = 0.05; df = 1, 1

ANOVA Trt*Variety: P = 0.973; F = 0.24; df = 7, 7

Corn 2020 Bt Prophylactic Insecticide CEW Trial

Location: Carvel REC, Georgetown, DE Fld 25C
Planting Date: 17 June
Plot size: 4 rows x 25'
Experimental Design: split plot design with 4 reps. Main plot factor was insecticide application (Besiege at 10 fl oz applied at full silk), subplot factor was variety (3 varieties).
Row Spacing: 30"
Harvest Date: 4 November

Variety	Bt trait (protein)	Yield (+ insecticide)	Yield (- insecticide)
1. C1487	---	158.1 ± 2.6	160.6 ± 6.1
2. LL1488 VT2P	VT double pro Cry1A.105 + Cry2Ab2	158.5 ± 8.2	150.3 ± 5.8
3. LC1586 TC	Trecepta Cry1A.105 + Cry2Ab2 + Vip3A	166.4 ± 5.5	170.4 ± 5.2
ANOVA Variety	F = 2.83; df = 2, 15; P = 0.091		
ANOVA Insecticide	F = 0.02; df = 1, 15; P = 0.905		
ANOVA Variety*Insecticide	F = 0.63; df = 2, 15; P = 0.547		

Soybean 2020 Prophylactic Insecticide Cost Benefit

Overall Project Summary

In 2020, 5 partner farmers treated strips, sections, or whole soybean fields with Warrior II when performing post emergence herbicide or R-stage fungicide applications. At each location, a series of 10-sweep samples were collected weekly to determine if the addition of insecticide influenced pest populations. Harvest data was obtained from cooperator yield monitors to determine if there was an influence on yield that could be attributed to insect reduction. The ultimate goal of this project is to determine if prophylactic insecticide use can result in a measurable influence on production economics.

In the overall summary chart below, the average number of each individual species in the untreated sections were subtracted from the average number in the treated plots, thus, a negative sign indicates greater numbers in the untreated sections and a positive number indicates greater numbers in pyrethroid treated plots. The difference between untreated strips and pyrethroid treated strips were tested against a hypothesized mean value of 0 (no difference). In this chart, only marginally significant P values are displayed (paired T-test).

Where possible, yield from combine data was adjusted to account for erroneous data or from large areas on field heterogeneity (such as wet spots).

Yield Treated:
Yield Untreated:

Insect abbreviations are as follows:
BLB = bean leaf beetle
GCW = green cloverworm
JB = Japanese beetle
SB = stink bug
DSB = Dectes stem borer
BEB = big eyed bug (beneficial)
GH = grasshopper
SL = soybean looper
CEW = corn earworm

Week of the month (no. farms)	BLB	GCW	JB	SB	DSB	BEB	GH	SL	CEW
July1 (1)	-0.25	-0.08	0	-0.25	0	0	0	0	0
July 2 (2)	-1.40 P = 0.18	-2.25	-0.38	0.26	0	-0.04	-0.34	0	0
July 3 (1)	0.25	-13.3	0.5	-0.33	0	-0.08	0	0	0
July4 (1)	0	-0.13	-0.2	0	0	0.07	0.13	0	0
Aug1 (2)	-0.20	0.09	-0.04	0	-0.1	0	-0.34	0	0
Aug2 (3)	0.12	-0.68	0	0.19 P = 0.14	0	0	-0.29	0.02	0
Aug 3 (4)	0.77	-1.97 P = 0.13	0	-0.09	0	0	-0.03	0.70	0.01
Aug4 (5)	0.09	-1.28	0	0.02	0	-0.03	-0.34	0.1	0.01
Sep1 (5)	0.34	0	0	0.11 P = 0.20	0	0	-0.48 P = 0.138	-0.04	0
Sep2 (1)	0	0	0	0.2	0	0	0.2	0	0
Sep3 (4)	-0.15	0	0	0.01	0	0	0.06	0.03	-0.01
Sep4 (2)	0.02	0	0	-0.16	0	0	0.08	0.62	0

Field 1 near Harbeson, DE

Variety: CZ4206TLL
Planting Date: 19 May 2020
Row Spacing: 15”
Plant Population: 150,000/acre
Treatment Date: June 29
Treatment notes: 6 90’x90’ blocks treated, 6 nearby blocks untreated; 2 sets of 10 sweep net samples taken per block per sampling date. Presented data are insects per 10 sweeps.
Entire field treated July 23 due to GCW.

