2022 ANNUAL SUMMARY REPORT

Vegetable Insect Pest Management Research in Virginia

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VIRGINIA TECH

FOREWORD

This booklet contains arthropod pest management research conducted on vegetable crops in eastern Virginia in 2022. Research was conducted at several locations in Virginia including:

1) the Virginia Tech Eastern Shore Agricultural Research and Extension Center (AREC) near Painter, VA;
2) the Virginia Tech Kentland Research Farm near Blacksburg, VA;
3) the Southwest Virginia 4-H Educational Center in Abingdon, VA.

All plots were maintained according to standard commercial practices. Soil type at the ESAREC is a Bojac Sandy Loam. Soil type at the Kentland Research Farm is Shottower loam. Most of the research involves field evaluations of insecticides. Some of the information presented herein will be published in a similar format in the journal Arthropod Management Tests: 2023, vol. 48 (Entomological Society of America AMT). We hope that this information will be of value to those interested in insect pest management on vegetable crops, and we wish to make the information accessible. However, please note that all information is for informational purposes only. Because most of the data from the studies are based on a single season's environmental conditions, it is requested that the data not be published, reproduced, or otherwise taken out of context without the permission of the authors. The authors neither endorse any of the products in these reports nor discriminate against others. Additionally, some of the products evaluated are not commercially available and/or not labeled for use on the crop(s) in which they were used. **Please note, all industry confidential materials have been removed from data tables in this report.**

2022 Weather Data for research farm locations can be found at the following links:

- ESAREC, Painter, VA
- Kentland Farm, VA

If you have questions concerning the data or interpretation of the results, please feel free to contact us.

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CROP: PEPPER

Location	Virginia Tech Homefield Farm, Whitethorne, VA
Transplant Date	9 Jun 2022
Variety	Aristotle bell pepper
Experimental Design	12 treatments arranged in a RCB design with 4 replicates.
Plot Size	1 rows x 20 ft on white plastic mulch beds on 6 ft centers

Treatment Application Method	Trial included both drench treatments as well as foliar sprays. **Drench – trts were mixed into 320 fl oz = 9.5 liters of water to treat 40 plants (10 plants x 4 reps) with 8 fl oz each plant using a ladle to manually apply the drench to the base of the plant. Foliar treatments were applied with a 3-nozzle drop down boom equipped with D3 tips and 45 cores and powered by a CO2 backpack sprayer delivering 36 GPA.
Plot Maintenance	Plots were maintained according to standard commercial practices, drip irrigation. In order to flare aphids, plots were sprayed: 29 July; 18, 25 Aug; 2, 16 Sept with Danitol 2.4EC at 10 fl oz/A.
Treatment dates	12 Sept

Target Pest	Green peach aphid: *Myzus persicae*
Data Collection	On 15 (3 DAT) and 22 Sept (10 DAT), # of live aphids per 10 leaves was assessed leaves were rated according to a 0-5 Rating scale: rating # ~ # aphids/leaf 0 0 1 1-10 2 10-50 3 50-100 4 100-500 5 >500. After which, natural enemies brought aphid populations down.

RESULTS

			15 Sep (3 DAT)	22 Sep (10 DAT)
Treatment	**Rate/Acre**	**Type**	**leaf rating (0-5 scale)**	**leaf rating (0-5 scale)**
Untreated Check	-	-	0.4 ± 0.1 abc	0.02 ± 0.02 e
Pyganic 5%EC	15.6 fl. oz	foliar	0.5. ± 0.1 a	0.3 ± 0.1 ab
Senstar	10.0 fl. oz	foliar	0.3 ± 0.1 bcd	0.1 ± 0.04 cde
Sivanto Prime 200SL (drench)**	21.0 fl. oz	drench	0.5. ± 0.1 ab	0.3 ± 0.1 abc
AzaDirect (Drench)	32.0 fl. oz	drench	0.6 ± 0.1 a	0.4 ± 0.1 a
P-value from Anova			0.002	0.018

All data were analyzed using analysis of variance procedures. Means were separated using Fisher's LSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different ($P>0.05$).

CROP: TOMATO

Location	Virginia Tech Homefield Farm, Whitethorne, VA
Transplant Date	16 Jun2022
Variety	Tomato - Roma VF – Harris Seeds
Experimental Design	11 treatments arranged in a RCB design with 4 replicates.
Plot Size	1 rows x 20 ft on white plastic mulch beds on 6 ft centers

Treatment Application Method	All treatments were applied with a 1-nozzle boom equipped with D3 tips and 45 cores and powered by a CO2 backpack sprayer delivering 36 GPA. Manually walked up each side of the plot and assured that entire plants were treated.
Plot Maintenance	Plots were maintained according to standard commercial practices, drip irrigation.
Treatment dates	26 Aug

Target Pest	Potato aphid: *Macrosiphum euphorbiae*
Data Collection	On 29 Aug (3 DAT) and 2 Sept (7 DAT), five full leaves per plot were inspected for aphids.

RESULTS

		29 Aug (3 DAT)	2 Sept (7 DAT)
Treatment	**Rate/Acre**	**# aphids/5 leaves**	**# aphids/5 leaves**
Untreated Check	-	41 ± 16 a	8 ± 2 ab
Pyganic 5%EC	15.6 fl. oz	1 ± 1 c	5 ± 2 abcd
Senstar	10.0 fl. oz	11 ± 9 bc	1 ± 1 bcd
Movento + DyneAmic	4.0 fl. oz	5 ± 4 c	0 ± 0 d
P-value from Anova		0.038	0.006

All data were analyzed using analysis of variance procedures. Means were separated using Fisher's LSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different ($P>0.05$).

CROP: YELLOW SQUASH

Location	Virginia Tech Homefield Farm, Whitethorne, VA
Transplant Date	9 Jun 2022
Variety	Early Prolific Straight-Neck Organic
Experimental Design	5 treatments arranged in a RCB design with 4 replicates.
Plot Size	1 rows x 20 ft on white plastic mulch beds on 6 ft centers

Treatment Application Method	All treatments were applied with a 3-nozzle drop down boom equipped with D3 tips and 45 cores and powered by a CO2 backpack sprayer delivering 36 GPA.
Plot Maintenance	Plots were maintained according to standard commercial practices, drip irrigation. No applications of pyrethroids were used to flare aphids in this trial. A moderate population of aphids (10-50 per leaf) started naturally prior to treatment on 7 Sep.
Treatment dates	7 Sep

Target Pest	Melon aphid: *Aphis gossypii*

Data Collection	On 12 (5 DAT) and 15 Sep (8 DAT), five full leaves per plot were rated for aphid infestation Rating Categories 0= 0 aphids 1= <10 aphids 2= 11-50 aphids 3= 50-100 4= 100-500 5= >500.

RESULTS

		12 Sep (5 DAT)	15 Sep (8 DAT)
Treatment	**Rate/Acre**	**leaf rating (0-5 rating)**	**leaf rating (0-5 rating)**
Untreated Check	-	2 ± 0 a	2 ± 0 a
Pyganic 5%	15.6 fl oz	2 ± 0 a	1 ± 0 ab
Senstar	10.0 fl oz	0 ± 0 b	1 ± 0 b
P-value from Anova		<0.001	0.013

All data were analyzed using analysis of variance procedures. Means were separated using Fisher's LSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different (*P*>0.05).

CROP: ZUCCHINI SQUASH

Location	Virginia Tech Homefield Farm, Whitethorne, VA
Transplantlant Date	9 Jun 2022
Variety	Spineless Perfection UT Non-GMO
Experimental Design	15 treatments arranged in a RCB design with 4 replicates.
Plot Size	1 rows x 20 ft on white plastic mulch beds on 6 ft centers

Treatment Application Method	All treatments were applied with a 3-nozzle drop down boom equipped with D3 tips and 45 cores and powered by a CO2 backpack sprayer delivering 36 GPA.
Plot Maintenance	Plots were maintained according to standard commercial practices, drip irrigation. In order to flare aphids, plots were sprayed: 29 Jul; 18, 25 Aug; 2, 16 Sep with Danitol 2.4EC at 10 fl oz/A.
Treatment dates	7 Sept

Target Pest	Melon aphid: ***Aphis gossypii***
Data Collection	On 12 (5 DAT) and 15 Sep (8 DAT), five full leaves per plot were rated for aphid infestation Rating Categories 0= 0 aphids 1= <10 aphids 2= 11-50 aphids 3= 50-100 4= 100-500 5= >500.

RESULTS

Treatment	Rate/Acre	12 Sep (5 DAT) leaf rating (0-5 rating)	15 Sep (8 DAT) leaf rating (0-5 rating)
Untreated Check		5 ± 0 a	3 ± 0 ab
Movento + DyneAmic	4.0 fl. oz	4 ± 0 b	2 ± 0 cde
P-value from Anova		<0.001	<0.001

All data were analyzed using analysis of variance procedures. Means were separated using Fisher's LSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different (*P*>0.05).

CUCUMBER BEETLES

CROP: CANTALOUPE

Location	Virginia Tech Homefield Farm, Whitethorne, VA
Plant Date	26 Jul 2022
Variety	Ferry-Morse Hearts of Gold cantaloupe
Experimental Design	7 treatments arranged in a RCB design with 4 replicates.
Plot Size	1 rows x 20 ft on white plastic mulch beds on 6 ft centers, plants 2 ft apart

Treatment Application Method	All treatments were applied with a single nozzle boom equipped with D3 tips and 45 cores and powered by a CO2 backpack sprayer delivering 36 GPA.
Plot Maintenance	Plots were maintained according to standard commercial practices, drip irrigation.
Treatment dates	26 Jul, 1 Aug, 7 Aug for most treatments. For Surround, 25 Jul, 2 Aug, and 7 Aug.

Target Pest	Cucumber beetles (Mostly 75% *Acalymma vittatum* plus 25% *Diabrotica undecimpunctata*)
Data Collection	On 29 Jul; 3, 8, 17 Aug, assessed plants 1-minute visual counts for beetles in each plot; On 1, 8 and 26 Aug recorded cumulative # cantaloupe fruit per plot.

RESULTS

Treatment*	Rate/Acre	# cucumber beetles/ 1 min visual count: 29 Jul (3 DAT1)	3 Aug (2 DAT2)	8 Aug (1 DAT3)	17 Aug (10 DAT3)	Cumulative # fruit per plot
Untreated Check	-	3.5 ± 1	1 ± 0	3 ± 1 a	2 ± 1	25 ± 5
Surround WP	50 lbs	2.5 ± 0	0 ± 0	2 ± 1 ab	2 ± 1	23 ± 3
Pyganic	17 fl oz	5 ± 2	0 ± 0	1 ± 0 ab	3 ± 2	21 ± 3
Entrust SC	8 fl oz	6 ± 2	0 ± 0	3 ± 1 a	2 ± 1	21 ± 2
Azera	56 fl oz	6 ± 3	1 ± 0	2 ± 1 ab	3 ± 1	22 ± 3
AzaDirect	56 fl oz	5 ± 2	1 ± 0	0 ± 0 b	1 ± 0	23 ± 3
Venerate	215 fl oz	4 ± 1	0 ± 0	1 ± 1 ab	1 ± 1	23 ± 3
P-value from Anova		ns	ns	0.0434	ns	ns

All data were analyzed using analysis of variance procedures. Means were separated using Fisher's LSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different (*P*>0.05).

FLEA BEETLES

CROP: CABBAGE

Location	Virginia Tech Homefield Farm, Whitethorne, VA
Transplant Date	3 Jun 2022
Variety	Blue Lagoon cabbage
Experimental Design	11 treatments arranged in a RCB design with 4 replicates.
Plot Size	1 rows x 20 ft on white plastic mulch beds on 6 ft centers

Treatment Application Method	Trial included both drench treatments as well as foliar sprays. **Drench – trts were mixed into 320 fl oz = 9.5 liters of water to treat 40 plants (10 plants x 4 reps) with 8 fl oz each plant using a ladle to manually apply the drench to the base of the plant. Foliar treatments were applied with a 3-nozzle drop down boom equipped with D3 tips and 45 cores and powered by a CO2 backpack sprayer delivering 36 GPA.
Plot Maintenance	Plots were maintained according to standard commercial practices, drip irrigation.
Treatment dates	17 Jun; 15 Jul

Target Pest	*Phyllotreta* spp. flea beetles (mostly *P. striolata*)
Data Collection	On 20 Jun (3 DAT), Jun 24 (7 DAT), 14 Jul (27 DAT) and 19 Jul (4 DAT2), 21 Jul (6 DAT2), 25 Jul (10 DAT2), # of live flea beetles and harlequin bug nymphs was assessed on 5 plants per plot

RESULTS

			# Flea Beetle adults/5 plants					
Treatment	**Rate/Acre**	**Application Method**	**20 Jun (3 DAT1)**	**24 JunJun (7 DAT1)**	**29 JunJun (12 DAT1)**	**19 July (4 DAT2)**	**21 July (6 DAT2)**	**25 July (10 DAT2)**
Untreated Check	-	-	18 ± 10 a	30 ± 12 abc	32 ± 13 a	38 ± 13 ab	50 ± 14 ab	24 ± 13 bc
Harvanta 50SL	5.5 fl. oz	Foliar	1± 2 e	12 ± 6 cde	30 ± 14 a	2 ± 3 c	3 ± 3 d	17 ± 16 abc
Radiant	5.0 fl. oz	Foliar	2 ± 1 de	21 ± 10 bcde	30 ± 0 a	4 ± 3 c	25 ± 6 bc	39 ± 17 bc
Sivanto Prime 200SL	21.0 fl. oz	Soil drench	3 ± 2 cde	5 ± 2 e	13 ± 7 b	3 ± 3 c	6 ± 6 d	22 ± 2 bc
Spear T	36.0 fl. oz	Foliar	6 ± 3 bcde	48 ± 62 ab	39 ± 15 a	33 ± 21 ab	59 ± 39 a	37 ± 33 bc
Plinazolin SC400	1.03 fl. oz	Foliar	2 ± 2 de	9 ± 7de	11 ± 3 b	2 ± 1 c	3 ± 3 d	2 ± 2 d
P-value from Anova			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

All data were analyzed using analysis of variance procedures. Means were separated using Fisher's LSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different ($P>0.05$).

