Delaware Field and Vegetable Crop Insect Pest Management Trials, 2018

David Owens
Entomology Extension Specialist
Carvel Research and Education Center
16483 County Seat Highway
Georgetown, DE 19947
(302) 856-2585 ext 574; E-mail owensd@udel.edu

Bill Cissel
Extension IPM Agent
Department of Entomology and Wildlife Ecology
Townsend Hall Room 250
531 South College Avenue
Newark, DE 19716
(302) 893-9206; E-mail bcissel@udel.edu

Technical Support: Samantha Cotton, Joseph Deidesheimer, Caroline May, Agostina Armando, Joe Wheeler, Kevin Troyer

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

Acknowledgments

This research could not have been possible without the support from numerous individuals, farmers, and organizations, many of whom are listed below:

Carvel REC faculty and Staff, especially:
Mark Isaacs (Director)
Brian Hearn
James Atkins
Ward Harris

Sussex County Council

Competitive Grants:
Delaware Soybean Board

Industry Support:
Arysta LifeScience
Nichino America
Bayer Crop Science
FMC
Valent USA
Syngenta
Neudorff
Crites Seed, Inc.
Trapwoods Consulting, Inc.

University Collaborators:
Dr. Ivan Hiltpold, University of Delaware
Dr. Sally Taylor, Virginia Tech Tidewater AREC, Suffolk, VA
Dr. Dominic Reisig, NCSU Vernon James REC
Dr. Nicholas Seiter, University of Illinois
Dr. Nathan Kleczewski, University of Illinois

Famers:
Randy McCloskey
Guy and Dale Phillips
Jay Baxter
Roland Hill
Louis Outten
Dick Woolyhan

Pea 2018 Seed Corn Maggot

Location: Carvel REC
Variety: 'Hudson'
Planting Date: 3 April
Experimental Design: Randomized complete block design with 6 treatments and 4 replicates.
Plot size: 1 row x 20'
Row Spacing: 30"
Treatment Method: Broadcast soil treatments applied as a 12" spray band using a CO_2 – pressurized backpack sprayer with single nozzle boom equipped with a TP8002E nozzle delivering 27.9 GPA at 26 PSI. Insecticide incorporated into the upper 2 inches of soil using a bow rake.
Treatment Date: 3 April
Sample Size: Stand Evaluation from 2 3-ft sections
Data Analysis: ANOVA; Tukey-Kramer HSD means separation

TRT	Material	Rate	Application Method
1	UTC	---	
2	Cruiser		Seed Treatment
3	Lorsban		Seed Treatment
4	Radiant	6 fl oz/A	Broadcast PPI
5	Verimark	13.5 fl oz/A	Broadcast PPI
6	Capture LFR	8.5 fl oz/A	Broadcast PPI

TRT	Material	Stand			Runts		Dead		Injured seedlings
		15 DAP	22 DAP	29 DAP	22 DAP	29 DAP	22 DAP	29 DAP	29 DAP
1	UTC	40.0	39.5	35.8	4.5	4.3	0.5	3.3	34.0
2	Cruiser	46.3	47.3	39.8	2.8	4.0	0.8	4.8	36.3
3	Lorsban	43.0	49.0	44.8	1.3	3.5	0	1.8	40.3
4	Radiant	36.8	38.3	33.0	3.0	2.8	0	4	35.5
5	Verimark	36.5	40.0	31.3	2.0	4.8	0.3	2.8	33.8
6	Capture LFR	43.8	44.8	40.0	3.3	5.3	0.3	4.0	34.5
	ANOVA	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*

Notes: Chicken litter applied to soil on 3 April at a rate of 9 tons/acre. Seed planted with an Earthway 1001-B push planter with a pea seed plate. A mixture of pet food and bone and blood meal applied at 256 g per plot at planting.

Sweet Corn 2018 Corn Earworm

Location: Carvel REC
Variety: 'Summer Sweet 7902R'
Planting Date: 6 July
Experimental Design: Randomized complete block design with 6 treatments and 4 replicates.
Plot size: 2 rows x 25'
Row Spacing: 60"
Treatment Method: Directed ear spray; CO_2- pressurized backpack sprayer with single-row boom equipped with 2 D2 tips and #25 cores delivering 40 GPA at 41 PSI.
Sample Size: 25 ears/plot
Data Analysis: ANOVA; Tukey-Kramer HSD means separation. Ear injury square root transformed prior to analysis.