Mean Yield Treated: 59.88 ± 2.08 bu
Mean Yield Untreated: 60.78 ± 3.68 bu

July 1

Trt	BLB	GCW	JB	SB	DSB	BEB	GH	SL	CEW
UTC	0.25 ± 0.2	0.3 ± 0.2	0.4 ± 0.2	0.3 ± 0.1	0	0	0	0	0
Pyrethroid	0	0.4 ± 0.3	0.4 ± 0.3	0	0	0	0	0	0
T	P = 0.20	P = 0.80	P = 1.0	P = 0.08					

July 9

Trt	BLB	GCW	JB	SB	DSB	BEB	GH	SL	CEW
UTC	1.4 ± 1.0	4.8 ± 0.3	1.5 ± 0.5	0.2 ± 0.1	0.1 ± 0.1	0.2 ± 0.2	0.1 ± 0.1	0	0
Pyrethroid	0.4 ± 0.2	0.3 ± 0.3	0.3 ± 0.1	0.1 ± 0.1	0.1 ± 0.1	0.1 ± 0.1	0	0	0
T	P = 0.38	P = 0.01	P = 0.09	P = 0.55	P = 1.0	P = 0.67	P = 0.36		

July 17

Trt	BLB	GCW	JB	SB	DSB	BEB	GH	SL	CEW
UTC	1.1 ± 0.4	25.8 ± 1.9	0.3 ± 0.1	0.6 ± 0.4	0.5 ± 0.3	0.1 ± 0.1	0.2 ± 0.1	0	0
Pyrethroid	0.8 ± 0.5	12.4 ± 2.4	0.8 ± 0.4	0.3 ± 0.1	0.5 ± 0.2	0	0.2 ± 0.2	0	0
T	P = 0.72	P <0.01	P = 0.26	P = 0.45	P = 1.0	P = 0.36	P = 1.0		

August 3

Trt	BLB	GCW	JB	SB	DSB	BEB	GH	SL	CEW
UTC	0.2 ± 0.1	1.3 ± 0.2	0.2 ± 0.1	0	0	0	0.2 ± 0.1	0	0
Pyrethroid	0.2 ± 0.1	1.8 ± 0.4	0.1 ± 0.1	0	0	0	0.1 ± 0.1	0	0
T	P = 1.0	P = 0.22	P = 0.55				P = 0.55		

August 14

Trt	BLB	GCW	JB	SB	DSB	BEB	GH	SL	CEW
UTC	1.0 ± 0.5	0.7 ± 0.3	0	0	0	0	0.2 ± 0.1	0	0
Pyrethroid	0.3 ± 0.1	1.3 ± 0.5	0	0.3 ± 0.3	0	0	0.3 ± 0.1	0.2 ± 0.1	0
T	P = 0.20	P = 0.28		P = 0.36			P = 0.60	P = 0.17	

August 21

Trt	BLB	GCW	JB	SB	DSB	BEB	GH	SL	CEW
UTC	1.5 ± 1.0	2.3 ± 0.5	0	0	0	0	0.1 ± 0.1	0.2 ± 0.2	0
Pyrethroid	3.7 ± 1.7	1.7 ± 0.5	0	0	0	0	0.5 ± 0.2	0.3 ± 0.2	0
T	P = 0.30	P = 0.45					P = 0.08	P = 0.50	

August 27

Trt	BLB	GCW	JB	SB	DSB	BEB	GH	SL	CEW
UTC	1.2 ± 0.3	0.9 ± 0.5	0	0.1 ± 0.1	0	0.2 ± 0.2	0.2 ± 0.1	0	0
Pyrethroid	1.4 ± 0.8	0.6 ± 0.2	0	0.2 ± 0.1	0	0	0.2 ± 0.1	0.5 ± 0.2	0
T	P = 0.77	P = 0.51		P = 0.55		P = 0.36	P = 1.0	P = 0.04	

September 4

Trt	BLB	GCW	JB	SB	DSB	BEB	GH	SL	CEW
UTC	1.0 ± 0.5	0	0	0.3 ± 0.2	0	0	0.3 ± 0.2	0.3 ± 0.2	0
Pyrethroid	2.8 ± 1.0	0	0	0.7 ± 0.3	0	0	0.2 ± 0.1	0	0
T	P = 0.13			P = 0.44			P = 0.42	P = 0.24	

September 16

Trt	BLB	GCW	JB	SB	DSB	BEB	GH	SL	CEW
UTC	0.1 ± 0.1	0	0	0.9 ± 0.5	0	0	0.2 ± 0.2	0.8 ± 0.3	0.1 ± 0.1
Pyrethroid	0.5 ± 0.3	0	0	0.8 ± 0.5	0	0	0.3 ± 0.2	0	0
T	P = 0.18			P = 0.89			P = 0.50	P = 0.04	P = 0.36