HARLEQUIN BUGS

CROP: CABBAGE

Location	Virginia Tech Homefield Farm, Whitethorne, VA
Transplantlant Date	3 Jun 2022
Variety	Blue Lagoon cabbage
Experimental Design	11 treatments arranged in a RCB design with 4 replicates.
Plot Size	1 rows x 20 ft on white plastic mulch beds on 6 ft centers

Treatment Application Method	Trial included both drench treatments as well as foliar sprays. **Drench – trts were mixed into 320 fl oz = 9.5 liters of water to treat 40 plants (10 plants x 4 reps) with 8 fl oz each plant using a ladle to manually apply the drench to the base of the plant. Foliar treatments were applied with a 3-nozzle drop down boom equipped with D3 tips and 45 cores and powered by a CO2 backpack sprayer delivering 36 GPA.
Plot Maintenance	Plots were maintained according to standard commercial practices, drip irrigation.
Treatment dates	17 Jun; 15 Jul

Target Pest	Harlequin bug: *Murgantia histrionica*
Data Collection	On 20 Jun (3 DAT), Jun 24 (7 DAT), 14 Jul (27 DAT) and 19 Jul (4 DAT2), 21 Jul (6 DAT2), 25 Jul (10 DAT2), # of live flea beetles and harlequin bug nymphs was assessed on 5 plants per plot

RESULTS

			# Harlequin Bug nymphs/5 plants		
Treatment	**Rate/Acre**	**Application Method**	**19 Jul (4 DAT2)**	**21 Jul (6 DAT2)**	**25 Jul (10 DAT2)**
Untreated Check	-	-	6.0 ± 5.9 b	10.5 ± 7.0 ab	20.8 ± 9.9 a
Harvanta 50SL	5.5 fl. oz	Foliar	6.25 ± 3.9 ab	15.8 ± 14.0 ab	14.8 ± 10.1 ab
Radiant	5.0 fl. oz	Foliar	6.3 ± 4.2 ab	8.8 ± 10.4 abc	14.8 ± 18.3 abc
Sivanto Prime 200SL	21.0 fl. oz	Soil drench	0.3 ± 0.5 c	0.5 ± 0.6 d	1.0 ± 0.8 d
Spear T	36.0 fl. oz	Foliar	9.8 ± 10.9 ab	8.5 ± 4.7 abc	9.3 ± 7.5 abc
Plinazolin SC400	1.03 fl. oz	Foliar	0.0 ± 0.0 c	2.3 ± 2.1 cd	4.0 ± 4.1 cd
P-value from Anova			0.001	0.01	0.05

All data were analyzed using analysis of variance procedures. Means were separated using Fisher's LSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different (*P*>0.05).

THRIPS

CROP: TOMATOES

Location	Virginia Tech ESAREC, Painter, VA
Transplant Date	18 May 2022
Variety	Better Boy
Experimental Design	6 treatments arranged in a RCB design with 4 replicates

Plot Size	1 rows x 20 ft on plastic mulch

Treatment Application Method	All treatments were applied with a 2-nozzle boom held sideways on each side of the row, equipped with D3 tips and 45 cores and powered by a CO2 backpack sprayer delivering 24GPA.
Treatment dates	6, 14 and 24 Jun

Target Pest	Tobacco thrips: *Frankliniella fusca*, flower thrips: *Frankliniella tritici*
Data Collection	On 29 Jun and 5 Jul, 15 blossoms were collected from each plot and placed in a vial containing 70% ethyl alcohol. Each blossom was then removed from the vial and the contents were sifted on a filter paper with the use of a Büchner funnel. Each filter paper was then placed under a dissecting microscope and the number of thrips present (adults and larvae) was recorded for each plot. On 13, 21, 29 Jun and 5 Jul, 50 leaves were collected from each plot and placed in a Ziploc bag containing 70% ethyl alcohol. Each leaf was then removed from the vial and the contents were sifted on a filter paper with the use of a Büchner funnel. Each filter paper was then placed under a dissecting microscope and the number of thrips present (adults and larvae) was recorded for each plot. On 11 Jul, 30 marketable size fruit were harvested from each plot and the number of thrips and stink bug damaged fruit was recorded.

RESULTS

		# thrips / 50 leaves								# thrips / 15 blossoms			
		13 Jun (7 DAT1)		21 Jun (7 DAT2)		29 Jun (6 DAT3)		5 Jul (12 DAT3)		29 Jun (6 DAT3)		5 Jul (12 DAT3)	
Treatment	**Rate/Acre**	**Adult**	**Larvae**	**Adult**	**Larvae**	**Adult**	**Larvae**	**Adult**	**Larvae**	**Adult**	**Larvae**	**Adult**	**Larvae**
Untreated Check	-	3.8	2.5	1.0	0.5	0.8	4.8 a	12.0	1.5	35.0	40.8	2.5	2.0
Plinazolin + DyneAmic	3.08 fl. oz + 0.25% v/v	3.5	0.8	2.0	0.3	1.3	0.8 b	11.0	2.5	15.3	1.8	2.0	4.8
Plinazolin + DyneAmic	4.11 fl. oz + 0.25% v/v	3.8	0.5	1.0	0.0	0.3	0.8 b	12.8	2.5	34.3	3.3	1.0	4.8
Radiant + DyneAmic	10 fl. oz + 0.25% v/v	4.0	0.5	2.8	0.3	2.5	0.5 b	8.0	0.3	15.5	1.5	2.5	2.0
Aza-Direct (foliar)	32 fl. oz	2.3	1.5	1.3	1.0	0.5	0.3 b	11.5	3.0	32.0	15.3	1.8	1.3
Aza-Direct (drip)	32 fl. oz	8.0	3.3	0.8	0.3	0.8	1.3 b	14.8	2.3	22.0	40.8	2.5	2.8
P-value from Anova		ns	ns	ns	ns	ns	0.0394	ns	ns	ns	ns	ns	ns

All data were analyzed using analysis of variance procedures. Means were separated using Fisher's LSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different (*P*>0.05).

Treatment	Rate/Acre	% stink bug damaged fruit	% thrips damaged fruit
Untreated Check	-	25.5	41.8 a
Plinazolin + DyneAmic	3.08 fl. oz + 0.25% v/v	32.5	29.3 ab
Plinazolin + DyneAmic	4.11 fl. oz + 0.25% v/v	16.8	35.8 a
Radiant + DyneAmic	10 fl. oz + 0.25% v/v	18.5	19.0 b
Aza-Direct (foliar)	32 fl. oz	29.3	33.5 a
Aza-Direct (thrips)	32 fl. oz	22.5	40.8 a
P-value from Anova		ns	0.0248

All data were analyzed using analysis of variance procedures. Means were separated using Fisher's LSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different (*P*>0.05).

CROP: SNAP BEANS

Location	Virginia Tech ESAREC, Painter, VA
Plant Date	6 Jun 2022
Variety	Valentino
Experimental Design	12 treatments arranged in a RCB design with 4 replicates
Plot Size	1 row x 20 ft with unplanted guard rows

Treatment Application Method	All foliar treatments were applied with a 3-nozzle boom equipped with D3 tips powered by a CO_2 backpack sprayer at 40psi delivering 62 GPA. Drench treatments were applied at the soil level with a watering can containing 13 pts covering 2 rows.
Treatment dates	24, 30 Jun and 7 Jul

Target Pest	Tobacco thrips: *Frankliniella fusca* Flower thrips: *Frankliniella tritici* Western flower thrips: *Frankliniella occidentalis*
Data Collection	On 11, 14 and 21 Jul, 50 blossoms were collected from each plot and placed in a vial containing 70% ethyl alcohol. Each blossom was then removed from the vial and the contents were sifted on a filter paper with the use of a Büchner funnel. Each filter paper was then placed under a dissecting microscope and the number of thrips present (adults and larvae) was recorded for each plot. On 29 Jun and 5 Jul, leaves were collected from each plot and placed in a Ziploc bag containing 70% ethyl alcohol. Each leaf was then removed from the vial and the contents were sifted on a filter paper with the use of a Büchner funnel. Each filter paper was then placed under a dissecting microscope and the number of thrips present (adults and larvae) was recorded for each plot. On 22 Jul, beans were mechanically harvested, weighed and examined for thrips, stink bug and lepidopteran larvae damage.

RESULTS

		# thrips / 10 trifoliates				# thrips / 50 blossoms					
		29-Jun (5 DAT1)		5-Jul (5 DAT2)		11-Jul (4 DAT3)		14-Jul (7 DAT3)		21-Jul (14 DAT3)	
Treatment	**Rate/Acre**	**Adults**	**Larvae**	**Adults**	**Larvae**	**Adults**	**Larvae**	**Adults**	**Larvae**	**Adults**	**Larvae**
Untreated Check	-	3.3	3.8 bc	3.3	2.5 ab	2.8 a	2.0	12.0	4.3 a	24.8	26.5 c
Plinazolin + DyneAmic	3.08 fl. oz + 0.25% v/v	0.8	0.0 e	1.0	0.0 c	0.3 bc	0.3	7.8	0.3 e	38.3	44.8 bc
Plinazolin + DyneAmic	4.11 fl. oz + 0.25% v/v	0.0	0.3 de	1.0	0.0 c	0.8 bc	0.3	10.8	1.0 de	44.3	78.0 a
Plinazolin + DyneAmic	10 fl. oz + 0.25% v/v	0.5	0.3 de	1.8	0.5 c	0.8 bc	0.3	8.3	1.0 de	37.8	49.3 bc
Radiant SC	10 fl. oz	0.8	0.3 de	2.0	0.3 c	0.8 bc	0.5	7.8	1.3 cde	35.5	71.8 ab
Aza-Direct	32 fl. oz	2.3	3.5 bcd	2.8	1.8 abc	2.8 a	0.8	15.0	3.8 ab	33.8	45.0 bc

Aza-Direct (drench)	32 fl. oz	1.3	4.5 ab	2.3	1.5 abc	1.5 ab	0.5	8.0	1.5 cde	32.0	29.0 c
Harvanta	16.4 fl. oz	1.5	0.5 cde	2.0	1.0 abc	0.5 bc	0.8	12.0	1.8 cde	30.0	31.5 c
Spear T + DyneAmic	3 gallons + 0.125% v/v	1.5	3.5 bcd	0.8	2.8 a	1.3	0.0	11.3	3.0 abc	33.8	42.8 c
Besiege	10 fl. oz	5.3	7.3 a	4.8	2.8 a	1.0 bc	2.0	8.8	2.3 bcd	28.5	43.5 c
Assail 30SG	5.3 oz	3.0	2.0 bcde	3.8	1.0 abc	1.5 ab	1.0	11.3	3.0 abc	31.0	53.5 abc
Entrust SC	6 fl. oz	1.0	0.8 cde	1.8	0.8 bc	0.0 c	0.3	11.5	2.3 bcd	19.5	35.3 c
P-value from Anova		ns	0.0007	ns	0.0139	0.0016	ns	ns	0.0052	ns	0.0101

All data were analyzed using analysis of variance procedures. Means were separated using Fisher's LSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different (*P*>0.05).

Treatment	Rate/Acre	weight per plot (lbs)	% thrips damage	% stink bug damage	% lepidopteran larvae damage
Untreated Check	-	5.1	6.5	8.0	4.8
Plinazolin + DyneAmic	3.08 fl. oz + 0.25% v/v	5.5	3.5	4.3	5.0
Plinazolin + DyneAmic	4.11 fl. oz + 0.25% v/v	6.3	3.3	8.3	4.3
Plinazolin + DyneAmic	10 fl. oz + 0.25% v/v	5.9	3.8	7.0	4.5
Radiant SC	10 fl. oz	4.9	2.5	11.8	8.0
Aza-Direct	32 fl. oz	3.9	4.3	10.5	4.8
Aza-Direct (drench)	32 fl. oz	4.7	4.0	6.3	5.8
Harvanta	16.4 fl. oz	5.8	4.0	19.0	6.8
Spear T + DyneAmic	3 gallons + 0.125% v/v	5.3	8.5	11.5	9.0
Besiege	10 fl. oz	6.5	2.3	8.8	5.8
Assail 30SG	5.3 oz	4.8	5.8	9.5	8.0
Entrust SC	6 fl. oz	5.3	2.3	10.3	3.3
P-value from Anova		ns	ns	ns	ns

All data were analyzed using analysis of variance procedures. Means were separated using Fisher's LSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different (*P*>0.05).

STINK BUGS

CROP: TOMATOES

Location	Virginia Tech ESAREC, Painter, VA
Soil Type	Bojac Sandy Loam
Plant Date	18 May 2022
Variety	Better Boy
Experimental Design	6 treatments arranged in a RCB design with 4 replicates
Plot Size	1 rows x 20 ft on plastic mulch

Treatment Application Method	All treatments were applied with a 2-nozzle boom held sideways on each side of the row, equipped with D3 tips and 45 cores and powered by a CO2 backpack sprayer delivering 36 GPA.
Treatment dates	13, 20 and 27 Jul

Target Pest	Southern Green stink bug: *Nezara viridula* Brown marmorated stink bug: *Halyomorpha halys* Green stink bug: *Chinavia halaris* Brown stink bug: *Euschistus servus*
Data Collection	On 27 Jul and 3 Aug, 30 fruit were harvested from each plot and examined for stink bug and lepidopteran larvae damage.

RESULTS

		% stink bug damaged fruit			% lepidopteran damaged fruit	
Treatment	**Rate/Acre**	**27-Jul (7 DAT2)**	**3-Aug (7 DAT3)**	**Total**	**27-Jul (7 DAT2)**	**3-Aug (7 DAT3)**
Untreated Check	-	20.0 ab	30.8 a	50.8 ab	2.5	3.3
Bifenthrin 2EC	6.4 fl. oz	11.7 bc	19.2 abc	30.8 bc	0.8	3.3
Argyle OD	9 fl. oz	12.5 bc	13.3 bc	25.8 c	1.7	5.8
Venom 70SG	4 oz	10.8 bc	6.7 c	17.5 c	0.0	1.7
Plinazolin + DyneAmic	7 fl. oz	6.6 c	20.0 abc	26.7 c	0.8	11.7
Lannate LV	24 fl. oz	26.7 a	25.8 ab	52.5 a	0.0	4.2
P-value from Anova		0.0079	0.032	0.0123	ns	ns

All data were analyzed using analysis of variance procedures. Means were separated using Fisher's LSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different ($P>0.05$).

CROP: TOMATOES

Location	Virginia Tech Homefield Farm, Whitethorne, VA
Plant Date	16 Jun 2022
Variety	Tomato Roma VF Untreated Non-GMO - Harris Seeds
Experimental Design	9 treatments arranged in a RCB design with 4 replicates.
Plot Size	1 rows x 20 ft on white plastic mulch beds on 6 ft centers, plants 2 ft apart

Treatment Application Method	All treatments were applied with a single nozzle boom equipped with D3 tips and 45 cores and powered by a CO2 backpack sprayer delivering 36 GPA.
Plot Maintenance	Plots were maintained according to standard commercial practices, drip irrigation.
Treatment dates	26 Jul, 1 Aug, 7 Aug, 16 Aug

Target Pest	Stink bugs mostly brown marmorated stink bug *Halyomorpha halys*
Data Collection	On 23 Aug, 50 ripe fruit per plot were harvested and evaluated for insect injury. Tomato plants went down quickly from disease (blight) preventing any additional harvests.

RESULTS

Treatment	Rate/Acre	% stink bug damage to harvested fruit on Aug 23
Untreated Check	-	36 ± 24
Actara 25 SWG	5.5 oz	19 ± 20
Assail 30 SG	4.0 oz	24 ± 24
Harvanta 50 SL	10.9 fl. oz	32 ± 4
Plinazolin L	2.05 fl. oz	18 ± 15

Plinazolin M	3.08 fl. oz	13 ± 9
Plinazolin H	4.11 fl. oz	17 ± 12
Sivanto Prime	21.0 fl. oz	26 ± 21
Spear T H	384 fl. oz	32 ± 24
P-value from Anova		ns

All data were analyzed using analysis of variance procedures. Means were separated using Fisher's LSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different (*P*>0.05).