Application Rates and Dates:

TRT	Material	Rate	Application Dates
1	UTC	---	---
2	Experimental	---	8/16, 8/21
	Radiant	6 fl oz/A	8/18, 8/24, 8/27
	Warrior II	1.92 fl oz/A	8/30, 9/2
3	Warrior II – 2 Day	1.92 fl oz/A	8/16, 8/18, 8/21, 8/23, 8/25, 8/27, 8/29, 8/31, 9/2
4	Besiege	10 fl oz/A	8/16, 8/21, 8/27
	Warrior II	1.92 fl oz/A	8/18, 8/24, 8/30, 9/2
5	Warrior II – 3 Day	1.92 fl oz/A	8/16, 8/18, 8/21, 8/24, 8/27, 8/30, 9/2
6	Experimental	---	8/16, 8/18, 8/21, 8/24, 8/27, 8/30, 9/2

Harvest Date: 6 September

TRT	No. CEW/ 25 ears	% Clean ears	% Clean +tip ears	% Damaged ears	# Sap beetle damaged kernels	% sap beetle ears
1	23.0 a	12.0 c	24.0 b	76.0 a	29.5 a	26.1 a
2	1.3 bc	94.1 ab	95.0 a	5.0 b	10.5 ab	8.9 abc
3	2.5 bc	92.0 ab	96.0 a	4.0 b	3.8 b	7.0 bc
4	0.8 bc	97.0 ab	98.0 a	2.0 b	4.3 b	5 bc
5	5.0 b	81.0 b	93.0 a	7.0 b	16.5 ab	20 ab
6	0.5 c	98.0 a	99.0 a	1.0 b	0 b	0 c
ANOVA	*P <0.001*	*P <0.001*	*P <0.001*	*P <0.001*	*P = 0.005*	*P = 0.002*

Notes: Purpose was to compare pyrethroid efficacy alone with other modes of action; compare pheromone trap threshold treatment timing recommendations.

Sweet Corn 2018 Sentinel Plot CEW Bt Susceptibility

Location: Carvel REC
Newark, DE
Variety: See Table
Planting Date: 24 June (CREC)
21 June (Newark)
Experimental Design: Randomized complete block design with 5 treatments and 4 replicates.
Plot size: 4 rows x 28'
Row Spacing: 30"
Seeding Rate: 24,000 seeds/A
Treatment Method: NA
Sample Size: 50 ears/plot
13 whorls/plot for FAW damage rating
Harvest Date: 30 August for both sites
Data Analysis: ANOVA; Tukey-Kramer HSD means separation.

TRT	Variety	Protein	% Clean Ears	% Tip Damaged	% Sap Beetle Ears	FAW Damage Rating
1	BC 0805 Attribute	Cry1ab	9.0 b	76.0 a	53.0 a	0.23
2	Obsession	---	2.0 b	59.0 a	36.0 ab	0.31
3	Remedy Attribute II	Cry1ab + Vip3A	100 a	0 b	9.0 b	0
4	Providence	---	5.0 b	63.0 a	67.0 a	0.35
5	Obsession II	Cry1A.105 + Cry2Ab2	7.0 b	72.0 a	45.0 a	0.10
	ANOVA		*P <0.0001*	*P <0.0001*	*P = 0.0009*	*NS*

Notes: No ECB were detected. FAW pressure was very light. Newark plots heavily damaged by deer, data is not shown. FAW damage rating 0-10 scale with a 0 being no injury and a 10 being a completely destroyed whorl. Newark data followed similar trends.

Watermelon 2018 Aphids

Location: Carvel REC
Variety: 'Bottle Rocket'
'SP-7' pollinizer
Planting Date: 30 May
Experimental Design: Randomized complete block design with 6 treatments and 4 replicates
Plot size: 1 row x 21'
Row Spacing: 7'
Treatment Method: Foliar applications made with a CO_2- pressurized backpack sprayer with a 6' boom equipped with 4 D4 nozzles and #45 cores delivering 40 GPA at 38 PSI. Drip applications made through a second drip tape 25' long threaded under the plastic mulch. Applications made with a CO_2 pressurized 2 L bottle at 8 PSI filled first with 2 L of water, 2 L of product solution, and flushed with 2 L of water.

Treatment Date: 21 August
Sample Size: 15 leaf samples/ plot
Data Analysis: ANOVA; Tukey-Kramer HSD means separation. Data were log (x + 0.1) transformed prior to analysis.

TRT	Insecticide	Rate	Application Method	1 d Pre	2 DAT	6 DAT	14 DAT	20 DAT
1	Untreated Check	---	---	24.4	15.4 ab	25.5 a	7.7	0.8
2	Experimental	---	Drip	23.4	24.0 ab	23.0 a	7.9	0.1
3	Experimental	---	Drip	24.0	28.9 a	21.9 a	5.3	0.4
4	Sivanto HL + 0.25% Induce	7 fl oz/A	Broadcast	14.9	6.5 b	5.4 ab	2.0	0.2
5	Sivanto Prime	14 fl oz/A	Broadcast	22.3	7.0 ab	6.2 ab	1.5	0.7
6	Minecto Pro + 0.25% Induce	10 fl oz/A	Broadcast	30.4	3.9 b	1.2 b	0.3	0.2
	ANOVA			*NS*	*P = 0.0001*	*P <0.001*	*NS*	*NS*

Notes: Species complex present approximately 80% Green Peach Aphid, 20% Melon Aphid. Flare sprays of Perm-Up were applied on 27 June and 8 August.