Season long summation

Trt	BLB	GCW	JB	SB	DSB	BEB	GH	SL	CEW
UTC	7.4 ± 2.6	36.1 ± 2.6	2.3 ± 0.7	2.3 ± 0.8	0.6 ± 0.3	0.4 ± 0.2	1.3 ± 0.5	1.5 ± 0.4	0.1 ± 0.1
Pyrethroid	10.3 ± 2.1	18.5 ± 2.2	1.6 ± 0.6	2.3 ± 0.4	0.6 ± 0.2	0.1 ± 0.1	1.7 ± 0.4	0.8 ± 0.1	0
T	P = 0.41	P <0.01	P = 0.46	P = 1.0	P = 1.0	P = 0.17	P = 0.69	P = 0.17	P = 0.36

Field 2 near Selbyville, DE

Variety: DG 41x98
42x99
DG S43x70
Planting Dates: June 29 and July 2
Row Spacing: 15”
Treatment Date: August 5
Treatment notes: 4 sets of paired fields treated or untreated. Sampling consisted of 5 10-sweep samples from each field. Fields were scouted on August 13 but no pest insects were recorded. Data is not shown.

Mean Treated Yield: 52.11 ± 1.40
Mean Untreated Yield: 52.09 ± 1.41

Season Total

Trt	BLB	GCW	JB	SB	DSB	BEB	GH	SL	CEW
UTC	0.1 ± 0.1	1.6 ± 0.5	0	0.2 ± 0	0	0	0.6 ± 0.2	2.5 ± 0.6	0.1 ± 0.1
Pyrethroid	0.1 ± 0.1	0.3 ± 0.2	0	0.1 ± 0.1	0	0	0.5 ± 0.1	2.9 ± 0.6	0.1 ± 0.1
T -test	P = 1.0	P = 0.06		P = 0.06			P = 0.86	P = 0.66	P = 1.0

August 21

Trt	BLB	GCW	JB	SB	DSB	BEB	GH	SL	CEW
UTC	0.1 ± 0.1	0.9 ± 0.5	0	0.2	0	0	0.2 ± 0.2	0.1 ± 0.1	0.1 ± 0.1
Pyrethroid	0	0.2 ± 0.1	0	0.1 ± 0.1	0	0	0.3 ± 0.1	0.3 ± 0.3	0
T -test	P = 0.356	P = 0.218		P = 0.024			P = 0.816	P = 0.463	P = 0.356

August 28

Trt	BLB	GCW	JB	SB	DSB	BEB	GH	SL	CEW
UTC	0.1 ± 0.1	1.0 ± 0.1	0	0	0	0	0.2 ± 0	0.1 ± 0.1	0.1 ± 0.1
Pyrethroid	0	0.1 ± 0.1	0	0	0	0	0.3 ± 0.2	0.1 ± 0.1	0.1 ± 0.1
T -test	P = 0.374	P = 0.008					P = 0.025	P = 1.0	P = 0.678

September 4

Trt	BLB	GCW	JB	SB	DSB	BEB	GH	SL	CEW
UTC	0	0	0	0	0	0	0.1 ± 0.1	0.1 ± 0.1	0
Pyrethroid	0.1 ± 0.1	0	0	0	0	0	0	0.1 ± 0.1	0
T -test	P = 0.356						P = 0.134	P = 0.521	

September 15

Trt	BLB	GCW	JB	SB	DSB	BEB	GH	SL	CEW
UTC	0	0	0	0	0	0	0.1 ± 0.1	0.5 ± 0.1	0
Pyrethroid	0	0	0	0	0	0	0.1 ± 0.1	0.2 ± 0.0	0
T -test							P = 1.0	P = 0.128	

September 25

Trt	BLB	GCW	JB	SB	DSB	BEB	GH	SL	CEW
UTC	0	0	0	0	0	0	0.1 ± 0.05	1.8 ± 0.4	0
Pyrethroid	0.04 ± 0.04	0	0	0	0	0	0.1 ± 0.05	2.2 ± 0.5	0
T-test							P = 1.0	P = 0.528	

Field 3 near Seaford, DE

Variety: Axis 3818
Planting Date: 4 July 2020
Row Spacing: 15”
Treatment notes: 6 sprayer passes, 90 ft wide. In each sprayer pass, 5 10-sweep samples were collected.
Treatment Date: July 29 – Passes 2, 4, and 6 = original trial treatment protocol
August 10 – Passes 1, 2, 4, and 6 = partner ‘kitchen sink’ protocol
August 27 – Passes 1, 2, 4, 5, and 6 = partner ‘kitchen sink’ protocol
‘Kitchen Sink’ protocols included an application of cyfluthrin (Tombstone).

Yield for each pass was selected by two 33.9 ft combine passes contained within the sprayer passes. Replant sections due to extreme rainfall events were emitted.