CROP: SNAP BEANS

Location	Virginia Tech Homefield Farm, Whitethorne, VA
Plant Date	19 Jun 2022
Variety	Caprice snap bean – Harris Seeds
Experimental Design	7 treatments arranged in a RCB design with 4 replicates.
Plot Size	1 rows x 20 ft on white plastic mulch beds on 6 ft centers

Treatment Application Method	All treatments were applied with a 3-nozzle dropdown boom equipped with D3 tips and 45 cores and powered by a CO2 backpack sprayer delivering 36 GPA.
Plot Maintenance	Plots were maintained according to standard commercial practices, drip irrigation.
Treatment dates	3 and 12 Aug

Target Pest	Mexican bean beetle: *Epilachna varivestsis*; Stink bugs: mostly *Halyomorpha halys*
Data Collection	On 8 Aug (5 DAT) and 15 Aug (3 DAT2), each plot was inspected for 1 minute and total live pest insects were recorded. On 15 Aug, 100 random bean pods were harvested per plot and assessed for stink bug injury.

RESULTS

		# MBB per 1 min visual inspection					
		8 Aug (5 DAT1)		15 Aug (3 DAT2)		% damaged pods	
Treatment*	**Rate/Acre**	**Adult**	**Larvae**	**Adult**	**Larvae**	**# Stink bug feeding**	**# Missing bean**
Untreated Check	-	2 ± 0 a	7 ± 4	1 ± 0	10 ± 2 a	2 ± 0	14 ± 5
GPI 220	2.5 fl. oz	1 ± 0 b	4 ± 2	2 ± 1	1 ± 1 bc	2 ± 1	5 ± 2
Vantacor	1.66 fl. oz	1 ± 0 b	1 ± 1	1 ± 1	0 ± 0 c	1 ± 1	7 ± 3
Spear T	384 fl. oz	0 ± 0 c	5 ± 2	0 ± 0	5 ± 3 b	2 ± 1	5 ± 2
Torac	14 fl. oz	0 ± 0 c	1 ± 1	0 ± 0	0 ± 0 c	4 ± 1	4 ± 1
Elevest	5.6 fl. oz	0 ± 0 c	0 ± 0	0 ± 0	0 ± 0 c	1 ± 1	2 ± 1
Harvanta 50SL	10.9 fl. oz	0 ± 0 c	0 ± 0	0 ± 0	0 ± 0 c	1 ± 1	6 ± 2
P-value from Anova		<0.001	ns	ns	<0.001	ns	ns

*All treatments had Latron LI-700 NIS added at 0.5% v:v.

All data were analyzed using analysis of variance procedures. Means were separated using Fisher's LSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different (*P*>0.05).

CROP: SNAP BEANS

Location	Virginia Tech Homefield Farm, Whitethorne, VA
Plant Date	26 Jul 2022
Variety	Antiqua (organic snap bean)
Experimental Design	7 treatments arranged in a RCB design with 4 replicates.
Plot Size	1 rows x 20 ft on white plastic mulch beds on 6 ft centers, plants 2 ft apart

Treatment Application Method	All treatments were applied with a single nozzle boom equipped with D3 tips and 45 cores and powered by a CO2 backpack sprayer delivering 36 GPA.
Plot Maintenance	Plots were maintained according to standard commercial practices, drip irrigation.
Treatment dates	3 and 12 Aug.

Target Pest	Mexican bean beetle: *Epilachna varivestsis*; Stink bugs: mostly *Halyomorpha halys*
Data Collection	On 8 and 15 Aug, 1 min visual counts of beetles, lepsand stink bugs in each plot. On 15 Aug, harvested 100 random pods per plot and inspected them for Mexican bean beetle chewing damage, stink bug punctures and blemishes or deformed pods.

RESULTS

		# stink bugs per 1 min visual inspection		
Treatment	**Rate/Acre**	**Aug 8 (5 DAT1)**	**Aug 15 (3 DAT2)**	**% stink bug damaged pods**
Untreated Check	-	0.0	0.5	31.5 a
Surround WP	50 lbs	0.5	0.0	11.0 b
Pyganic	17 fl. oz	0.0	0.0	11.5 b
Entrust SC	8 fl. oz	0.0	0.3	14.6 b
Azera	56 fl. oz	0.0	0.5	13.5 b
AzaDirect	56 fl. oz	0.25	0.0	0.6 b
Venerate	215 fl oz	0.25	0.0	0.7 b
P-value from Anova		ns	ns	0.0023

All data were analyzed using analysis of variance procedures. Means were separated using Fisher's LSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different (*P*>0.05).

LEPIDOPTERAN LARVAE

BEET ARMYWORM

Location	Virginia Tech Blacksburg, VA
Target Pest	Beet armyworm: *Spodoptera exigua*
Insect collection date, location and method	Beet armyworm larvae were purchased from Benzon Research Inc. (~200 larvae were collected and the healthiest 160 (mostly 3rd instars) were used
Experimental Design	4 treatments replicated 5 times Treatments included:

	Water Check; Dipel DF (Bt *kurstaki*) 16 oz/A Spear Lep (36 fl oz/A) + Dipel DF 16 oz/A
Methods	8 larvae (3rd and 4th instars) were placed in a large glass 16-cm diam. Petri dish with a tablespoon size section of agar-based armyworm diet from Benzon Research dipped in field-rate concentrations for each treatment based on 30 gallon of water per acre. Dishes were left at ambient temperature in the laboratory.
Data Collection	Mortality was assessed at 72 h.

RESULTS

Treatment	Rate/Acre	% Mortality at 72 hr
Untreated Check	-	0.0 c
Dipel DF	16 oz	55.0 b
Spear Lep + Dipel DF	36 fl oz + 16 oz	82.5 a
P-value from Anova		<0.0001

All data were analyzed using analysis of variance procedures. Means were separated using Fisher's LSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different (*P*>0.05).

CROP: SWEET CORN

Location	Virginia Tech ESAREC, Painter, VA
Soil Type	Bojac Sandy Loam
Plant Date	6 Jul 2022
Variety	TakeOff
Experimental Design	9 treatments arranged in a RCB design with 4 replicates
Plot Size	2 rows x 20 ft with unplanted guard rows

Treatment Application Method	All foliar treatments were applied with a 1-nozzle boom equipped with D3 spray tips and powered by a CO_2 backpack sprayer at 40psi delivering 38 GPA.
Treatment dates	15, 17, 19, 22, 24, 26, 29, 31 Aug

Target Pest	Corn earworm: *Helicoverpa zea* Fall armyworm: *Spodoptera frugiperda*
Data Collection	On 1 Sep, 25 ears were harvested from each plot and examined for lepidopteran larvae damage. The number of lepidopteran larvae, clean ears and ears with tip damage only was recorded.

RESULTS

Treatment*	Rate/Acre	% tip damaged only ears	% clean ears	Mean no. corn earworm per 25 ears
Untreated Check	-	26.0 a	13.0 d	34.5 a
Lannate LV (a) fb Bifenture 2EC plus Lambda-cy (b) fb Lannate LV plus Rimon (c) fb Bifenture 2EC plus Lambda-cy (d, e) fb	24 fl. oz fb 4.8 fl oz plus 3.5 fl oz fb 24 fl oz plus 12 fl oz fb 4.8 fl oz plus 3.5 fl oz fb 24 fl oz plus 12 fl oz fb 24 fl oz	9.0 bc	86.0 ab	1.5 c

Lannate LV plus Rimon (f)fb Lannate LV (g)				
Lannate LV (a) fb Rimon (b) fb Lannate LV plus Rimon (c, d) fb Bifenture 2EC plus Lambda-cy (e,f) fb Lannate LV (g)	24 fl oz fb 12 fl oz fb 24 fl oz plus 12 fl oz fb 4.8 fl oz plus 3.5 fl oz fb 24 fl oz	22.0 ab	68.0 c	8.0 b
Heligen (a,c,d,f,g) rotated with Coragen (b,e)	2.4 fl oz rotated with 3.5 fl oz	20.0 ab	79.0 bc	4.0 bc
Heligen plus Optimol (a,b,c,f,g) rotated with Coragen (d,e)	2.4 fl oz plus 27 fl oz rotated with 3.5 fl oz	17.0 abc	72.0 c	4.0 bc
Experimental (a) fb Entrust (b,e) fb Leprotec © followed by GPI 220 (d) fb Bifenture 2EC (fg)	2.5 fl oz oz fb 6 fl oz fb 3.5 fl oz fb 2.5 fl oz fb 4.8 fl oz	6.0 c	91.0 ab	1.8 c
Elevest fb Entrust (b,e) fb Leprotec © followed by GPI 220 (d) fb Bifenture 2EC (fg)	9.6 fl oz fb 6 fl oz fb 3.5 fl oz fb 9.6 fl oz fb 4.8 fl oz	6.0 c	93.0 a	1.3 c
Vantacor fb Entrust (b,e) fb Leprotec © followed by GPI 220 (d) fb Bifenture 2EC (fg)	2.5 fl oz fb 6 fl oz fb 3.5 fl oz fb 2.5 fl oz fb 4.8 fl oz	12.0 bc	88.0 ab	2.5 c
Coragen fb Entrust (b,e) fb Leprotec © followed by GPI 220 (d) fb Bifenture 2EC (fg)	5 fl oz fb 6 fl oz fb 3.5 fl oz fb 5 fl oz fb 4.8 fl oz	11.0 bc	86.0 ab	2.0 c
P-value from Anova		0.0044	<0.0001	<0.0001

*one final spray was added on 31 Aug to all treatments (Bifenture 2EC at 4.8 fl oz/acre)

All data were analyzed using analysis of variance procedures. Means were separated using Fisher's LSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different (*P*>0.05).

CROP: SWEET CORN

Location	Virginia Tech ESAREC, Painter, VA
Soil Type	Bojac Sandy Loam
Plant Date	6 Jul 2022
Variety	TakeOff
Experimental Design	5 treatments arranged in a RCB design with 4 replicates
Plot Size	4 rows x 20 ft with unplanted guard rows

Treatment Application Method	All foliar treatments were applied with a 1-nozzle boom equipped with D3 spray tips and powered by a CO_2 backpack sprayer at 40psi delivering 20 GPA.
Treatment dates	15, 17, 19, 22, 24, 26, 29, 31 Aug

Target Pest	Corn earworm: *Helicoverpa zea*
Data Collection	On 17, 24 and 31 Aug, plots were examined for 2 mins and the number of beneficial insects and *chareopsis* species was recorded.

	On 1 Sep, 25 ears were harvested from each plot and examined for lepidopteran larvae damage. The number of lepidopteran larvae, clean ears and ears with tip damage only was recorded.

RESULTS

Table 1. Summary of efficacy of comparison of IPM techniques and conventional insecticide option in the Check of corn earworm in sweet corn; ESAREC, Painter, VA 2022 (beneficial insect counts)

		Mean no. beneficial insects / 2 mn observation									Mean no. total beneficial insects			Mean no. Chareopsis species per 2 mn observation		
Treatment*	**Rate/ Acre**	**Ladybugs (all species) 8/17**	**Pollinators 8/17**	**Others 8/17**	**Ladybugs (all species) 8/24**	**Pollinators 8/24**	**Others 8/24**	**Ladybugs (all species) 8/31**	**Pollinators 8/31**	**Others 8/31**	**17-Aug**	**24-Aug**	**31-Aug**	**17-Aug**	**24-Aug**	**31-Aug**
Untreated Check	-	2.8	0.3	0.8	0.8	1.3	0.0	1.0	0.8 b	0.5	3.8	2.0 b	2.3 b	2.5	9.3 b	6.0 ab
Coragen (a,b) rotated with Warrior ZT (based on trap catch)	5 fl oz fb 1.92 fl. oz	3.0	0.0	0.0	0.3	1.5	0.5	0.3	0.0 c	0.0	3.0	2.3 b	0.3 b	2.0	0.0 b	1.8 b
Coragen (a, b) rotated with Entrust SC (based on trap catch)	5 fl. oz fb 8 fl. oz	2.3	0.0	0.0	1.5	0.3	0.0	2.0	0.0 c	0.3	2.3	1.8 b	2.3 b	4.3	2.8 b	7.8 a
Warrior ZT (a, b, c, d, e, f, g)	1.92 fl. oz	0.5	0.5	0.3	0.5	1.3	0.0	0.8	0.3 bc	0.0	1.3	1.8 b	1.0 b	0.3	1.0 b	1.5 b
Attribute II BT corn (no sprays)	n/a	1.3	0.0	0.0	3.5	1.5	0.5	2.3	7.0 a	1.5	1.3	33.5 a	10.8 a	3.3	32.0 a	10.3 a
P-value from Anova		ns	ns	ns	ns	ns	ns	ns	<0.0001	ns	ns	<0.0001	<0.0001	ns	<0.0001	0.0039

*one final spray (h) was added on 31 Aug to all treatments (Bifenture 2EC at 4.8 fl oz/acre)

All data were analyzed using analysis of variance procedures. Means were separated using Fisher's LSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different (*P*>0.05).

Table 2. Summary of efficacy of comparison of IPM techniques and conventional insecticide option in the Check of corn earworm in sweet corn; ESAREC, Painter, VA 2022 (Harvest Data)

Treatment*	**Rate/Acre**	**% clean ears**	**% tip damaged only ears**	**Mean no. corn earworm larvae per 25 ears**
Untreated Check	-	1.0 c	37.0 a	43.0 a

Coragen (a,b) rotated with Warrior ZT (based on trap catch)	5 fl oz fb 1.92 fl. oz	89.0 ab	9.0 b	2.0 c
Coragen (a, b) rotated with Entrust SC (based on trap catch)	5 fl. oz fb 8 fl. oz	71.0 ab	5.0 b	0.5 c
Warrior ZT (a, b, c, d, e, f, g)	1.92 fl. oz	56.0 b	30.0 a	8.3 b
Attribute II BT corn (no sprays)	n/a	100.0 a	0.0 b	0.0 c
P-value from Anova		0.0001	<0.0001	<0.0001

*one final spray (h) was added on 31 Aug to all treatments (Bifenture 2EC at 4.8 fl oz/acre)
All data were analyzed using analysis of variance procedures. Means were separated using Fisher's LSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different (*P*>0.05).

CROP: SWEET CORN

Location	Virginia Tech Kentland Farm, VA
Plant Date	7 Jul
Variety	American Dream
Experimental Design	9 treatments arranged in a RCB design with 4 replicates
Plot Size	1 row x 20 ft

Treatment Application Method:	All treatments were applied with a 1-nozzle boom equipped with D3 spray tips and powered by a CO_2 backpack sprayer at 40psi delivering 38 gpa. Sprays were aimed at the tassels and ears/silks.
Plot Maintenance	Plots were maintained according to standard commercial practices
Treatment dates:	7 sprays: 22, 24, 26, 29, 31 Aug; 2, 6 Sep

Target Pest	Corn earworm: *Helicoverpa zea*
Data Collection	On 8 Sept, ~25 ears were harvested from each plot and examined for lepidopteran damage. The number of larvae per species was recorded as well as the number of clean ears, tip damaged only ears and unmarketable ears.