Watermelon 2018 Two Spotted Spider Mite

Location: Carvel REC
Variety: 'Bottle Rocket'
'SP-7' pollinizer
Planting Date: 30 May
Experimental Design: Randomized complete block design with 6 treatments and 4 replicates
Plot size: 2 rows x 20'
Row Spacing: 7'
Treatment Method: CO_2- pressurized backpack sprayer with a 13.3' boom equipped with 8 D4 tips and #45 cores delivering 40 GPA at 52 PSI.
Treatment Date: 10 July
Sample Size: 10 crown leaves per plot
Data Analysis: ANOVA; Tukey Kramer HSD means separation. Pre-count, 3DAT, and 6 DAT (mobiles only) data were square root transformed. All other data were log transformed prior to analysis.

Mobile mites per leaf:

TRT	Material	Rate	1-d PRE	3 DAT	6 DAT 16 July	13 DAT 23 July	20 DAT 30 July
1	UTC	---	57.0	56.9	40.9 a	89.5 a	54.0 a
2	Portal	8.5 fl oz/A	99.2	32.3	29.4 ab	40.4 ab	14.6 ab
3	Oberon	2 pints/A	67.9	32.8	8.0 ab	17.7 ab	10.2 ab
4	Minecto Pro	10 fl oz/A	46.5	23.8	2.8 b	6.5 b	0.8 b
5	Kanemite	31 fl oz/A	149.3	86.2	16.1 ab	62.7 ab	19.0 ab
6	Zeal	6 fl oz/A	87.4	43.4	4.7 ab	5.3 ab	2.8 b
	ANOVA		*NS*	*NS*	*P = 0.030*	*P = 0.013*	*P = 0.011*

Eggs per leaf:

TRT	Material	Rate	1-d PRE	3 DAT	6 DAT 16 July	13 DAT 23 July	20 DAT 30 July
1	UTC	---	21.0	54.1	36.2	42.2	13.9 a
2	Portal	8.5 fl oz/A	29.1	22.9	33.8	16.6	4.7 a
3	Oberon	2 pints/A	17.4	34.4	2.9	51.0	3.8 ab
4	Minecto Pro	10 fl oz/A	13.	23.0	3.0	2.3	0.3 b
5	Kanemite	31 fl oz/A	39.3	56.4	18.0	24.5	3.5 a
6	Zeal	6 fl oz/A	14.4	34.5	5.5	6.9	1.2 ab
	ANOVA		*NS*	*NS*	*NS*	*NS*	*P = 0.008*

Notes: Plots infested on 14 June from greenhouse colony. Plots treated 27 June with carbaryl to flare mites.

Field Corn 2018 Corn Earworm

Location: Carvel REC
Variety: Northern King 'NK1066-3122-EZ1'
Planting Date: 19 June
Experimental Design: Complete block design with 2 treatments and 4 replicates
Plot size: 8 rows x 50'
Row Spacing: 30"
Treatment Method: Crop Care 25' side mount high pressure sprayer equipped with Tx 80015VK nozzles delivering 30 GPA at 250 PSI.
Treatment Date: 20 August
Sample Size: 20 ears/plot
Data Analysis: T-test

TRT	Material	Rate	# Clean Ears 17 DAT	# CEW 17 DAT	# Exits 17 DAT
1	UTC	---	0	31.3	1.3
2	Besiege	10 fl oz/A	0.8	17.5	3.5
	T-test		*NS*	*P = 0.013*	*NS*

Notes: Field began silking on 15 August. Purpose of experiment to demonstrate results of late planted field corn receiving an insecticide application.

Field Corn 2018 Slugs

Location: Middletown, DE
Variety: DeKalb '64-87'
Planting Date: 21 April
Experimental Design: Randomized complete block design with 4 treatments and 4 replicates
Plot size: 6 rows x 20'
Row Spacing: 30"
Treatment Method: Pellets spread with a Scott's Handy Green lawn spreader
Treatment Date: 10 May
Sample Size: Visual Observation from 17.5 row ft. from rows 3 and 4.
Harvest Date: 4 October
Data Analysis: ANOVA, Tukey Kramer HSD means separation.