Original Treatment Protocol
Treated Yield: 67.26 ± 0.5
Untreated Yield: 64.92 ± 2.3
P = 0.416

Original Treatment + Kitchen Sink 1
Treated yield: 65.59 ± 1.7
Untreated yield: 67.09 ± 1.3
P = 0.528

Original Treatment + Kitchen Sink 1 + Kitchen Sink 2
Treated yield: 65.63 ± 1.3
Untreated yield: 68.4

Due to differences in treatment timing, no season long table is displayed below.

July 31

Trt	BLB	GCW	JB	SB	DSB	BEB	GH	SL	CEW
UTC	0	0.3 ± 0.1	0.2 ± 0.1	0	0	0	0.1 ± 0.1	0	0
Pyrethroid	0	0.1 ± 0.1	0	0	0	0.1 ± 0.1	0.3 ± 0.2	0	0
T - test		P = 0.44	P = 0.22			P = 0.42	P = 0.54		

August 14

Trt	BLB	GCW	JB	SB	DSB	BEB	GH	SL	CEW
UTC	0	0.5 ± 0.3	0	0	0	0	0.8 ± 0	0	0
Pyrethroid	0.1 ± 0.1	0	0	0.1 ± 0.1	0	0	0.1 ± 0.1	0.1 ± 0.1	0

T - test	P = 0.18	P = 0.34		P = 0.39			P <0.01	P = 0.18	

August 21

Trt	BLB	GCW	JB	SB	DSB	BEB	GH	SL	CEW
UTC	0	4.6 ± 1.2	0	0	0	0	0.6 ± 0.6	0.4 ± 0	0.1 ± 0.1
Pyrethroid	0.2 ± 0.1	0	0	0	0	0	0	0.8 ± 0.2	0
T - test	P = 0.22	P = 0.16					P = 0.50	P = 0.24	P = 0.50

August 27

Trt	BLB	GCW	JB	SB	DSB	BEB	GH	SL	CEW
UTC	0	6.2 ± 0.8	0	0	0	0	1.4 ± 0.2	0.5 ± 0.1	0
Pyrethroid	0.1 ± 0.1	0.2 ± 0.1	0	0	0	0	0.3 ± 0.1	0.1 ± 0.1	0
T - test	P = 0.39	P = 0.08					P = 0.06	P = 0.07	

September 4

Trt	BLB	GCW	JB	SB	DSB	BEB	GH	SL	CEW
UTC	0.2	0	0	0	0	0	0.8	0.4	0
Pyrethroid	0.04 ± 0.04	0	0	0	0	0	0.08 ± 0.05	1.0 ± 0.3	0

September 15

Trt	BLB	GCW	JB	SB	DSB	BEB	GH	SL	CEW
UTC	0	0	0	0.2	0	0	0.6	0.2	0
Pyrethroid	0	0	0	0.1 ± 0.1	0	0	0.7 ± 0.3	1.4 ± 0.5	0.04 ± 0.04

September 25

Trt	BLB	GCW	JB	SB	DSB	BEB	GH	SL	CEW
UTC	0	0	0	0.4	0	0	0.4	1.0	0
Pyrethroid	0	0	0	0.1 ± 0.1	0	0	0.6 ± 0.2	1.8 ± 0.7	0

Field 4 near Georgetown, DE

Variety: Asgrow 43x8
Planting Date: 30 May 2020
Row Spacing: 15”
Treatment notes: middle 2 passes of field (200’ wide total) treated, edge 200’ around passes not treated
Treatment Date: July 9

Due to peculiarities with field conditions, how the field was setup and harvested, yield data was more uncertain than the previous three sites, and thus not reported here. A preliminary examination did not indicate any obvious yield differences.

Means per 10 sweeps; analyzed ignoring pseudoreplication for the purpose of displaying field trend only.

July 14

Trt	BLB	GCW	JB	SB	DSB	BEB	GH	SL	CEW
UTC	2.5 ± 1.2	0	0	0	0	0	1.3 ± 0.5	0	0
Pyrethroid	0.3 ± 0.3	0	0.5 ± 0.5	0.8 ± 0.3	0	0	0.5 ± 0.5	0	0
T - test	P = 0.15			P = 0.06			P = 0.32		

August 3

Trt	BLB	GCW	JB	SB	DSB	BEB	GH	SL	CEW
UTC	0.4 ± 0.2	0.4 ± 0.2	0.4 ± 0.4	0	0.2 ± 0.2	0	0.6 ± 0.2	0	0
Pyrethroid	0	0	0.4 ± 0.4	0	0	0	0	0	0
T - test	P = 0.18	P = 0.18	P = 1.0		P = 0.37		P = 0.07		