RESULTS

Treatment	Rate/Acre	% clean ears	% tip damage	% unmarketable ears	% total worm damage (combined)	# CEW larvae
Untreated Check	-	30 ± 11 b	58 ± 6 a	12 ± 1 a	71 ± 11 a	26 ± 7.6 a
Lannate LV (at tassel) (a) fb Bifenture 2EC (b) plus Lambda-cy (b,c) fb Lannate LV (c,d) plus Rimon (d) fb Rimon (e,f) fb Lannate LV (g)	24.0 fl. oz 4.8 fl. oz 3.5 fl. oz 24.0 fl. oz 12.0 fl. oz 12.0 fl. oz 24.0 fl. oz	100 ± 0 a	0 ± 0 c	0 ± 0 b	0 ± 0 b	0 ± 0 c
Lannate LV (at tassel) (a) fb Rimon (b,c) fb Lannate LV (d) plus Rimon (d) fb Bifenture 2EC (e,f) plus Lambda-cy (e,f) fb Lannate LV (g)	24.0 fl. oz 12.0 fl. oz 24.0 fl. oz 12.0 fl. oz 4.8 fl. oz 3.5 fl. oz 24.0 fl. oz	98 ± 1 a	2 ± 1 bc	0 ± 0 b	2 ± 1 b	1 ± 0.3 bc

Heligen (a,b,c) rotated with Coragen (d,e) rotated with Bifenthrin 2EC (f,g)	2.4 fl. oz 5.0 fl. oz 4.8 fl. oz	46 ± 8 b	49 ± 5 a	5 ± 1 a	54 ± 8 a	18 ± 3 a
Heligen (a,b,c) plus Optimol (a,b,c) rotated with Coragen (d,e) rotated with Bifenthrin 2EC (f,g)	2.4 fl. oz 27.0 fl. oz 5.0 fl. oz 4.8 fl. oz	88 ± 10 a	12 ± 10 b	0 ± 0 b	12 ± 9 b	5 ± 3 b
GPI220 (a,b) fb Bifenthrin 2E (c,e,g) fb Lannate LV (d,f)	2.5 fl. oz 4.8 fl. oz 24.0 fl. oz	97 ± 2 a	3 ± 2 bc	0 ± 0 b	3 ± 2 b	0 ± 0.3 c
Elevest (a,b) fb Bifenthrin 2E (c,e,g) fb Lannate LV (d,f)	9.6 fl. oz 4.8 fl. oz 24.0 fl. oz	99 ± 1 a	1 ± 1 bc	0 ± 0 b	1 ± 1 b	0 ± 0 c
Vantacor (a,b) fb Bifenthrin 2E (c,e,g) fb Lannate LV (d,f)	2.5 fl. oz 4.8 fl. oz 24.0 fl. oz	97 ± 2 a	3 ± 2 bc	0 ± 0 b	3 ± 2 b	0 ± 0.3 c
Coragen (a,b) fb Bifenthrin 2E (c,e,g) fb Lannate LV (d,f)	5.0 fl. oz 4.8 fl. oz 24.0 fl. oz	93 ± 5 a	7 ± 5 bc	0 ± 0 b	7 ± 5 b	1 ± 1 bc
P-value from Anova		<0.001	<0.001	<0.001	<0.001	0.001

All data were analyzed using analysis of variance procedures. Means were separated using Fisher's LSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different (*P*>0.05).

CROP: SWEET CORN

Location	Virginia Tech Kentland Farm, VA
Plant Date	7 Jul
Variety	American Dream
Experimental Design	9 treatments arranged in a RCB design with 4 replicates
Plot Size	1 row x 20 ft

Treatment Application Method:	All treatments were applied with a 1-nozzle boom equipped with D3 spray tips and powered by a CO_2 backpack sprayer at 40psi delivering 38 gpa. Sprays were aimed at the tassels and ears/silks.
Plot Maintenance	Plots were maintained according to standard commercial practices
Treatment dates:	7 sprays: 22, 24, 26, 29, 31 Aug; 2, 6 Sep

Target Pest	Corn earworm: *Helicoverpa zea*
Data Collection	On 8 Sep, ~25 ears were harvested from each plot and examined for lepidopteran damage. The number of larvae per species was recorded as well as the number of clean ears, tip damaged only ears and unmarketable ears.

RESULTS

Treatment	Rate/Acre	% clean ears	% tip damage	% unmarketable ears	% total lepidopteran damage (combined)	# CEW larvae
Untreated Check	-	28 ± 14 c	56 ± 10 a	16 ± 1	72 ± 1 a	31 ± 8
Entrust SC (a-g)	4.0 fl. oz	91 ± 6 a	9 ± 6 b	0 ± 0	9 ± 1 c	1 ± 1
Entrust SC* (high limit 4 apps) (a-d) fb Azera (e-g)	6.0 fl. oz 56.0 fl. oz	98 ± 1 a	2 ± 1 b	0 ± 0	2 ± 1 c	1 ± 1
Heligen (a-c) rotated with Entrust SC (d-f)	2.4 fl. oz 6.0 fl. oz	58 ± 10 bc	39 ± 9 a	3 ± 1	42 ± 1 ab	11 ± 3
Heligen + Optimol (a-c) rotated with Entrust SC (d-f)	2.4 + 27.0 fl. oz 6.0 fl. oz	57 ± 12 bc	34 ± 6 a	10 ± 1	43 ± 1 ab	13 ± 5
Heligen (a-g)	2.4 fl. oz	56 ± 18 b	41 ± 17 a	2 ± 1	44 ± 1 b	13 ± 4
Heligen + Optimal (a-g)	2.4 + 27.0 fl. oz	43 ± 19 bc	55 ± 18 a	2 ± 1	57 ± 1 ab	20.5 ± 4
Heligen + Azera (a-g)	2.4 + 56.0 fl. oz	31 ± 15 bc	55 ± 14 a	14 ± 1	69 ± 1 ab	26 ± 4
P-value from Anova		<0.001	<0.001	ns	<0.001	<0.001

All data were analyzed using analysis of variance procedures. Means were separated using Fisher's LSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different ($P>0.05$).

CROP: Bt SWEET CORN EVALUATIONS IN VIRGINIA

In the late 1990s, sweet corn varieties containing genes from the bacterium *Bacillus thuringiensis* (Bt) that expressed Cry insecticidal toxins were introduced to the market. Additional insecticidal genes from Bt including Cry1Ab, Cry2Ab2, Cry1Ac, Cry1F, and Vip3A have been added to corn in subsequent years. Populations of corn earworm in the U.S. have demonstrated resistance to Bt transgenic Cry1Ab, Cry2Ab2, and Cry1Ac toxins. Additionally, fall armyworm populations have shown resistance to Cry1F toxins. As part of a multistate effort to assess the performance of the various Bt toxins on lepidopteran pests in the Eastern U.S. (Dively et al. 2020), we evaluated commercially available sweet corn varieties: Attribute 'BC0805' expressing Cry1Ab, Attribute II 'Remedy' expressing Cry1Ab and Vip3A, and their non-Bt isoline 'Providence'; and Performance Series 'Obsession II' expressing Cry1A.105+Cry2Ab2, and its non-Bt isoline 'Obsession I'. Reported here are the 2022 results of field plots established at the Eastern Shore AREC in Painter, VA, Tidewater AREC in Suffolk, VA; Kentland Farm located in Whitethorne, VA, and the Virginia Cooperative Extension Southwest Virginia 4-H Center in Abingdon, VA (planted by VCE Washington Co., ANR Agent, Phil Blevins). At the TAREC site in Suffok, only two varieties were planted, Providence non Bt versus Remedy with Vip3A. Across all sites, the only Bt variety providing effective Check was 'Remedy' containing the Vip3A gene.

Reference cited:

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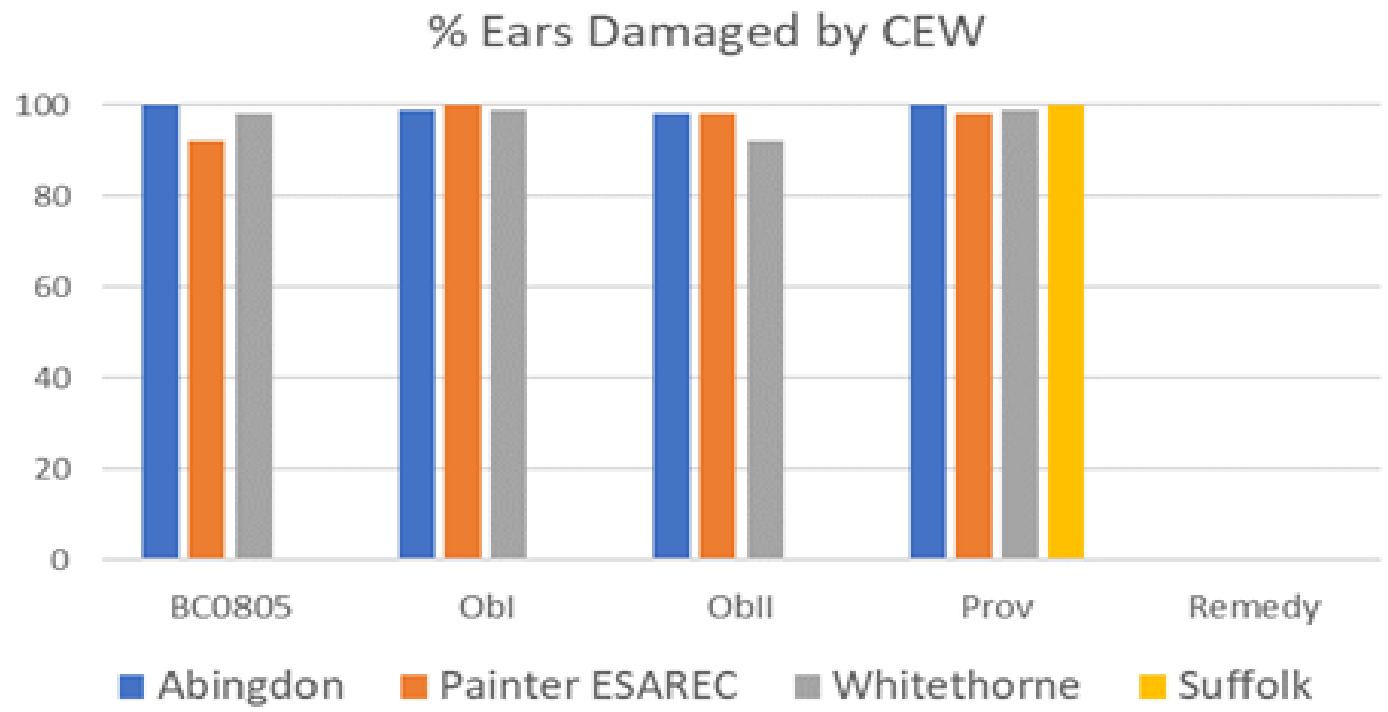
Fig. 1. Percentage of corn earworm damaged ears in small plot trials of Bt sweet corn varieties at four locations in Virginia in 2022.



COMPARISON OF PHEROMONE LURES AND TRAP STYLES FOR CORN EARWORM MONITORING IN SWEET CORN

This study was conducted in a commercial sweet corn field in Eastville, VA (Northampton County) of approximately 2 acres in size. Four pheromone lures and three trap styles were compared as follows:

TRAPS: Bucket trap, Mesh Heliothis trap, Metal Hartstack Heliothis trap
LURES: Trece, Alpha, Scentry, Hercon

Traps were placed approximately 135 to 150 ft apart on 12 Aug at full tasseling, as indicated below:

	Bucket			Metal		Mesh	
	SCENTRY			SCENTRY		SCENTRY	
							Metal
Mesh							ALPHA
HERCON							
							Mesh
			SWEET CORN FIELD				ALPHA
Bucket							
HERCON							135 ft spacing
							Bucket
Mesh							ALPHA
HERCON	Bucket			Metal		Mesh	
	TRECE			TRECE		TRECE	

Traps were checked every 2 to 3 days following the initial check (5 nights).

Bucket trap (left), Heliothis mesh trap (middle), and Harstack wire mesh trap (right).

RESULTS

- Corn earworm flights were heavy at the time of the study. One trap had 784 moths over 5 nights.
- Metal Hartstack traps caught significantly more CEW moths per night than the Heliothis mesh or the bucket trap (Fig. 1).
- Hercon pheromone lures had the highest CEW trap catch per night (Fig. 2).

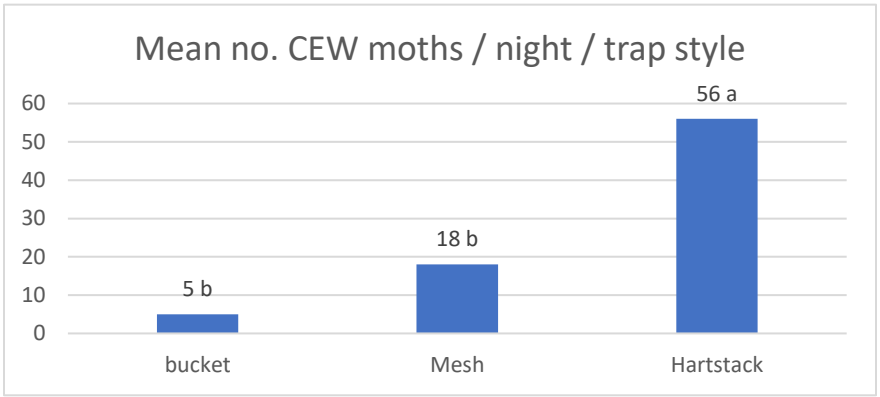


Figure 1. Summary of comparison of pheromone lures and trap styles for CEW monitoring in sweet corn; Eastville, VA 2022 (trap style data)

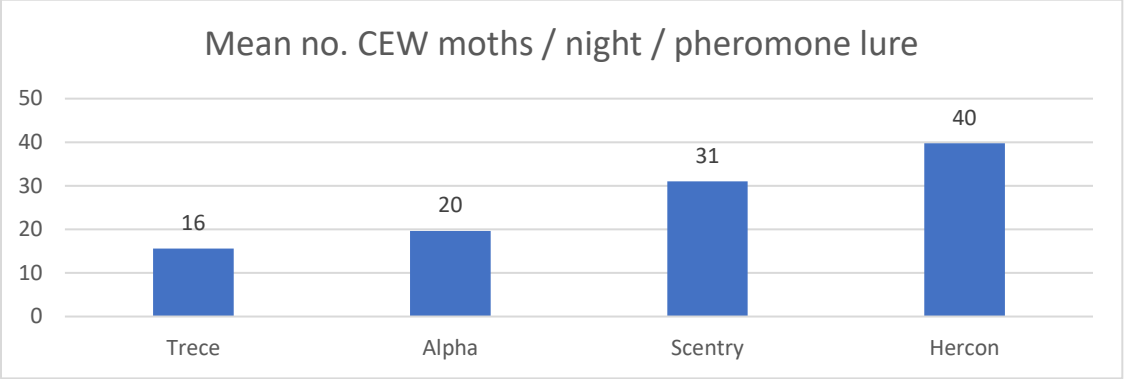


Figure 2. Summary of comparison of pheromone lures and trap styles for CEW monitoring in sweet corn; Eastville, VA 2022 (pheromone lure data)

RAW DATA

TRAP	LURE	17-Aug (5 nights)	19-Aug (2 nights)	22-Aug (3 nights)	24-Aug (2 nights)	26-Aug (2 nights)	29-Aug (3 nights)	TOTAL CEW MOTHS	# CEW / night
Bucket	Trece	65	13	25	5	9	6	123	8
Bucket	Alpha	28	10	21	5	5	2	71	4
Bucket	Scentry	37	6	10	8	6	2	69	4
Bucket	Hercon	37	6	22	7	6	2	80	5
Mesh	Trece	53	23	1	2	1	2	82	5
Mesh	Alpha	47	23	28	16	8	0	122	8
Mesh	Scentry	153	60	60	29	4	0	306	19
Mesh	Hercon	368	115	89	55	9	0	636	40
Metal	Trece	457	41	12	28	6	1	545	34
Metal	Alpha	449	129	115	19	24	14	750	47
Metal	Scentry	643	143	153	119	35	22	1115	70
Metal	Hercon	784	30	178	131	50	19	1192	75

CROP: TOMATOES

Location	Virginia Tech ESAREC, Painter, VA
Plant Date	27 Jul 2022
Variety	CR1453
Experimental Design	10 treatments arranged in a RCB design with 4 replicates
Plot Size	1 row x 20 ft

Treatment Application Method	All treatments were applied with a 3-nozzle boom equipped with D3 tips and 45 cores and powered by a CO_2 backpack sprayer delivering 31GPA.
Treatment dates	1, 8, 14 and 22 Sep

Target Pest	Corn earworm: *Helicoverpa zea* Yellowstriped armyworm: *Spodoptera ornithogalli*

Data Collection	On 28 Sep, 30 fruit were harvested from each plot and examined for lepidopteran larvae damage. The number of fruit with surface damage and/or internal holes were recorded.