Rainfall: (Data from DEOS Blackbird station)

Date	Amount (inches)	Date	Amount (inches)
May 10	0.06	May 22	0.24
May 12	1.21	May 27	0.38
May 13	0.18	May 29	0.01
May 14	0.04	May 30	0.01
May 15	1.31	May 31	0.17
May 16	0.43	June 2	0.06
May 17	0.81	June 3	0.64
May 18	1.07	June 4	0.02
May 19	0.70	June 5	0.07
May 20	0.50		

Stand Counts:

TRT	Material	Rate	0 D Pre	5 DAT	7 DAT	14 DAT	22 DAT	28 DAT
1	UTC	---	40.5	55.0	57.0	56.8	57.0	57.0
2	Ferroxx AQ	7.5 lbs/acre	49.5	55.5	56.8	56.8	56.5	56.5
3	Ferroxx AQ	10 lbs/acre	37.8	51.0	53.3	52.8	52.8	53.8
4	Deadline MPs	10 lbs/acre	32.8	48.8	49.5	51.0	49.3	48.8
	ANOVA		NS	*NS*	*NS*	*NS*	*NS*	*NS*

Field Corn 2018 Slugs (cont.)

% Injured Plants:

TRT	Material	Rate	0 D Pre	5 DAT	7 DAT	14 DAT	22 DAT	28 DAT
1	UTC	---	100	73.4 a	60.1	92.1	72.9	22.4
2	Ferroxx AQ	7.5 lbs/acre	97.9	40.8 b	35.7	81.8	52.2	14.5
3	Ferroxx AQ	10 lbs/acre	100	30.2 b	50.6	79.8	71.2	23.9
4	Deadline MPs	10 lbs/acre	98.1	29.5 b	23.0	90.7	72.5	22.3
	ANOVA		*NS*	*P <0.001*	*NS*	*NS*	*NS*	*NS*

Yield (moisture standardized to 15.5%):

TRT	Treatment	Yield per plant (pounds)	Yield (bu/A)
1	UTC	0.5 ± 0.1	125.2 ± 10.4
2	Ferroxx AQ 7.5	0.3 ± 0.04	121.3 ± 8.0
3	Ferroxx AQ 10	0.5 ± 0.1	115.2 ± 20.5
4	Deadline M-Ps 10	0.6 ± 0.1	124.2 ± 20.5
	ANOVA	*NS*	*NS*

Notes: >90% of slugs were gray garden slugs.

Soybean 2018 Bean Leaf Beetle

Location: Cordova, MD
Variety: Asgrow '4135'
Planting Date: 10 May
Experimental Design: Randomized complete block design with 4 treatments and 3 replicates.
Plot size: 8 rows x 20'
Row Spacing: 15"
Treatment Method: CO_2- pressurized backpack sprayer with 10' boom equipped with 6 XR11004 nozzles delivering 16 GPA at 22 PSI.
Treatment Date: 27 August

Sample Size: 15 sweeps/plot
Data Analysis: ANOVA; Tukey-Kramer HSD means separation. Counts were LOG (x + 0.1) transformed prior to analysis.

TRT	Material	Rate	2 DAT	7 DAT
1	UTC	---	8.7 a	5.3 a
2	Warrior II	1.0 fl oz/A	0.7 b	1.0 b
3	Prevathon	9.7 fl oz/A	9.0 a	4.0 ab
4	Steward	9.2 fl oz/A	0 b	9.7 a
	ANOVA		*P = 0.001*	*P = 0.008*

Soybean 2018 Dectes Stem Borer 1

Location: Middletown
Variety: Asgrow '44X6'
Planting Date: 11 May
Experimental Design: Randomized complete block design with 5 treatments and 4 replicates
Plot size: 4 rows x 25'
Row Spacing: 30"
Treatment Method: CO_2 pressurized backpack sprayer equipped with a 9' boom fitted with 6 XR11003 nozzles delivering 21.5 GPA at 40 PSI
Treatment Date: 13 July and 9 August
Sample Size: 10 sweeps per plot; 25 stems at R7
Data Analysis: ANOVA; Tukey-Kramer HSD means separation. Infested stem percentage data square root (x + 0.1) transformed prior to analysis

TRT	Material	Rate	Application Timing	0-d Pre	4 DAT	11 DAT	18 DAT	27 DAT	% Lodging	% Infested
1	UTC	--	--	0.3	0.3	0	0.3	0	0.6	10.2 a
2	Prevathon	20 fl oz/A	~7 days after first adult	0.3	0	0	0.3	0	0.4	4.0 ab
3	Prevathon + Steward	14 fl oz. + 6 fl oz/A	~7 days after first adult	0	0	0	0	0.3	0.5	7.0 ab
4	Prevathon	20 fl oz/A	~7 days + 3-4 weeks after first adult	0	0	0.3	0	0	0	6.0 ab
5	Prevathon + Steward	20 fl oz. + 6 fl oz/A	~7 days + 3-4 weeks after first adult	0	0.3	0	0	0	0	1.0 b
	ANOVA			*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*P = 0.038*