August 14

Trt	BLB	GCW	JB	SB	DSB	BEB	GH	SL	CEW
UTC	0	8.2 ± 1.6	0	0.2 ± 0.2	0	0	0.2 ± 0.2	0.2 ± 0.2	0
Pyrethroid	1.0 ± 0.5	6.0 ± 1.6	0	0.4 ± 0.2	0	0	0	0	0
T - test	P = 0.14	P = 0.36		P = 0.55			P = 0.37	P = 0.37	

August 21

Trt	BLB	GCW	JB	SB	DSB	BEB	GH	SL	CEW
UTC	0.6 ± 0.2	10.4 ± 1.4	0	0.2 ± 0.2	0	0	0	0.8 ± 0.4	0
Pyrethroid	0.8 ± 0.4	8.4 ± 1.4	0	0	0	0	0	0.2 ± 0.2	0.2 ± 0.2
T - test	P = 0.67	P = 0.34		P = 0.37				P = 0.21	P = 0.37

August 27

Trt	BLB	GCW	JB	SB	DSB	BEB	GH	SL	CEW
UTC	0	0	0	0	0	0	0	0	0
Pyrethroid	0.2 ± 0.2	1.4 ± 0.5	0	0	0	0	0	0.4 ± 0.2	0
T - test	P = 0.37	P = 0.05						P = 0.18	

September 4

Trt	BLB	GCW	JB	SB	DSB	BEB	GH	SL	CEW
UTC	0	0	0	0	0	0	0	0	0
Pyrethroid	0	0	0	0	0	0	0	0	0
T - test									

September 17

Trt	BLB	GCW	JB	SB	DSB	BEB	GH	SL	CEW
UTC	1.0 ± 0.4	0	0	0.6 ± 0.4	0	0	0	1.4 ± 0.5	0
Pyrethroid	0	0	0	008 ± 0.4	0	0	0	1.4 ± 0.7	0
T - test	P = 0.09							P = 1.0	

Total

Trt	BLB	GCW	JB	SB	DSB	BEB	GH	SL	CEW
UTC	4.0 ± 0.8	19.0 ± 2.6	0.4 ± 0.4	1.0 ± 0.5	0.2 ± 0.2	0	1.8 ± 0.6	2.4 ± 0.9	0
Pyrethroid	2.2 ± 0.7	15.8 ± 2.6	0.8 ± 0.5	1.8 ± 0.4	0	0	0.4 ± 0.4	2.0 ± 0.7	0.2 ± 0.2
T - test	P = 0.13	P = 0.41	P = 0.55	P = 0.27	P = 0.37		P = 0.09	P = 0.74	P = 0.37

Field 5 near Greenwood, DE

Variety: Asgrow 46x6
Planting Date: 11 May
Row Spacing: 15”
Treatment notes: a single 120’ sprayer pass across the full length of the field middle
Treatment Date: August 19

Due to peculiarities with field conditions, how the field was setup and harvested, yield data was more uncertain than the first three sites, and thus not reported here. A preliminary examination did not indicate any obvious yield differences.

August 24

Trt	BLB	GCW	JB	SB	DSB	BEB	GH	SL	CEW
UTC	0	0.8	0	0	0	0	0.6	0	0
Pyrethroid	0	0.2	0	0	0	0	0	0	0

September 1

Trt	BLB	GCW	JB	SB	DSB	BEB	GH	SL	CEW
UTC	0	0	0	0	0	0	0	0	0
Pyrethroid	0	0	0	0.2	0	0	0	0	0

September 9

Trt	BLB	GCW	JB	SB	DSB	BEB	GH	SL	CEW
UTC	0	0	0	0	0	0	0.4	0	0
Pyrethroid	0	0	0	0.2	0	0	0.6	0	0

Total

Trt	BLB	GCW	JB	SB	DSB	BEB	GH	SL	CEW
UTC	0	0.8	0	0	0	0	1.0	0	0
Pyrethroid	0	0.2	0	0.4	0	0	0.6	0	0

Early Season Moth Trapping

Wire mesh traps. Lure was replaced once. Some reports of minor late season TAW feeding in June were received. No reports of black cutworm damage were received.

True armyworm populations increased greatly in the summer. Some reports of pasture damage were received toards the end of July/early August.