RESULTS

Treatment	Rate/Acre	% lepidopteran damaged fruit	% fruit with internal holes
Untreated Check	-	52.5 a	22.5 a
Dipel DF	1 lb	22.5 b	9.2 bcd
Dipel DF	2 lb	11.7 cde	5.8 cd
Dipel DF fb knack	2 lb fb 3 fl. oz	21.7 bc	12.5 bc
Leprotec	2 fl. oz	24.2 b	16.7 ab
Entrust SC	6 fl. oz	8.3 e	2.5 d
Entrust SC fb Xentari WG fb Entrust SC fb Dipel DF	6 fl. oz fb 1lb fb 6 fl. oz fb 1 lb	10.8 de	7.5 cd
Xentari WG	1 lb	20.0 bcd	8.3 cd
Xentari WG	2 lb	25.0 b	9.2 bcd
Xentari WG fb knack	1 lb fb 3 fl. oz	19.2 bcd	7.5 cd
P-value from Anova		<0.0001	0.0006

All data were analyzed using analysis of variance procedures. Means were separated using Fisher's LSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different (*P*>0.05).

CROP: TOMATOES

Location	Virginia Tech Homefield Farm, Whitethorne, VA
Transplant Date	16 Jun 2022
Variety	Tomato Roma VF Untreated Non-GMO - Harris Seeds
Experimental Design	9 treatments arranged in a RCB design with 4 replicates.
Plot Size	1 rows x 20 ft on white plastic mulch beds on 6 ft centers, plants 2 ft apart

Treatment Application Method	All treatments were applied with a single nozzle boom equipped with D3 tips and 45 cores and powered by a CO2 backpack sprayer delivering 36 GPA.
Plot Maintenance	Plots were maintained according to standard commercial practices, drip irrigation.
Treatment dates	26 Jul, 1 Aug, 7 Aug, 16 Aug

Target Pest	Lepidopteran pests
Data Collection	On 23 August 50 ripe fruit per plot were harvested and evaluated for insect injury. Proportion damage data were analyzed using ANOVA. Tomato plants went down quickly from disease (blight) preventing any additional harvests.

RESULTS

Treatment	Rate/Acre	% lepidopteran damaged fruit at harvest 23 Aug
Untreated Check	-	12 ± 4
Actara 25 SWG	5.50 oz	9 ± 7
Assail 30 SG	4.0 fl. oz	9 ± 9
Harvanta 50 SL	10.9 fl. oz	4 ± 4
Plinazolin L	2.05 fl. oz	7 ± 5

Plinazolin M	3.08 fl. oz	8 ± 3
Plinazolin H	4.11 fl. oz	6 ± 3
Sivanto Prime	21.0 fl. oz	15 ± 12
Spear T H	384 fl. oz	10 ±8
P-value from Anova		ns

All data were analyzed using analysis of variance procedures. Means were separated using Fisher's LSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different (*P*>0.05).

CROP: HEMP

Location	Virginia Tech ESAREC, Painter, VA
Soil Type	Bojac Sandy Loam
Transplant Date	26 Jul 2022 (from transplants started in greenhouse)
Variety	Joey
Experimental Design	6 treatments arranged in a RCB design with 4 replicates
Plot Size	1 row x 10 ft on plastic mulch

Treatment Application Method	All foliar treatments were applied with a 1-nozzle boom equipped with D3 spray tips and powered by a CO_2 backpack sprayer at 40psi delivering 58 GPA.
Treatment dates	30 Aug, 2 (except for Exirel) and 7 Sep

Target Pest	Corn earworm: *Helicoverpa zea*
Data Collection	On 30 Aug (precount), 2, 7 and 13 Sep, the number of lepidopteran larvae was recorded per all plants in the plots.

RESULTS

		# lepidopteran* larvae / plant			
Treatment	**Rate /Acre**	**30 Aug (pre-count)**	**2 Sep (3 DAT1)**	**7 Sep (5 DAT2)**	**13 Sep (6 DAT3)**
Untreated Check	-	0.6	1.0	0.5	0.8
Exirel	13.5 fl. oz	0.8	0.1	0.0	0.0
Grandevo CG	48 oz	1.2	0.2	0.3	0.4
Venerate XC	2 gallons	0.9	0.3	0.7	0.4
experimental	NA	1.4	1.4	0.7	0.3
experimental	NA	0.7	0.4	0.4	1.1
P-value from Anova		ns	ns	ns	ns

All data were analyzed using analysis of variance procedures. Means were separated using Fisher's LSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different (*P*>0.05).

*30 Aug: 92% corn earworm; 6% yellowstriped armyworm, 2% beet armyworm

2 Sep: 69% corn earworm, 20% yellowstriped armyworm, 9% saltmarsh caterpillar, 2% beet armyworm

7 Sep: 72% corn earworm, 19% saltmarsh caterpillar, 9% yellowstriped armyworm

13 Sep: 88% corn earworm, 8% saltmarsh caterpillar, 4% beet armyworm

CROP: HEMP

Location	Virginia Tech Kentland Farm, Whitethorne, VA
Plant Date	1 Jun 2022
Variety	Joey

Experimental Design	9 treatments arranged in a RCB design with 4 replicates
Plot Size	1 row x 10 ft on plastic mulch

Treatment Application Method	All foliar treatments were applied with a 1-nozzle boom equipped with D3 spray tips and powered by a CO_2 backpack sprayer at 40psi delivering 58 GPA.
Plot Maintenance	Plots were maintained according to standard commercial practices.
Treatment dates	2 Aug; 11 Aug

Target Pest	Corn earworm: *Helicoverpa zea*
Data Collection	On 9 Aug and 16 Aug, Hemp plants were inspected visually for 1 minute and numbers of insect pests (lepidopteran larvae, bugs, beetles) recorded. In addition, 5 mature seed heads were clipped and shaken into a 5-gallon bucket to dislodge tiny lepidopteran larvae. These were added to the weekly counts.

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RESULTS

Treatment	Rate/Acre	# CEW (visual + seed head shakes) 9 Aug (7 DAT1)	# CEW (visual + seed head shakes) 16 Aug (5 DAT2)
Untreated Check	-	2.0 ± 1.83	2.0 ± 0.82
AzaDirect	32.0 fl. oz	1.25 ± 0.96	1.0 ± 1.15
Grandevo MBI-203 M	32.0 oz	1.25 ± 1.5	1.0 ± 0.82
Grandevo MBI-203 H	48.0 oz	3.25 ± 2.22	1.5 ± 1.3
Heligen	2.40 fl. oz	2.5 ± 3.0	1.25 ± 0.96
Heligen+BoteGHA	2.40 fl. oz + 16.0 fl. oz	1.5 ± 0.58	0.75 ± 0.96
Kaolin	50 lbs/A	1.25 ± 1.89	1.5 ± 1.73
Spear T	384.0 fl. oz	1.75 ± 0.96	1.5 ± 0.58
Spear T+Leprotec	384.0 fl. oz + 16.0 fl. oz	1.75 ± 1.26	3.5 ± 2.38
P-value from Anova		0.790	0.128

All data were analyzed using analysis of variance procedures. Means were separated using Fisher's LSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different ($P>0.05$).

CROP: SUMMER SQUASH

Location	Virginia Tech ESAREC, Painter, VA
Plant Date	23 Aug 2022
Variety	Spineless Perfection
Experimental Design	10 treatments arranged in a RCB design with 4 replicates
Plot Size	1 row x 20 ft

Treatment Application Method	All treatments were applied with a 3-nozzle boom equipped with D3 tips and 45 cores and powered by a CO_2 backpack sprayer delivering 31GPA.
Treatment dates	6 Oct

Target Pest	Pickleworm: *Diaphania nitidalis* Melonworm: *Diaphania hyalinata*

	Corn earworm: *Helicoverpa zea*
Data Collection	On 13 and 20 Oct, all marketable size fruit were harvested and examined for lepidopteran larvae damage. The number of damaged fruit was recorded. On 13 and 20 Oct, the number of lepidopteran larvae was recorded per 10 blossoms. On 13 and 20 Oct, the number of cucumber beetles (striped and spotted) was recorded per 10 blossoms.

All data were analyzed using analysis of variance procedures. Means were separated using Fisher's LSD at the 0.05 level of significance.

RESULTS

		Total # fruit			% damaged fruit			# lepidopteran / 10 blossoms	
Treatment	**Rate/Acre**	**13 Oct (7 DAT)**	**20 Oct (14 DAT)**	**Total mean no. fruit harvested**	**13-Oct**	**20-Oct**	**Mean total % damaged fruit**	**13 Oct (7 DAT)**	**20 Oct (14 DAT)**
Untreated Check	-	7.0	16.8	23.8	4.5	17.5	14.1 a	1.0	1.8
Plinazolin + DyneAmic	2.05 fl. oz	5.0	17.8	22.8	0.0	2.3	1.8 bc	0.3	0.3
Plinazolin + DyneAmic	3.08 fl. oz	3.8	20.0	23.8	0.0	0.0	0.0 c	0.5	0.0
Besiege + DyneAmic	7 fl. oz	4.5	20.3	24.8	0.0	2.4	2.0 bc	0.3	0.0
Radiant + DyneAmic	8 fl. oz	4.3	13.5	17.8	6.3	0.0	1.7 bc	0.5	0.0
Coragen + DyneAmic	5 fl. oz	4.5	18.3	22.8	3.6	2.0	2.3 bc	1.3	0.0
Harvanta + DyneAmic	16.4 fl. oz	5.0	13.0	18.0	0.0	5.6	4.0 bc	0.3	0.3
Spear lep + Leprotec	32 fl. oz + 16 fl. oz	3.0	12.5	15.5	31.3	4.8	8.7 ab	0.3	0.3
Leprotec	16 fl. oz	4.0	17.5	21.5	3.6	4.8	4.7 bc	0.5	0.5
Dipel DF	1 lb	4.5	13.0	17.5	0.0	2.6	1.9 bc	0.5	1.3
P-value from Anova		ns	ns	ns	ns	ns	0.0429	ns	ns

All data were analyzed using analysis of variance procedures. Means were separated using Fisher's LSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different (*P*>0.05).

*13 Oct: 59% pickleworm; 41% corn earworm

20 Oct: 39% pickleworm; 39% melonworm; 22% corn earworm

		# cucumber beetles / 10 blossoms	
Treatment	**Rate/Acre**	**13 Oct (7 DAT)**	**20 Oct (14 DAT)**
Untreated Check	-	3.0	2.5
Plinazolin + DyneAmic	2.05 fl. oz + 0.25% v/v	0.3	1.0
Plinazolin + DyneAmic	3.08 fl. oz + 0.25% v/v	0.3	0.8
Besiege + DyneAmic	7 fl. oz + 0.25% v/v	0.3	0.5
Radiant + DyneAmic	8 fl. oz + 0.25% v/v	4.5	3.0
Coragen + DyneAmic	5 fl. oz + 0.25% v/v	3.3	1.8
Harvanta + DyneAmic	16.4 fl. oz + 0.25% v/v	1.3	2.0
Spear lep + Leprotec	32 fl. oz + 16 fl. oz	1.5	2.0
Leprotec	16 fl. oz	6.5	1.0

Dipel DF	1 lb	3.8	3.3
P-value from Anova		ns	ns

All data were analyzed using analysis of variance procedures. Means were separated using Fisher's LSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different (*P*>0.05).

CROP: SUMMER SQUASH

Location	Virginia Tech Homefield Farm, Whitethorne, VA
Plant Date	26 Jul 2022
Variety	Ferry-Morse Squash Early Prolific Straight-Neck Yellow Squash
Experimental Design	7 treatments arranged in a RCB design with 4 replicates.
Plot Size	1 rows x 15 ft on white plastic mulch beds on 6 ft centers, plants 2 ft apart

Treatment Application Method	All treatments were applied with a single nozzle boom equipped with D3 tips and 45 cores and powered by a CO2 backpack sprayer delivering 36 GPA.
Plot Maintenance	Plots were maintained according to standard commercial practices, drip irrigation.
Treatment dates	15 Sep

Target Pest	Pickleworm: *Diaphania nititdalis* Stoll Melonworm: *Diaphania hyalinata* L.
Data Collection	We observed pickleworm in the plots on 12 Sep and then stripped all plants of any developing fruit, and applied treatments on 15 Sep. For each day from 16 to 21 Sep, all harvest-sized fruit were picked and examined for injury (tunnel holes).

RESULTS

Treatment*	Rate/Acre	% fruit with pickleworm holes
Untreated Check	-	11.9
Plinazolin SC200 + Dyne-amic	2.05 fl. oz	1.9
Plinazolin SC200 + Dyne-amic	3.08 fl. oz	2.8
Beseige 1.25 + Dyne-amic	7.0 fl. oz	3.6
Radiant 120 + Dyne-amic	8.0 fl. oz	0.0
Coragen 1.67 + Dyne-amic	5.0 fl. oz	12.5
P-value from Anova		ns

*All treatments had Dynamic added at 0.5% v:v.

All data were analyzed using analysis of variance procedures. Means were separated using Fisher's LSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different (*P*>0.05).

COLORADO POTATO BEETLE

CROP: POTATOES

Location	Virginia Tech ESAREC, Painter, VA
Plant Date	4 March 2022
Variety	Envol
Experimental Design	8 treatments arranged in a RCB design with 4 replicates
Plot Size	2 rows x 20 ft with unplanted guard rows

Treatment Application Method:	All foliar treatments were applied with a 4-nozzle boom equipped with 110003VS spray tips spaced 20" apart spraying 2 rows at a time and powered by a CO_2 backpack sprayer at 40psi delivering 38 GPA.
Treatment dates:	See table below

Target Pest	Colorado potato beetle: *Leptinotarsa decemlineata*
Data Collection	On 17, 23, 31 May and 7 Jun, all present life stages of CPB were recorded per 10 randomly selected stems. On 1 Jun, % CPB defoliation was recorded per 2 row plots.