Soybean 2018 Dectes Stem Borer 2

Location: Warrington Irrigation Research Farm
Variety: 'S40LL35'
Planting Date: 10 May
Experimental Design: Randomized complete block design with 6 treatments and 4 replicates
Plot size: 10 rows x 25'
Row Spacing: 15"
Treatment Method: CO_2 pressurized backpack sprayer equipped with a 13.3' boom fitted with 8 XR8004 nozzles delivering 20 GPA at 38 PSI

Treatment Date: 16 July and 6 August
Sample Size: 10 sweeps per plot; 20 row-ft. pushed for lodging, 25 plants at R7
Data Analysis: ANOVA; Tukey-Kramer HSD means separation

TRT	Material	Rate	Application Timing	0-d PRE	8 DAT	17 DAT	% Lodging	% Infested
1	UTC	--	--	1.3	0	0	7.1 a	23.0 a
2	Prevathon	20 fl oz/A	~7 days after first adult	1.0	0	0	1.1 b	1.0 b
3	Prevathon + Steward	14 fl oz. + 6 fl oz/A	~7 days after first adult	0.5	0.3	0	1.2 b	3.0 b
4	Prevathon	20 fl oz/A	~7 days + 3-4 weeks after first adult	1.0	0.3	0	0 b	0 b
5	Prevathon + Steward	20 fl oz. + 6 fl oz/A	~7 days + 3-4 weeks after first adult	0.3	0.3	0	0.8 b	2.0 b
6	Besiege	10 fl oz/A	~7 days after first adult	0.5	0	0	0.4 b	3.0 b
	ANOVA			*NS*	*NS*		*P < 0.001*	*P <0.001*

Notes: Guard rows present between plots. 11 plots had tunneled stems, 9 plots had lodging. Of these plots, 4 were on the field edge, and two of those belonged to treatment 1. Use caution when interpreting results.

Soybean 2018 Grasshopper

Location: Carvel REC
Variety: Ag Venture 'AV38E8LL'
Planting Date: 11 May
Experimental Design: Randomized complete block design with 4 treatments and 3 replicates
Plot size: 25' x 100'
Row Spacing: 15"
Treatment Method: Crop Care 25' side mount high pressure sprayer equipped with Tx 80015VK nozzles delivering 30 GPA at 250 PSI.
Treatment Date: 22 September
Sample Size: 25 sweeps per plot; visual observation from 200 row-ft.
Data Analysis: ANOVA; Tukey-Kramer HSD means separation. Data log (x + 0.1) transformed prior to analysis

TRT	Material	Rate	Grasshoppers per 25 sweeps				Grasshoppers per 200 row ft.			
			Pre	2 DAT	9 DAT	13 DAT	Pre	2 DAT	9 DAT	13 DAT
1	UTC	---	9.7 a	6.7 a	4.3 a	1.7	46.0	23.7 a	63.7 a	11.7
2	Prevathon + 1% v/v MSO	20 fl oz/A	6.0 ab	1.7 ab	0.3 b	0.7	44.7	1.3 b	4.7 b	0
3	Sniper	6.4 fl oz/A	3.3 b	0 b	0 b	0.3	39.7	0 b	8.7 b	0.3
4	Lorsban	1.0 pt/A	6.0 ab	0.7 b	0 b	0.3	26.7	0.7 b	7.0 b	0
	ANOVA		0.024	0.021	<0.001	NS	NS	0.001	<0.001	NS

Notes: Cool and cloudy conditions on 2 DAT and 13 DAT. Species present was migratory grasshopper.

Soybean 2018 Soybean Looper

Location: Carvel REC
Variety: Unstated
Planting Date: July
Experimental Design: Treatments 1 and 2 with 3 replicates, treatment 3 with 2 replicates
Plot size: 4 rows x 8'
Row Spacing: 15"
Treatment Method: CO_2 pressurized backpack sprayer equipped with a 6' boom fitted with 4 XR11002 nozzles delivering 20 GPA at 33 PSI
Treatment Date: 3 October
Sample Size: visual searching of 1 row
Data Analysis: ANOVA; Tukey Kramer HSD means separation

TRT	Treatment	Rate	Reps	2 DAT	5 DAT
1	UTC	---	3	9 a	4 a
2	Proclaim	4.8 oz/A	3	1 b	0 b
3	Besiege	10 fl oz/A	2	9 a	4 a
	ANOVA			*P = 0.018*	*P = 0.011*

Notes: Third instar loopers were collected from soybean fields and placed in the middle two rows of each plot. Two rows between each plot were removed, and a 3' alley cut between replicates. Reps 1 and 2 received 100 loopers, rep 3 received 75 loopers.