True Armyworm

Location	March 17	March 25	March 31	April 7	April 14	April 21	April 28	May 5	May 11	May 20	
Willairds, MD	3	0	2	11	12	5				12	
Salisbury, MD	0	0		2		0				3	
Suddlersville, MD	0	0	0	5	7	0	1	9	4	3	
Laurel, DE	0	0	4	4	3	4	5	3	3	1	
Seaford, DE	4	25	67	68	195	36	47	92	4	2	
Harrington, DE	4	27	53	57	62	62	42	72	---	14	
Hartly, DE	6	20	42	30	54	15	44	52	3	14	
Smyrna, DE	6	21	32	57	83	7	20	10			

Black cutworm

Location	March 17	March 25	March 31	April 7	April 14	April 21	April 28	May 5	May 11	May 20	
Willairds, MD	0	5	13	23	7	1				32	
Salisbury, MD	0	0		3		0				12	
Suddlersville, MD	0	11	12	11	19	0	8	48	15	7	
Laurel, DE	0	0	2	0	36	2	3	24	24	17	
Seaford, DE	0	13	30	35	57	15	67	59	56	7	
Harrington, DE	0	5	25	29	37	2	22	59	20	52	
Hartly, DE	0	1	32	20	11	0	3	14	13	0	
Smyrna, DE	0	4	5	2	9	0	0	14			

BMSB Trapping

In conjunction with USDA-ARS researchers Joseph Kaser and Kim Hoelmer, in cooperation with a study led by David Crowder from Washington State University, we placed BMSB pheromone traps consisting of a dual pheromone lure attached to a clear sticky panel fastened onto a wooden tomato stake in 6 locations in Kent and Sussex counties. Traps were checked approximately every two weeks (Trap Pond was checked on 17 Sept). 3 traps were deployed at each site.

For pheromone traps located near or in orchards, members of the Brown Marmorated Stink Bug Working Group have been working on a pheromone trap based threshold. A reasonable threshold is somewhere between 1 and 10 adults per trap, cumulative (i.e. if a trap catches 3 bugs on day 1, and 3 bugs on day 2, and 4 bugs on day 3, then the threshold of 10 adults is reached on day 3).

Location	**4 September**	**15 September**	**29 September**
Bridgeville (Redden Rd nr 13)	17, 37, 12	10, 12, 9	4, 1, 5
Seaford (Longacre Ln)	11, 8, 15	14, 8, 10	0, 2, 2
Lewes (Robbinsonville Rd)	16, 17	1, 3	0, 2
Trap Pond State Park	3, 2, 0	3, 2, 1	0, 3, 2
Camden (Allabands Mill Rd)	17, 21, 20	11, 9, 10	8, 7, 13
Felton (Curvy Ln)	3, 1, 2	1, 4, 3	1, 4, 0

Corn Earworm Pyrethroid Susceptibility Bioassay 2020

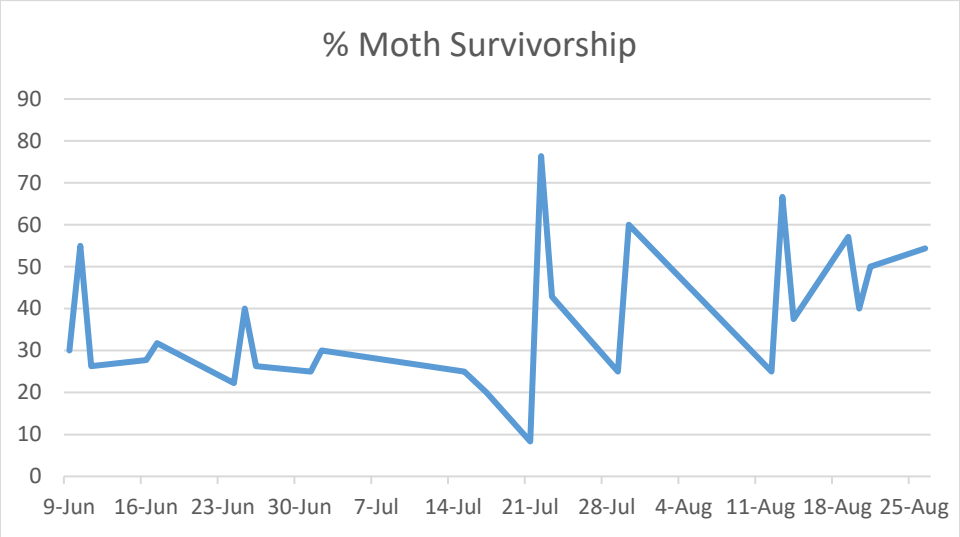
Purpose: Determine CEW susceptibility to cypermethrin as a proxy for pyrethroid susceptibility

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 replaced after 1 month post-preparation. Control vials were treated with acetone only. Moths kept in vials 24 hours before evaluation. 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 morality = (Treated mortality - Control mortality)/ 1 - Control mortality.



Overall: 381 moths were treated, 372 served as untreated controls. Overall survivorship was 35.8%. June (160 treated): 32.2%; July (131 treated): 33.1%; August (90 treated): 46.2%.