RESULTS

				# Colorado potato beetle / 10 stems								% defoliation Jun 1
				17-May		23-May		31-May		7-Jun		
Treatment	**Rate/Acre**	**Application Dates**	**Spray initiation timing**	**Small larvae**	**Large larvae**	**Small larvae**	**Large larvae**	**Small larvae**	**Large larvae**	**Small larvae**	**Large larvae**	
Untreated Check				45.3 a	7.0 a	73.5 a	113.8 a	6.8 a	30.5 a	8.5	11.5	68.3 a
Rimon EC (a,b,c,d) fb Assail 30SG + Bifenture LFC €	6 fl. oz fb 4 oz + 24 fl. oz	26 Apr, 3, 10, 17, 23 May	first egg mass	4.0 b	0.0 b	0.0 c	0.0 b	0.0 b	0.0 b	0.0	1.5	2.0 b
Rimon 0.83EC (a,b,c) fb Assail 30SG + Bifenture LFC (d)	8 fl. oz fb 4 oz + 24 fl. oz	26 Apr, 3, 10, 17 May	first egg mass	0.5 b	0.0 b	0.0 c	0.0 b	0.0 b	0.0 b	0.0	0.0	2.0 b
Rimon 0.83EC (a,b,c,d) fb Assail Liquid + Bifenture LFC €	6 fl.oz fb 3.35 fl. oz + 24 fl. oz	26 Apr, 3, 10, 17, 23 May	first egg mass	3.3 b	0.0 b	0.0 c	0.3 b	0.0 b	0.0 b	0.5	4.3	2.3 b
Lambda-Cy + AgriMek fb Assail 30SG + Bifenture LFC	3.84 fl. oz + 3.5 fl. oz fb 4 oz + 24 fl. oz	12, 19 May	50% egg hatch	1.0 b	0.5 b	0.0 c	0.0 b	0.0 b	0.0 b	0.3	0.0	2.0 b
Lambda-Cy + AgriMek fb Argyle OD +	3.84 fl. oz + 3.5 fl. oz fb 9 fl. oz + 24 fl. oz	12, 19 May	50% egg hatch	4.3 b	0.3 b	0.0 c	0.0 b	0.0 b	0.0 b	0.0	0.0	2.0 b

Bifenture LFC												
Calantha (a,b,c) fb Besiege(d)	16 fl. oz fb 9 fl. oz	3, 10, 17 May fb 2 Jun	10% egg hatch	45.8 a	0.0 b	29.0 b	5.8 b	8.0 a	7.3 b	0.3	0.8	5.0 b
Coragen	5 fl. oz	17 and 23 May	80% egg hatch	n/a	n/a	1.3 c	0.3 b	0.0 b	0.0 b	4.3	2.0	2.3 b
P-value from Anova				0.0017	<0.0001	<0.0001	0.0009	0.0085	0.0002	ns	ns	<0.0001

All data were analyzed using analysis of variance procedures. Means were separated using Fisher's LSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different (*P*>0.05).

Treatment	Rate/Acre	B grade tubers	small A grade tubers	large A grade tubers	chef grade tubers	Yield (in lbs)
Untreated Check	-	27.5 a	14.5	0.8	0.0	42.8
Rimon EC (a,b,c,d) fb Assail 30SG + Bifenture LFC (e)	6 fl. oz fb 4 oz + 24 fl. oz	19.9 bc	22.6	3.0	0.0	45.5
Rimon 0.83EC (a,b,c) fb Assail 30SG + Bifenture LFC (d)	8 fl. oz fb 4 oz + 24 fl. oz	19.5 c	20.2	3.5	0.0	43.1
Rimon 0.83EC (a,b,c,d) fb Assail Liquid + Bifenture LFC (e)	6 fl.oz fb 3.35 fl. oz + 24 fl. oz	21.3 bc	27.8	7.0	0.3	56.4
Lambda-Cy + AgriMek fb Assail 30SG + Bifenture LFC	3.84 fl. oz + 3.5 fl. oz fb 4 oz + 24 fl. oz	18.7 c	22.5	6.0	0.0	47.2
Lambda-Cy + AgriMek fb Argyle OD + Bifenture LFC	3.84 fl. oz + 3.5 fl. oz fb 9 fl. oz + 24 fl. oz	22.6 bc	25.5	4.7	0.3	53.1
Calantha (a,b,c) fb Besiege (d)	16 fl. oz fb 9 fl. oz	24.5 ab	23.5	3.5	0.0	51.6
Coragen	5 fl. oz	22.8 bc	25.2	5.4	0.3	53.7
P-value from Anova		0.011	ns	ns	ns	ns

All data were analyzed using analysis of variance procedures. Means were separated using Fisher's LSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different (*P*>0.05).

CROP: POTATOES

Location	Virginia Tech ESAREC, Painter, VA
Plant Date	4 March 2022
Variety	Envol
Experimental Design	6 treatments arranged in a RCB design with 4 replicates
Plot Size	2 rows x 20 ft with unplanted guard rows

Treatment Application Method	All foliar treatments were applied with a 4-nozzle boom equipped with 110003VS spray tips spaced 20" apart spraying 2 rows at a time and powered by a CO_2 backpack sprayer at 40psi delivering 38 GPA.
Treatment dates	18 and 26 May

Target Pest	Colorado potato beetle: *Leptinotarsa decemlineata*
Data Collection	On 28 May and 1 Jun, all present life stages of CPB were recorded per 10 randomly selected stems. On 9 and 14 Jun, % CPB defoliation was recorded per 2 row plots. On 30 Jun, all tubers were mechanically harvested and weighed

RESULTS

Treatment	Rate/Acre	# Colorado potato beetles / 10 stems			% defoliation		Yield (lbs)
		28-May (2 DAT2)		1-Jun (6 DAT2)	9-Jun (14 DAT2)	14-Jun (19 DAT2)	
		Small larvae	Large larvae	Large larvae			
Untreated Check	-	75.0 a	69.5 a	25.5 a	77.5 a	99.0 a	38.9
Torac + DyneAmic	14 fl oz + 0.125% v/v	0.0 b	1.0 b	0.5 b	7.5 b	48.8 b	53.4
Torac + DyneAmic	21 fl oz + 0.125% v/v	1.3 b	0.3 b	0.5 b	7.3 b	46.3 b	50.0
Harvanta + DyneAmic	5.5 fl oz + 0.125% v/v	0.5 b	0.3 b	0.0 b	4.3 b	45.0 b	53.8
P-value from Anova		<0.0001	0.0017	<0.0001	<0.0001	<0.0001	ns

All data were analyzed using analysis of variance procedures. Means were separated using Fisher's LSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different (*P*>0.05).

CROP: POTATOES

Location	Virginia Tech ESAREC, Painter, VA
Plant Date	4 March 2022
Variety	Envol
Experimental Design	7 treatments arranged in a RCB design with 4 replicates
Plot Size	2 rows x 20 ft with unplanted guard rows

Treatment Application Method:	All foliar treatments were applied with a 4-nozzle boom equipped with 110003VS spray tips spaced 20" apart spraying 2 rows at a time and powered by a CO_2 backpack sprayer at 40psi delivering 38 GPA.
Plot Maintenance	Plots were maintained according to standard commercial practices
Treatment dates:	See table below

Target Pest	Colorado potato beetle: *Leptinotarsa decemlineata*
Data Collection	On 19, 23 May and 1 Jun, all present life stages of CPB were recorded per 10 randomly selected stems. On 3 Jun, % CPB defoliation was recorded per 2 row plots.

RESULTS

Treatment	Rate/Acre	Application dates	# Colorado potato beetles / 10 stems					% defoliation on 3 Jun
			19 May small larvae	19 May large larvae	23 May small larvae	23 May large larvae	1 Jun large larvae	
Untreated Check	-	-	122.5 a	8.0	77.3 a	171.8 a	13.3 a	80.0 a

Plinazolin DC100 + DyneAmic	2.74 fl oz + 0.25% v/v	18 & 26 May	n/a	n/a	0.0 b	0.0 b	0.0 b	2.8 b
Plinazolin SC100 + DyneAmic	2.74 fl oz + 0.25% v/v	18 & 26 May	n/a	n/a	0.0 b	0.0 b	0.0 b	3.3 b
Coragen 20SC	5 fl oz	18 & 26 May	n/a	n/a	0.0 b	0.0 b	0.3 b	3.3 b
Experimental (at 50% egg hatch)	n/a	12 & 19 May	2.3 b	2.5	0.0 b	0.0 b	0.0 b	1.5 b
Vantacor + DyneAmic (at 50% egg hatch)	1.66 fl oz + 0.25% v/v	12 & 19 May	0.0 b	0.0	0.0 b	0.0 b	0.3 b	3.3 b
Blackhawk (at 50% egg hatch)	3 oz	12 & 19 May	28.5 b	0.3	1.0 b	0.3 b	8.5 ab	9.3 b
P-value from Anova			<0.0001	ns	<0.0001	0.0015	0.0268	<0.0001

All data were analyzed using analysis of variance procedures. Means were separated using Fisher's LSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different (*P*>0.05).

Treatment	Rate/Acre	B grade tubers	Small A grade tubers	Large A grade tubers	Chef grade tubers	Mean total yield (in cwt)
Untreated Check	-	22.6	5.8	3.4	0.4	115.93
Plinazolin DC100 + DyneAmic	2.74 fl oz + 0.25% v/v	22.4	9.8	7.6	0.3	144.9
Plinazolin SC100 + DyneAmic	2.74 fl oz + 0.25% v/v	19.1	9.5	8.5	1.7	139.76
Coragen 20SC	5 fl oz	17.2	11.0	6.7	0.8	128.88
Vantacor + DyneAmic (at 50% egg hatch)	1.66 fl oz + 0.25% v/v	22.3	12.4	9.4	2.0	166.2
Blackhawk (at 50% egg hatch)	3 oz	21.3	11.5	5.3	1.4	142.32
P-value from Anova		ns	ns	ns	ns	ns

All data were analyzed using analysis of variance procedures. Means were separated using Fisher's LSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different (*P*>0.05).

CROP: POTATOES

Location	Virginia Tech ESAREC, Painter, VA
Plant Date	4 March 2022
Variety	Envol
Experimental Design	5 treatments arranged in a RCB design with 4 replicates
Plot Size	2 rows x 20 ft with unplanted guard rows

Treatment Application Method	All foliar treatments were applied with a 4-nozzle boom equipped with 110003VS spray tips spaced 20" apart spraying 2 rows at a time and powered by a CO_2 backpack sprayer at 40psi delivering 38 GPA.
Treatment dates	See table below

Target Pest	Colorado potato beetle: *Leptinotarsa decemlineata*
Data Collection	On 23, 31 May and 7 Jun, all present life stages of CPB were recorded per 10 randomly selected stems. On 2 Jun, % CPB defoliation was recorded per 2 row plots. On 30 Jun, all tubers were mechanically harvested and weighed

RESULTS

Treatment	Rate/Acre	Application timing	Mean no. Colorado potato beetles / 10 stems						% defoliation 2 Jun	Mean total yield (in lbs)
			23-May		31-May		7-Jun			
			small larvae	large larvae	small larvae	large larvae	Large larvae	adults		
Untreated Check	-	-	122.3	145.0	2.0	13.0 bc	4.5	25.3	73.8	32.6
Trident WDG	16 fl. oz	3 apps every 5 days (17, 23 and 27 May)	55.8	121.0	2.8	68.8 a	2.0	23.8	75.0	27.9
Trident WDG	24 fl. oz	3 apps every 5 days (17, 23 and 27 May)	41.0	142.5	1.0	51.3 ab	2.5	22.8	70.0	31.2
Trident WDG	32 fl. oz	2 apps every 7 days (17 and 23 May)	111.3	96.3	2.0	57.3 ab	0.5	23.3	83.8	25.7
Entrust SC	3 fl. oz	2 apps every 10 days (17, 27 May)	54.0	150.3	0.0	3.3 c	0.0	44.5	58.8	23.9
P-value from Anova			ns	ns	ns	0.0345	ns	ns	ns	ns

All data were analyzed using analysis of variance procedures. Means were separated using Fisher's LSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different (*P*>0.05).

CROP: POTATOES

Location	Virginia Tech Homefield Farm, Whitethorne, VA
Plant Date	15 May
Variety	organic potatoes
Experimental Design	7 treatments arranged in a RCB design with 4 replicates.
Plot Size	1 rows x 20 ft on 6 ft centers, plants 1 ft apart

Treatment Application Method	All treatments were applied with a 3-nozzle boom equipped with D3 tips and 45 cores and powered by a CO2 backpack sprayer delivering 36 GPA.
Plot Maintenance	Plots were maintained according to standard commercial practices, drip irrigation.
Treatment dates	1 Jul

Target Pest	Colorado potato beetle larvae
Data Collection	On 5 Jul (4 DAT) and 12 Jul, a sample of 5 potato plants was inspected per plot and numbers of CPB larvae recorded. CPB populations crashed by the 2nd sample date ending this trial.

Treatment	Rate/Acre	# CPB larvae/ 5 plants 5 Jul (4 DAT)	# CPB Larvae + Adults/ 5 plants 12 Jul (11 DAT)
Untreated Check	-	15.2 ± 22.7	1.3 ± 1.9
Trident WG Low	16.0 oz	3.3 ± 4.6	0.8 ± 1.0
Trident WG High	25.0 oz	1.8 ± 3.5	0.0 ± 0.0
Trident WG + SpearT	16.0 oz + 384 fl. oz	1.8 ± 2.1	0.3 ± 0.5
Azera	32.0 fl. oz	8.8 ± 14.2	0.0 ± 0.0
Aza-Direct	32.0 fl. oz	4.5 ± 8.4	0.0 ± 0.0
Entrust SC	5.0 fl. oz	0.0 ± 0.0	0.3 ± 0.5

P-value from Anova	ns	ns

All data were analyzed using analysis of variance procedures. Means were separated using Fisher's LSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different (*P*>0.05).

CROP: EGGPLANTS

Location	Virginia Tech ESAREC, Painter, VA
Transplant Date	24 May 2022
Variety	Nadia
Experimental Design	4 treatments arranged in a RCB design with 4 replicates
Plot Size	1 row x 10 ft on plastic mulch

Treatment Application Method	All treatments were applied with a 3-nozzle boom equipped with D3 tips and 45 cores and powered by a CO_2 backpack sprayer delivering 31GPA.
Treatment dates	25 May 2022

Target Pest	Colorado potato beetle*: Leptinotarsa decemlineata* One CPB emerging egg mass was placed on each plant on 24 May.
Data Collection	On 1 Jun (7 DAT), the number of small larvae was recorded per 5 plants. On 1 Jun (7 DAT), % defoliation was recorded for each plot.

All data were analyzed using analysis of variance procedures. Means were separated using Fisher's LSD at the 0.05 level of significance.

RESULTS

Treatment	Rate/Acre	# small Colorado potato beetle larvae	% defoliation
Untreated Check	-	2.8	52.5 a
Calantha	16 fl. oz	1.8	41.3 a
Coragen	5 fl. oz	0.5	5.0 b
P-value from Anova		ns	0.0294

All data were analyzed using analysis of variance procedures. Means were separated using Fisher's LSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different (*P*>0.05).