Soybean 2018 Slugs 1

Location: Harbeson, DE
Variety: Asgrow '39x7'
Planting Date: 25 May
Experimental Design: Randomized complete block design with 3 treatments and 3 replicates
Plot size: 16' x 30'
Row Spacing: 7.5"
Treatment Method: Deadline spread by farmer using fertilizer broadcast equipment mounted on a tractor. Ferroxx AQ spread using a Scott's Handy Green lawn spreader
Treatment Date: 31 May
Sample Size: same 2 10 row-ft. sections
Data Analysis: ANOVA, Tukey-Kramer HSD means separation

Rainfall: (Data from DEOS Harbeson station)

Date	Amount (inches)	Date	Amount (inches)
June 1	0.04	June 10	0.3
June 3	1.75	June 11	0.31
June 4	0.11	June 13	0.06
June 9	1.84		

TRT	Material	Rate	Stand					Dead Plants	Damaged Plants			
			0-d PRE	4 DAT	7 DAT	12 DAT	19 DAT	4 DAT	0-D PRE	4 DAT	7 DAT	12 DAT
1	UTC	---	8.7	10.0	8.7	10.7	10.3	5.3 a	7.0	7.7	8.7	10.3
2	Ferroxx AQ	10 lbs/A	10.3	25.0	25.3	15.3	14.0	1.7 ab	7.0	20.3	19.7	11.7
3	Deadline MPs	10 lbs/A	5.3	17.7	16.7	13.3	12.0	0.7 b	4.7	13.0	15	10
	ANOVA		NS	NS	NS	NS	NS	P = 0.029	NS	NS	NS	NS

Notes: Field was replanted 20 June.

` Soybean 2018 Slugs 2

Location: Georgetown, DE
Variety: Credenze 'CZ4105 LL'
Planting Date: 12 May
Experimental Design: Randomized complete block design with 3 treatments and 4 replicates
Plot size: 20' x 100'
Row Spacing: 30"
Treatment Method: Slug bait pellets spread with a Scott's Handy Green lawn spreader
Treatment Date: 9 May
Sample Size: slug counts from 4 1-ft^2 samples/plot; plant samples from same 2 15 row-ft. sections
Data Analysis: ANOVA, Tukey-Kramer HSD means separation

Rainfall: (Data from the DEOS Stockley station)

Date	Amount (inches)	Date	Amount (inches)
May 10	0.02	May 22	0.25
May 12	1.05	May 27	1.40
May 13	0.15	May 28	0.14
May 14	1.17	May 30	0.02
May 15	0.81	May 31	0.01
May 16	0.27	June 1	0.04
May 17	0.12	June 3	1.21
May 18	2.89	June 4	0.07
May 19	1.34		

TRT	Material	Rate	4-June			8-June			Slugs/ft^2		
			Stand	Undmgd	Dead	Stand	Undmgd	Dead	9-May	16-May	29-May
1	UTC		56.4	0.5	5.0	55.7	16.2	2.8	2.4	3.1	1.8
2	Deadline MPs	5 lbs/A	59.5	2.4	3.4	53.6	16.4	2.0	2.1	2.7	1.4
3	Ferroxx AQ	5 lbs/A	53.4	2.6	4.8	52.8	10.7	2.0	2.5	1.9	1.4
	ANOVA		*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*

Notes: Purpose was to determine if half-rates of slug bait could suppress slugs enough before planting to prevent slug damage. Most slugs were marsh slugs

Soybean 2018 Thrips SVNV

Location: Wye Research and Education Center
Variety: 'P45T48R'
Planting Date: 20 June
Experimental Design: Randomized complete block design with 8 treatments and 4 replicates
Plot size: 8 rows x 25'
Row Spacing: 15"
Treatment Method: CO_2- pressurized backpack sprayer with a 9' boom equipped with 6 XR11003 nozzles delivering 21.5 GPA at 40 PSI.

Treatment Dates:

TRT	Material	Rate	Timing	Date of Application
1	UTC	---	UTC	
2	Actigard + 0.125% Induce	1 oz/A	V5	23 July
3	Actigard + 0.125% Induce	1 oz/A	R1	2 August
4	Actigard + 0.125% Induce	1 oz/A	R3	20 August
5	Actigard + 0.125% Induce	1 oz/A	R5	28 August
6	Actigard + 0.125% Induce	1 oz/A	V5 + R1	23 July, 2 Aug
7	Actigard + 0.125% Induce	1 oz/A	V5 + R1 + R3	23 July, 2 Aug, 20 Aug
8	Actigard + 0.125% Induce	1 oz/A	V5 + R1 + R3 + R5	23 July, 2 Aug, 20 Aug, 28 Aug

Sample Size: 15 leaflets from center 4 rows evaluated for SVNV Severity %. Thrips sampled from 10 upper canopy leaflets.
Harvest Date: 23 November
Data Analysis: ANOVA; Tukey Kramer HSD.

Notes: 951 of 958 adult thrips sampled were soybean thrips.