Degree Days (Georgetown, DE) and Other Notes

Seedcorn Maggot degree days (base 39F) for peak 1st generation: March 10

Seedcorn Maggot degree days for peak 2nd generation: May 3

Cereal Leaf Beetle peak egg lay (base 46): April 13

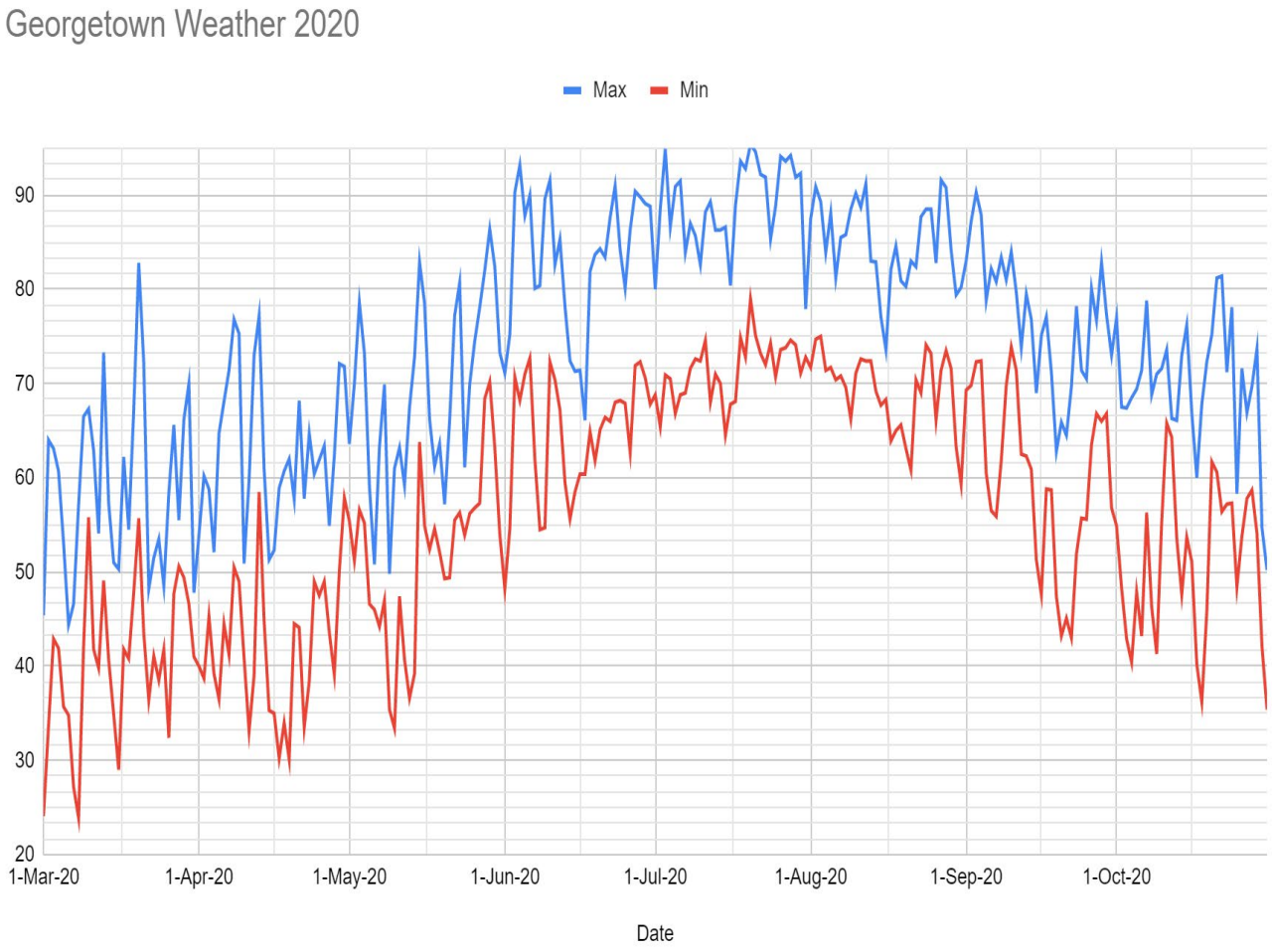
Alfalfa Weevil egg hatch (base 48): April 5

Black Cutworm cutting date (base 50), based on first 'significant' moth flight (possibly around 14 April in Seaford or 5 May): May 27 or June 1

First striped cucumber beetles were observed May 23

First Asparagus weevil eggs: April 10

Plum Curculio observed: May 13


Georgetown Weather 2020
Max
Min
90
80
70
60
50
40
30
20
1-Mar-20
1-Apr-20
1-May-20
1-Jun-20
1-Jul-20
1-Aug-20
1-Sep-20
1-Oct-20
Date