MEXICAN BEAN BEETLE

CROP: SNAP BEANS

Location	Virginia Tech Homefield Farm, Whitethorne, VA
Plant Date	26 Jul 2022
Variety	Antiqua (organic snap bean)
Experimental Design	7 treatments arranged in a RCB design with 4 replicates.
Plot Size	1 rows x 20 ft on white plastic mulch beds on 6 ft centers, plants 2 ft apart

Treatment Application Method	All treatments were applied with a single nozzle boom equipped with D3 tips and 45 cores and powered by a CO2 backpack sprayer delivering 36 GPA.
Plot Maintenance	Plots were maintained according to standard commercial practices, drip irrigation.
Treatment dates	3 and 12 Aug.

Target Pest	Mexican bean beetle (MBB): *Epilachna varivestis*
Data Collection	On 8 and 15 Aug, 1 min visual counts of beetles, lepidopteran larvae and stink bugs in each plot. On 15 Aug, harvested 100 random pods per plot and inspected them for MBB chewing damage.

RESULTS

		# of insects per 1 min visual inspection				
		8 Aug (5 DAT1)		15 Aug (3 DAT2)		% damaged pods
Treatment	**Rate/Acre**	**MBB Adult**	**MBB Larvae**	**MBB Adult**	**MBB Larvae**	**Beetle damage**
Untreated Check	-	0.5	16.3 a	7.5	8.5 ab	31.5
Surround WP	50 lbs	0.0	7.3 bc	0.3	9.8 a	14.5
Pyganic	17 fl. oz	1.0	5.3 bc	2.3	1.0 c	11.0
Entrust SC	8 fl. oz	1.0	2.0 c	4.5	0.3 c	0.7
Azera	56 fl. oz	0.75	1.5 c	2.3	0.5 c	12.5
AzaDirect	56 fl. oz	0.75	10.8 ab	7.8	2.5 bc	17.5
Venerate	215 fl. oz	0.5	7.5 bc	3.3	13.8 a	14.0
P-value from Anova		ns	0.023	ns	0.0029	ns

All data were analyzed using analysis of variance procedures. Means were separated using Fisher's LSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different ($P>0.05$).

CROP: SNAP BEANS

Location	Virginia Tech Homefield Farm, Whitethorne, VA
Plant Date	19 Jun 2022
Variety	Caprice snap bean – Harris Seeds
Experimental Design	7 treatments arranged in a RCB design with 4 replicates.
Plot Size	1 rows x 20 ft on white plastic mulch beds on 6 ft centers

Treatment Application Method	All treatments were applied with a 3-nozzle dropdown boom equipped with D3 tips and 45 cores and powered by a CO2 backpack sprayer delivering 36 GPA.
Plot Maintenance	Plots were maintained according to standard commercial practices, drip irrigation.
Treatment dates	3 and 12 Aug

Target Pest	Mexican bean beetle (MBB): *Epilachna varivestis*
Data Collection	On 8 Aug (5 DAT) and 15 Aug (3 DAT2), each plot was inspected for 1 minute and total live pest insects were recorded. On 15 Aug, 100 random bean pods were harvested per plot and assessed for MBB injury.

RESULTS

		# insects per 1 min visual inspection				
		8 Aug (5 DAT1)		15 Aug (3 DAT2)		% damaged pods
Treatment*	**Rate/Acre**	**MBB Adult**	**MBB Larvae**	**MBB Adult**	**MBB Larvae**	**Beetle damage**
Untreated Check	-	2 ± 0 a	7 ± 4	1 ± 0	10 ± 2 a	6 ± 2
Vantacor	1.66 fl.oz	1 ± 0 b	1 ± 1	1 ± 1	0 ± 0 c	5 ± 2
Spear T	384 fl.oz	0 ± 0 c	5 ± 2	0 ± 0	5 ± 3 b	4 ± 4

Torac	14 fl.oz	0 ± 0 c	1 ± 1	0 ± 0	0 ± 0 c	4 ± 2
Elevest	5.6 fl.oz	0 ± 0 c	0 ± 0	0 ± 0	0 ± 0 c	1 ± 1
Harvanta 50SL	10.9 fl.oz	0 ± 0 c	0 ± 0	0 ± 0	0 ± 0 c	1 ± 1
P-value from Anova		<0.001	ns	ns	<0.001	ns

*All treatments had Latron LI-700 NIS added at 0.5% v:v.

All data were analyzed using analysis of variance procedures. Means were separated using Fisher's LSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different (*P*>0.05).

CROP: SNAP BEANS

Location	Virginia Tech Blacksburg, VA
Target Pest	Mexican bean beetle: *Epilachna varivestis*
Insect Collection date, location and method	Mexican bean beetle larvae were collected from snap bean plants from Homefield Farm in Whitethorne, VA (~200 larvae were collected and the healthiest 160 (mostly 3rd instars) were used
Experimental Design	4 treatments replicated 5 times Treatments included: • Water Check • Trident WG (Bt tenebrionis) (16 oz/A) • Spear Lep (36 fl oz/A) + Trident WG (16 oz/A) • Entrust 5.0 fl oz/A
Methods	8 larvae were placed in a 9-cm Petri dish with an edamame green bean pod and leaf dipped in field-rate concentrations for each treatment based on 30 gallon of water per acre. Each pod and leaf were left to dry under a fume hood prior to being placed in each Petri dish. Dishes were left at ambient temperature in the laboratory.
Data Collection	Mortality was assessed at 24, 48, and 72 h. As Bt takes time to kill, the latter time provided the best data.

RESULTS

Treatment	Rate/Acre	% mortality at 72 hr
Untreated Check	-	12.5 c
Trident WG (Btt)	16 oz	37.5 bc
Spear Lep + Trident WG	36 fl oz + 16 oz	68.1 a
Entrust	5.0 fl oz	61.4 ab
P-value from Anova		0.0032

All data were analyzed using analysis of variance procedures. Means were separated using Fisher's LSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different (*P*>0.05).

TARNISHED PLANT BUG

CROP: STRAWBERRIES

Location	Virginia Tech Homefield Farm, Whitethorne, VA
Plant Date	23 Apr 2021 – Strawberry plots established and carried over from the previous year (2021)
Variety	Albion
Experimental Design	5 treatments arranged in a RCB design with 4 replicates
Plot Size	1 row x 20 ft on black plastic mulch

Treatment Application Method:	All foliar treatments were applied with a 3-nozzle boom equipped with D3 spray tips and powered by a CO_2 backpack sprayer at 40psi delivering 40gpa.
Plot Maintenance	Plots were maintained according to standard commercial practices
Treatment dates	16 Jun, 1 Jul

Target Pest	Lygus bugs: *Lygus lineoralis*
Data Collection	• On 5 Jul (4 DAT), 11 Jul (10 DAT), and 18 Jul (17 DAT), the number of lygus bugs and beetles were recorded by visually inspecting 5 plants per plot for 1 minute. • On 18 Jul, leaf defoliation (by Japanese beetle) was assessed by collecting 10 random leaves per plot and recording defoliation as (0-5 scale, 0 = no damage, 5 = completely defoliated) • On 5 and 11 Jul, all ripe berries were harvested from each row and the number of damaged berries was recorded from a subset of 10 random berries per date.

All data were analyzed using analysis of variance procedures. Means were separated using Fisher's LSD at the 0.05 level of significance. Some data were log transformed to normalized distribution.

RESULTS

Treatment	Rate/Acre	5 Jul (4 DAT2) # Lygus	11 Jul (10 DAT2) # Lygus	Cumulative Lygus	11 Jul (10 DAT2) Japanese beetles	18 Jul (17 DAT2) Defoliation rating (0-5)	% unmarketable berries (2 harvests 5-11 Jul)	% minor deformities to berries (2 harvests 5-11 Jul)
Untreated Check	-	1.0	1.0	2.0	8.5 a	2.02 a	55	38
Plinazolin SC 200 + NIS	2.05 fl oz + 0.1% v/v	0.0	0.5	0.5	2.5 ab	1.70 ab	49	29
Plinazolin SC 200 + NIS	3.08 fl oz + 0.1% v/v	0.5	0.0	0.5	2.8 ab	1.50 ab	46	16
Plinazolin SC 200 + NIS	4.11 fl oz + 0.1% v/v	0.25	0.5	0.75	0.8 b	1.33 b	36	29
Mustang Max + NIS	2.24 fl oz + 0.1% v/v	0.0	1.0	1.0	0.0 b	0.50 c	47	20
P-value from Anova		ns	ns	ns	0.087	0.0001	ns	ns

All data were analyzed using analysis of variance procedures. Means were separated using Fisher's LSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different (*P*>0.05).

WIREWORMS

CROP: POTATOES

Location	Virginia Tech ESAREC, Painter, VA
Plant Date	13 Apr 2022
Variety	Envol
Experimental Design	6 treatments arranged in a RCB design with 4 replicates

Plot Size	2 rows x 20 ft with unplanted guard rows

Treatment Application Method	All in-furrow and post-emergence treatments were applied at 20 gpa using a single nozzle boom equipped with an 80015VS spray tips powered by a CO2 backpack sprayer at 20 psi. Furrows were cut using a commercial potato planter without the coulters on.
Treatment dates	13 Apr and 25 Apr

Target Pest	Corn wireworm: *Melatonus communis*
Data Collection	On 18 May (35 DAP), stand counts were taken for each 2-row plot. On 14 Jul, all tubers were mechanically harvested and weighed. A sub-sample of 50 tubers per row (100 per plot) was examined for wireworm and grub damage.

RESULTS

Treatment	Rate/Acre	Stand Count 35 DAP	% wireworm damaged tubers	% grub damaged tubers	% total damaged tubers	Total Yield (in cwt)
Untreated Check	-	60.5 a	4.2	9.7 a	13.8 a	167.79
Regent 3.2 SC (in-furrow)	3.2 fl. oz	58.8 ab	2.0	1.8 b	3.8b	171.83
Majestene (in-furrow)	2 gallons	52.5 b	3.7	2.3 b	6.0 b	160.76
Majestene (in-furrow) fb Majestene (post-emergence)	2 gallons fb 2 gallons	42.3 c	4.5	3.3 b	7.8 b	156.96
P-value from Anova		<0.0001	<0.0001	0.0007	ns	ns

All data were analyzed using analysis of variance procedures. Means were separated using Fisher's LSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different (*P*>0.05).

CROP: POTATOES

Location	Southwest Virginia 4-H Center, Abingdon, VA
Plant Date	20 April 2021
Variety	Kennebek
Experimental Design	9 treatments arranged in a RCB design with 4 replicates
Plot Size	1 row x 20 ft with unplanted guard rows

Treatment Application Method	All in-furrow and post-emerge treatments were applied at 20 gpa using a single nozzle boom equipped with an 80015VS spray tips powered by a CO2 backpack sprayer at 20 psi. Furrows were cut using a commercial potato planter without the coulters on. Seed treatments were applied based on 50 lb of seed by spraying seed potatoes with treatment with hand pump sprayer before planting. Vibrance Ultra @ 0.25oz = 7.44 ml / 50lbs was added to all treatments in the trial including the untreated Check.

Plot Maintenance	Plots were maintained according to standard commercial practices
Treatment date	9 May (at-planting); Post emergence (Treatment 3 only): 21 May

Target Pest	Corn wireworm: *Melatonus communis*
Data Collection	On 19 Sep, all tubers were mechanically harvested. Yield was not assessed. A sub-sample of 50 tubers per row was examined for wireworm and grub damage.

RESULTS

Treatment (Application type*)	Rate/Acre	Yield (lbs per 20 ft row)	% wireworm damaged tubers	% white grub damaged tubers	% total damaged tubers
Vibrance Ultra only Check	-	31 ± 7	2.0 abcd	8.0	10.0
VU + Cruiser (Seed Trt)	1.88 ml per 50 lb seed	32 ± 5	4.5 a	7.0	11.5
VU + Plinazolin 400FS (Seed Trt)	0.85 ml per 50 lb seed	24 ± 4	3.0 bcd	4.5	5.5
VU + Plinazolin 400FS (Seed Trt)	1.70 ml per 50 lb seed	22 ± 5	3.0 abc	6.0	9.0
VU + Plinazolin SC300	2.56 fl oz/A IF	30 ± 2	3.5 ab	13.0	16.5
VU + Plinazolin SC300	3.43 fl oz/A IF	26 ± 2	0.5 cd	7.5	8.0
VU + Plinazolin SC300	4.29 fl oz/A IF	30 ± 2	1.5 bcd	10.5	12.0
VU + Cimegra	3.42 fl oz/A IF	30 ± 5	0.0 d	9.0	9.0
VU + Capture LFR	21.30 fl oz/A IF	27 ± 4	2.0 abcd	7.5	9.5
P-value from Anova		ns	0.0249	ns	ns

* IF = in-furrow at-planting; PE = post emergence at hilling cultivation; ST = seed treatment

**Note Vibrance Ultra @ 0.25oz = 7.44 ml / 50lbs was added to all treatments in the trial including the untreated Check.

All data were analyzed using analysis of variance procedures. Means were separated using Fisher's LSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different (*P*>0.05).

CROP: POTATOES

Location	Southwest Virginia 4-H Center, Abingdon, VA
Plant Date	20 Apr 2021
Variety	Kennebek
Experimental Design	8 treatments arranged in a RCB design with 4 replicates
Plot Size	1 row x 20 ft with unplanted guard rows

Treatment Application Method	In-furrow treatments were applied at 20 gpa using a single nozzle boom equipped with an 80015VS spray tips powered by a CO2 backpack sprayer at 20 psi. Furrows were cut using a commercial potato planter without the coulters on. Seed treatment was applied by spraying seed potatoes with treatment before planting.
Plot Maintenance	Plots were maintained according to standard commercial practices

Treatment date	9 May (at-planting)

Target Pest	Corn wireworm: *Melatonus communis*
Data Collection	On 19 Sep, all tubers were mechanically harvested. Yield was not assessed. A sub-sample of 50 tubers per row was examined for wireworm and grub damage.

RESULTS

Treatment (Application type*)	Rate/Acre	% wireworm damaged tubers	% white grub damaged tubers	% total damaged tubers
Untreated Check	-	5.0	8.5	13.5
BoteGHA (8 floz/1000 ft)	116 fl oz	1.5	8.0	9.5
Seduce granule baits (40 lb/A)	40 lb	3.0	11.0	14.0
P-value from Anova		ns	ns	ns

* IF = in-furrow at-planting; PE = post emergence at hilling cultivation; ST = seed treatment

All data were analyzed using analysis of variance procedures. Means were separated using Fisher's LSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different (*P*>0.05).

STUDY: CORRELATING WIREWORM ADULT BEETLE CATCH WITH LARVAL DENSITIES IN FIELDS

Wireworms are significant pests of potatoes on some farms on the Eastern Shore of Virginia. With funding from the VA Irish Potato Board and the USDA-ARS, we have been evaluating pheromone lures and traps for adult wireworms (click beetles). The lures have been shown to be very effective at drawing male beetles to traps and this has shown us the primary seasonal activity period for click beetles to be Jul (Fig. 1).