TRT	Timing	Pre		27 July		31 July		9 Aug		20 Aug		28 Aug	
		adults	larvae	adults	larvae	adults	larvae	adults	larvae	adults	larvae	adults	larvae
1	UTC	15.5	11.8	6.0	9.0	1.5	5.8	15.5	11.8	6.0	9.0	1.5	5.8
2	V5	15.3	17.8	6.0	10.5	2.5	6.5	15.3	17.8	6.0	10.5	2.5	6.5
3	R1	20.3	17.5	4.0	8.5	4.3	6.5	20.3	17.5	4.0	8.5	4.3	6.5
4	R3	14.5	8.3	4.0	6.5	1.5	5.5	14.5	8.3	4.0	6.5	1.5	5.5
5	R5	11.5	10.5	2.8	8.8	1.3	3.3	11.5	10.5	2.8	8.8	1.3	3.3
6	V5 + R1	22.8	7.5	6.3	10.3	3.8	4.0	22.8	7.5	6.3	10.3	3.8	4.0
7	V5 + R1 + R3	21.8	9.5	8.0	3.8	1.8	3.5	21.8	9.5	8.0	3.8	1.8	3.5
8	V5 + R1 + R3 + R5	24.3	10.5	5.0	6.0	3.3	7.3	24.3	10.5	5.0	6.0	3.3	7.3
	ANOVA	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*

TRT	Timing	% Symptomatic Plants		% Leaf Area Affected		Greenseeker				Yield (lbs)
		Sept 6	Sept 17	Sept 6	Sept 17	Sept 6	Sept 17	Sept 26	Oct 10	
1	UTC	11.7	33.3	0.08	0.92	0.86	0.87	0.82	0.33	10.3
2	V5	3.3	38.3	0.18	0.40	0.84	0.87	0.82	0.33	11.1
3	R1	5.0	33.3	0.13	0.52	0.84	0.87	0.82	0.39	10.6
4	R3	8.3	36.7	0.23	0.70	0.86	0.87	0.82	0.35	10.1
5	R5	8.3	26.7	0.08	0.83	0.84	0.87	0.81	0.30	10.1
6	V5 + R1	8.3	36.7	0.08	0.52	0.87	0.87	0.83	0.36	10.5
7	V5 + R1 + R3	10.0	53.3	0.62	0.90	0.83	0.86	0.83	0.39	9.8
8	V5 + R1 + R3 + R5	11.7	40.0	0.77	1.20	0.85	0.87	0.83	0.31	10.5
	ANOVA	*NS*	*NS*	*NS*	*NS*	*P = 0.041*	*NS*	*NS*	*NS*	*NS*

Soybean 2018 Thrips

Location: Felton, DE
Variety: 4.6 Plenish
Planting Date: 19 May
Experimental Design: Randomized complete block design with 2 treatments and 3 replicates
Plot size: 39’ x 250’
Row Spacing: 15”
Treatment Method: CO_2 pressurized backpack sprayer with a 13.3’ boom equipped with 8 XR8004 nozzles delivering 20 GPA at 38 PSI
Treatment Date: 26 June
Sample Size: 10 uppermost fully expanded leaflets and 10 leaflets 3 nodes below.
Harvest Date: 24 October
Data Analysis: T-test

TRT	Material	Rate	Pretreatment		2 DAT		Yield
			Lower	Upper	Lower	Upper	
1	UTC	---	94.7	36.0	40.7	47.7	54.7
2	Mustang Maxx	4 fl oz/A	47.7	49.3	44.3	36.7	54.7
	T-test		*NS*	*NS*	*NS*	*NS*	*NS*

Notes: Field had been treated the week prior with a POST herbicide.

Wheat 2018 IPM Pyrethroid Applications

Location: Carvel REC
Variety: 'Shirley'
Planting Date: 26 October 2017
Experimental Design: Randomized complete block design with 4 treatments and 4 replicates.
Plot size: 9' rows x 25'
Row Spacing: 7.5"
Treatment Method: CO_2- pressurized backpack sprayer with a 9' boom equipped with 6 XR8004 nozzles delivering 20 GPA at X PSI.

Treatment Date: See Table
Sample Size: 25 tillers per plot for CLB, 2 3-ft sections for TAW
Data Analysis: ANOVA; Tukey-Kramer HSD
Harvest Date: 25 June 2018
Harvested Rows: center 11 rows

Notes: CLB L denotes cereal leaf beetle larvae; CLB A denotes cereal leaf beetle adult, and TAW denotes true armyworm. Plots treated 5 May with Prosaro fungicide at 17 fl oz/A.