Soybean Pest Loss Survey 2020

Delaware in the year 2020

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	36,260	24.5%	1,480	1.0%	370	0.3%	1	$0.00	0.03	0.003	$0.00	0.01%	543	$7,018	$0.05	0.1%
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	90,132	60.9%	8,880	6.0%	14,800	10.0%	1	$8.50	0.75	0.100	$0.85	0.46%	33,728	$561,897	$3.80	7.6%
Blister Beetle	66,600	45.0%	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	91,760	62.0%	22,200	15.0%	32,560	22.0%	1	$15.00	2.60	0.220	$3.30	1.61%	119,034	$2,027,510	$13.70	27.4%
Cutworms	5,180	3.5%	0	0.0%	0	0.0%	0	$0.00	0.00	0.000	$0.00	0.00%	0	$0	$0.00	0.0%
Dectes Stem Borer	46,916	31.7%	0	0.0%	1,628	1.1%	1	$8.50	0.65	0.011	$0.09	0.21%	15,215	$210,571	$1.42	2.8%
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	14,800	10.0%	0	0.0%	0	0.0%	0	$0.00	0.00	0.000	$0.00	0.00%	0	$0	$0.00	0.0%
Grasshopper	91,908	62.1%	13,024	8.8%	14,800	10.0%	1	$8.50	0.50	0.100	$0.85	0.31%	22,928	$422,260	$2.85	5.7%
Green Cloverworm	110,556	74.7%	14,800	10.0%	22,200	15.0%	1.15	$8.50	0.60	0.173	$1.47	0.45%	33,096	$644,939	$4.36	8.7%
Japanese Beetle	59,200	40.0%	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	1,628	1.1%	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	81,400	55.0%	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	22,200	15.0%	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	7,400	5.0%	1,480	1.0%	0	0.0%	0	$0.00	0.15	0.000	$0.00	0.01%	554	$7,161	$0.05	0.1%
Slugs	29,600	20.0%	11,840	8.0%	4,144	2.8%	1.01	$20.00	3.25	0.028	$0.57	0.65%	47,998	$704,318	$4.76	9.5%
Soybean Aphid	23,828	16.1%	0	0.0%	0	0.0%	0	$0.00	0.05	0.000	$0.00	0.01%	594	$7,686	$0.05	0.1%
Soybean Looper	55,944	37.8%	4,144	2.8%	14,800	10.0%	1	$13.50	1.40	0.100	$1.35	0.53%	39,077	$705,071	$4.76	9.5%
Spider Mites	25,308	17.1%	7,400	5.0%	22,200	15.0%	1	$10.00	0.25	0.150	$1.50	0.04%	3,157	$262,817	$1.78	3.6%
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)	125,356	84.7%	14,800	10.0%	17,760	12.0%	1.1	$8.75	1.30	0.132	$1.16	1.10%	81,308	$1,222,252	$8.26	16.5%
Thistle 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	
Threecornered Alfalfa Hopper	10,212	6.9%	0	0.0%	0	0.0%	0	$0.00	0.00	0.000	$0.00	0.00%	0	$0	$0.00	0.0%
Thrips	148,000	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	5,180	3.5%	0	0.0%	5,180	3.5%	1	$20.00	12.00	0.035	$0.70	0.42%	31,014	$504,609	$3.41	6.8%
Automatic (no insects)	0	0.0%	0	0.0%	56,092	37.9%	1.1	$1.75	0.00	0.417	$0.73	0.00%	0	$107,977	$0.73	1.5%
									TOTAL	1.468	$12.56	5.80%	428,246	$7,396,085	$49.97	100.0%

SUMMARY DATA

Data Input

State	DE
Year	2020
Total Acres	148,000
Yield/acre	47
Price/Bushel	$12.93
% Acres Scouted	67
Scouting Fee/scouted acre	$7.75
% Acres Insect Seed Trt.	19.8
Seed Trt Cost/treated ac	$5.25

Yield & Management Results

Total Bushels Harvested	6,956,000
Total Bushels Lost to Insects	428,246
Percent Yield Loss	5.80%
Yield w/o Insects	49.89
Ave. # Spray Applications	1.468
Seed Treated Acres	29,304
Scouted Acres	99,160

Economic Results

	Total	Per Acre
Foliar Insecticides Costs	$1,858,869	$12.56
Seed Treatment Costs	$153,846	$1.04
Scouting costs	$768,490	$5.19
Total Costs	$2,781,205	$18.79
Yield Lost to insects	$5,537,216	$37.41
Total Losses + Costs	$8,318,421	$56.21

Stink Bug Composition

Species	% of SB
Brown	49
Brown Marmorated	9
Green	42
Redbanded	0
Redshouldered	0
Southern Green	0
Total (make it 100%)	100