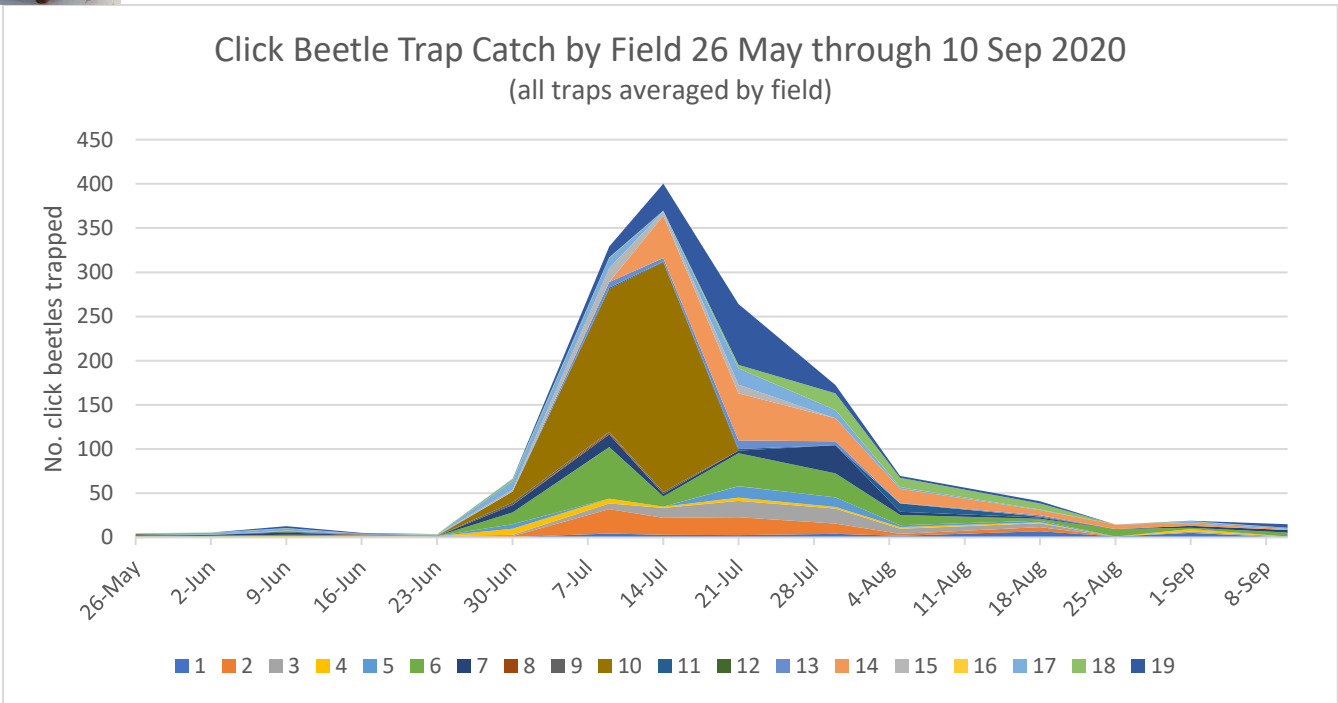

Fig. 1. Catch of click beetles at pheromone-baited traps placed around 19 potato fields (different colors) on the Eastern Shore of VA in 2020.

In 2021, we showed that clear sticky cards placed on tomato stakes were a superior trap for catching beetles (Fig. 2). Also, the timing of peak catch for 2021 was almost identical to the peak timing recorded in 2020, reinforcing the use of traps as a strong indicator of peak emergence for adult beetles.

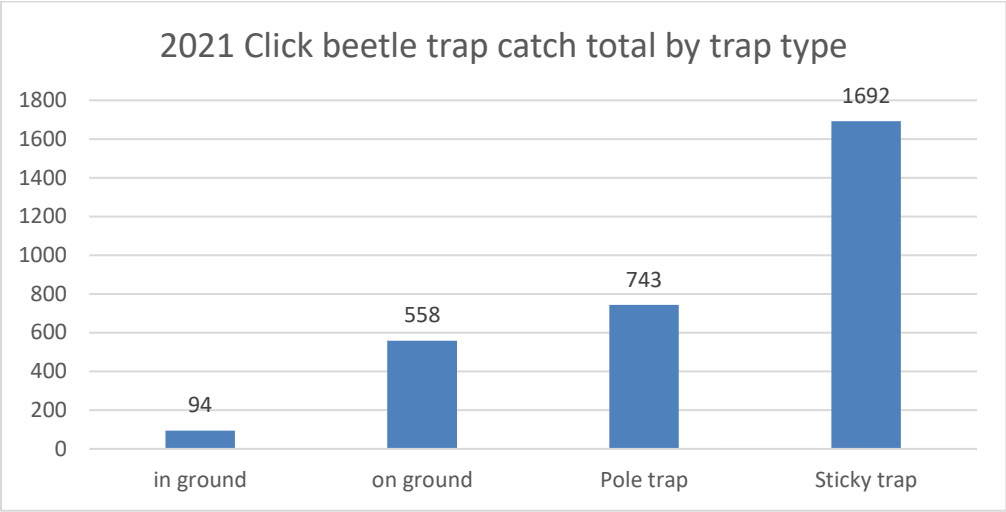

Fig. 2. Catch of click beetles in four trap types over 10 weeks placed around seven potato farms on the Eastern Shore.

2022 Objective:
To correlate pheromone-baited sticky trap catch of click beetles with subsequent wireworm density

Materials & Methods:

- The same seven commercial potato farms that were sampled in Virginia (Eastern Shore) in 2021 were sampled for wireworms in April 2022.
- On 8 April 2022, 80ft^2 of soil was dug in each field (1ft^2 x 20 x 4 locations within the field) and examined for the presence of wireworms.

Results:

- Results were inconsistent and there did not appear to be a correlation between previous year (2021) click beetle trap catch and current year (2022) spring wireworm density (Fig. 3) with two of the farms with the highest average trap catch in 2021 (Fields 2 & 5) having the lowest wireworm density in 2022 (Fig. 4).
- Surprisingly, there not a significant correlation between 2022 summer trap catch of beetles with wireworm density earlier in the spring (Fig. 5).
- In 2022, additional traps were placed in fields that would likely be in potatoes in 2023. We would like to continue the data collection over another year or two to determine a stronger potential correlation or pattern. Early sampling for wireworms in potato fields and subsequent damage rating at harvest would be conducted.
- The results of our work so far suggest that there are other important factors affecting why wireworms occur in certain fields over others.
- We will attempt to investigate what creates a wireworm “hot spot” within a field and within a farm. Variables such as: previous summer crop; winter cover crop; soil moisture; organic matter content will be incorporated into a model with pheromone trap catch of beetles.

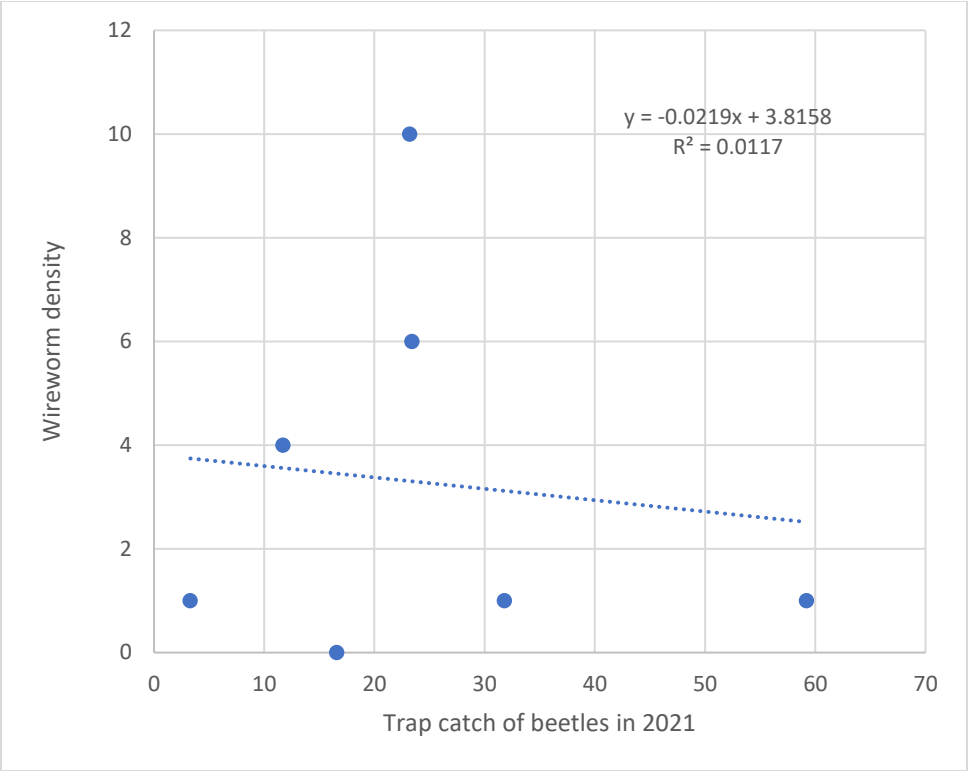

Fig 3. Comparison of average click beetle trap catch in 2021 to spring wireworm density the following year (2022) in 7 fields on the Eastern Shore of VA. Very poor correlation.

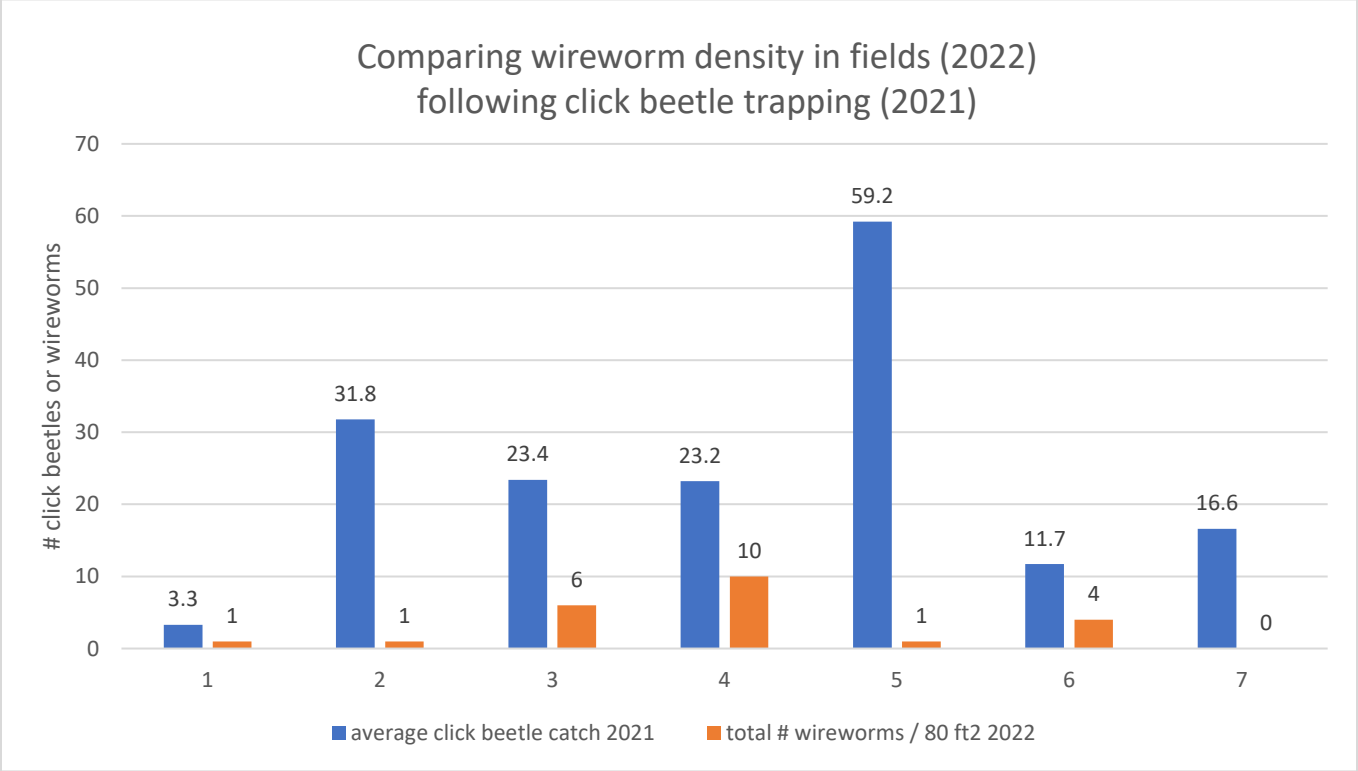

Fig 4. Comparison of average click beetle trap catch to wireworm density the following year in 7 fields

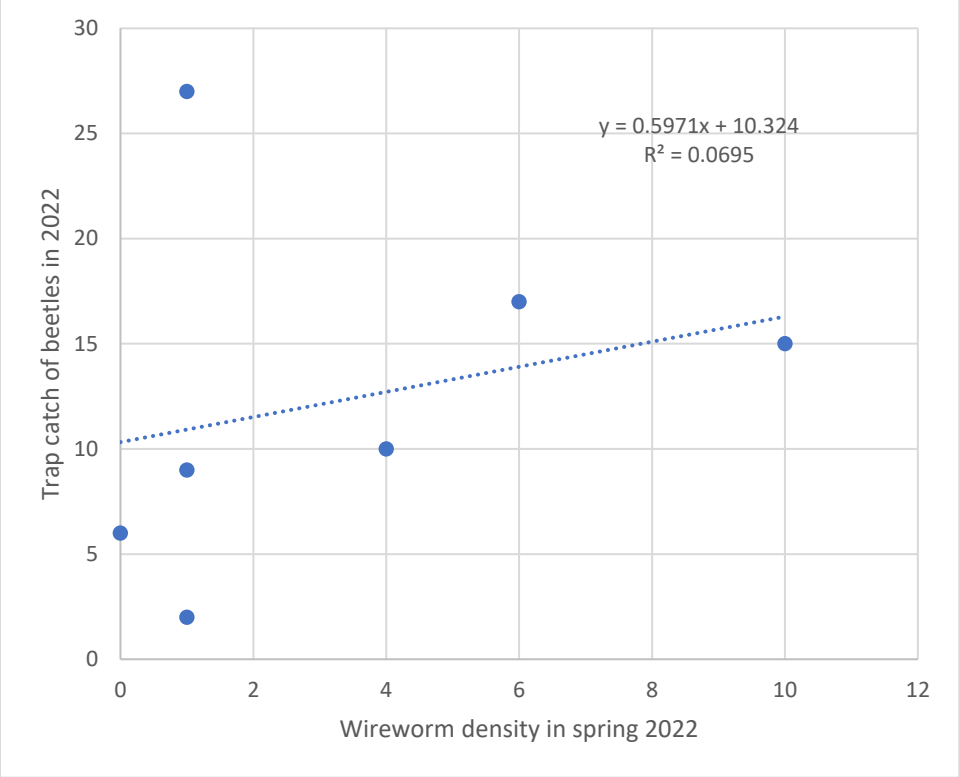

Fig 5. Comparison of spring wireworm density in 2022 with subsequent click beetle trap catch in the summer in 7 fields on the Eastern Shore of VA. Poor correlation.