TRT	Material	Rate	Timing	4-May	11-May	21-May	29-May	Yield (lbs)	Test Weight
1	UTC	---		0	0.5 CLB L	0	0	9.6	49.7 b
2	Warrior II	1.92 fl oz/A	Flag leaf 1 May	0.25 CLB A	0	0	0	9.5	50.9 ab
3	Warrior II	1.92 fl oz/A	Flower 11 May	0.25 CLB L	0	0	0	10.3	50.7 ab
4	Warrior II	1.92 fl oz/A	Scouting	0	0	0.75 TAW	0	9.9	51.5 a
	ANOVA							*NS*	*P = 0.023*

Corn Earworm Pyrethroid Susceptibility Bioassay 2018

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

Method: Adult Vial Test

Procedure: Male CEW moths collected daily from Hartstack pheromone traps baited with Zealure pheromone strips. Moths placed in glass scintillation vials treated with 5 µg technical grade cypermethrin dissolved in acetone. Vials were treated by Virginia Tech's Tidewater Agricultural Research and Education Center. Vials were replaced 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.

Month	**No. moths untreated**	**No. moths treated**	**% Survivorship**
June	9	12	21.4%
July	15	16	26.8%
August	85	90	32.3%
September	17	19	68.4%
Overall	126	137	42.8%

Soybean Insect Pest Loss Survey Estimates, 2018

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	35,500	23.2%	1,300	0.8%	300	0.2%	1	$10.00	0.10	0.002	$0.02	0.02%	1,461	$15,415	$0.10	0.8%
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	108,400	70.8%	5,800	3.8%	2,900	1.9%	1	$7.50	0.75	0.019	$0.14	0.53%	33,450	$306,076	$2.00	15.5%
Blister Beetle	40,700	26.6%	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	98,100	64.1%	5,800	3.8%	5,700	3.7%	1	$15.00	1.75	0.037	$0.56	1.12%	70,634	$685,890	$4.48	34.8%
Cutworms	3,500	2.3%	390	0.3%	130	0.1%	1	$10.00	0.40	0.001	$0.01	0.01%	576	$6,196	$0.04	0.3%
Dectes Stem Borer	65,100	42.5%	0	0.0%	2,000	1.3%	1	$7.50	0.05	0.013	$0.10	0.02%	1,339	$26,384	$0.17	1.3%
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	1,000	0.7%	0	0.0%	0	0.0%	0	$0.00	0.00	0.000	$0.00	0.00%	0	$0	$0.00	0.0%
Grasshopper	113,900	74.4%	1,200	0.8%	0	0.0%	0	$0.00	0.15	0.000	$0.00	0.11%	7,029	$59,750	$0.39	3.0%
Green Cloverworm	140,800	92.0%	3,400	2.2%	3,300	2.2%	1	$10.00	0.10	0.022	$0.22	0.09%	5,793	$82,241	$0.54	4.2%
Japanese Beetle	121,700	79.5%	500	0.3%	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	9,600	6.3%	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	40,000	26.1%	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	55,000	35.9%	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	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%
Slugs	25,300	16.5%	900	0.6%	25	0.0%	1	$30.00	0.50	0.000	$0.00	0.08%	5,205	$44,990	$0.29	2.3%
Soybean Aphid	49,000	32.0%	13,000	8.5%	8,000	5.2%	1	$12.50	0.02	0.052	$0.65	0.01%	403	$103,427	$0.68	5.2%
Soybean Looper	93,500	61.1%	3,100	2.0%	2,900	1.9%	1	$20.00	1.25	0.019	$0.38	0.76%	48,087	$466,741	$3.05	23.7%
Spider Mites	15,000	9.8%	400	0.3%	380	0.2%	1	$13.50	0.00	0.002	$0.03	0.00%	0	$5,130	$0.03	0.3%
Spotted Cucumber Beetle	120,000	78.4%	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)	130,000	85.0%	3,900	2.5%	30	0.0%	1	$10.00	0.02	0.000	$0.00	0.02%	1,070	$9,393	$0.06	0.5%
Threecornered Alfalfa Hopper	15,000	9.8%	0	0.0%	0	0.0%	0	$0.00	0.00	0.000	$0.00	0.00%	0	$0	$0.00	0.0%
Thrips	153,000	100.0%	0	0.0%	0	0.0%	0	$0.00	0.00	0.000	$0.00	0.00%	0	$0	$0.00	0.0%
Trochanter Mealybug	0	0.0%	0	0.0%	0	0.0%	0	$0.00	0.00	0.000	$0.00	0.00%	0	$0	$0.00	0.0%
Velvetbean Caterpillar	0	0.0%	0	0.0%	0	0.0%	0	$0.00	0.00	0.000	$0.00	0.00%	0	$0	$0.00	0.0%
Other	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%
Automatic (no insects)	0	0.0%	0	0.0%	80,000	52.3%	1	$2.00	0.00	0.523	$1.05	0.00%	0	$160,000	$1.05	8.1%
									TOTAL	**0.691**	**$3.16**	**2.78%**	**175,048**	**$1,971,634**	**$12.89**	**100.0%**