

SUMMARY OF THE 2022 FINAL REPORT TO THE VIRGINIA CORN BOARD

Name and Address of Principal Investigator: Sally Taylor, Virginia Tech Tidewater AREC, 6321 Holland Rd., Suffolk, VA 23437

Project Title: Neonicotinoid and alternative insecticides for soil insects

Objective of Research: To determine insect injury, plant stands, and yields of corn planted with different seed- and soil-applied insecticides.

Summary of Results:

In 2022, our entomology program established replicated experiments in Suffolk and Blacksburg, VA to evaluate several chemistries for their performance as seed treatments: a neonicotinoid Poncho® (clothianidin), a diamide (chlorantraniliprole), and a meta-diamide Teraxxa® (broflanilide), alongside at-plant, in-furrow granular products Counter® 20G (terbufos) or Force® 3G (tefluthrin) and liquid in-furrow Bifenthrin 2EC or Capture® LFR® (bifenthrin). Treatments were:

1. Untreated (fungicides only)
2. Poncho 250 @ 0.25 mg ai/seed
3. Poncho 1250 @ 1.25 mg ai/seed
4. Chlorantraniliprole 250 @ 0.25 mg ai/seed
5. Chlorantraniliprole 250 @ 0.25 mg ai/seed + Teraxxa @ 0.015 mg ai/seed
6. Counter 20G @ 6 oz/1000 row ft (=5.445 lb/acre for 36-in row centers) (Suffolk) or Force 3G @ 5 oz/1000 row ft (Blacksburg) (granular in-furrow using insecticide-untreated seed)
7. Bifenthrin 2EC @ 12.8 oz/acre (Suffolk) or Capture 1.5 LFR @ 17 oz/acre (Blacksburg) (liquid in-furrow using insecticide-untreated seed)

Wireworm pressure, determined using corn/rye bait traps buried just below the soil surface, was monitored at the Suffolk location—not enough wireworms were recovered to require an insecticide seed treatment or an at-plant soil insecticide according to current Extension recommendations. Plant stands were similar across treatments. There was no yield increase with insecticide seed treatments or in-furrow applications.

Blacksburg averaged four wireworms per bait trap (four times the Extension recommendation) and no white grubs. Untreated seed had the lowest stands, the shortest plants (numerically), the highest percentage of runt plants, and the lowest yield (numerically). Liquid in-furrow Capture and the chlorantraniliprole (with and without Teraxxa) seed treatments had the fewest damaged plants on May 25. Yields were not significantly different, ranging from 102 bu/acre (untreated) to 128 bu/acre (Poncho 250).

In summary, in our low wireworm pressure field, insecticide treatments moderately improved plant height early in the season. In the high-pressure field, insecticide treatments improved stand, had mixed results with reducing plant damage, and increased yield (although non-significantly) 2-26 bushels/acre over untreated seed. We thank the Virginia Corn Board for their support of this project.

Virginia Corn Board

2022 FINAL REPORT

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Project Title: Neonicotinoid and alternative insecticides for soil insects

Objective of Research: To determine insect injury, plant stands, and yields of corn planted with different seed- and soil-applied insecticides.

Methods:

Location 1: Suffolk, VA

'KSC7108VT2PRO' corn was planted strip-till into cotton stubble in Field 13 at the Tidewater Agricultural Research and Extension Center on April 22, 2022. Experimental design was a randomized complete block with four replicates; plots were 4-rows wide (36" row centers) by 35-ft long. Emergence date was April 29.

Treatments consisted of the following:

1. Untreated
2. Poncho 250 (clothianidin) @ 0.25 mg ai/seed
3. Poncho 1250 (clothianidin) @ 1.25 mg ai/seed
4. Chlorantraniliprole 250 @ 0.25 mg ai/seed
5. Chlorantraniliprole 250 @ 0.25 mg ai/seed + Teraxxa @ 0.015 mg ai/seed
6. Counter 20G (terbufos) @ 6 oz/1000 row ft (=5.445 lb/acre for 36-in row centers) (granular in-furrow using insecticide-untreated seed)
7. Bifenthrin 2EC @ 12.8 oz/acre (liquid in-furrow using insecticide-untreated seed)

Additional products applied to all treatments (unless indicated otherwise) per 100 kg were:

Allegiance FL @ 2.0 g ai
Proline 480SC @ 7.5 g ai
BAS 93330F @ 7.5 g ai
Colorcoat Green @ 39.1 ml
Flo Rite Pro 9805 @ 260 ml (treatments 1, 2, 6, 7) or 326 ml (treatments 3, 4, 5)
Secompla 985 @ 65.2 ml (treatments 3-5)
Talc @ 62.5 g

The at-plant, granular in-furrow terbufos (Counter) was metered through planter-mounted Gandy boxes. The at-plant, liquid in-furrow bifenthrin was applied through a microtube mounted between the planter disc openers at 8 psi and 5 gpa.

Wireworms and other below-ground pests were monitored using 8 bait traps, placed on a field transect on April 12 (prior to planting). Traps were “Foot Sox” brand nylon stockings containing a mixture of equal parts corn and rye seed (4 traps), or corn alone (4 traps), with the stocking tied off and soaked in water for 24-h prior to placement to initiate germination. Traps were buried 1-2 inches below the soil surface and were dug up and inspected for insect pests on April 21.

Plant stand was taken on May 9 and 19 by counting all live plants in a 10-ft section of each plot; plant height was also recorded on these dates and was based on 5 randomly selected plants per plot. Plots were harvested on September 23 using a Zurn 2-row picker, with yields adjusted to 15.5% moisture. Data were analyzed using ANOVA and LSD statistical procedures.

Location 2: Blacksburg, VA

Dr. Kyle Bekelja, with guidance from the Principal Investigator, conducted the Blacksburg experiment. Methods were similar to the Suffolk location, except the granular in-furrow insecticide was Force 3G (tefluthrin) @ 5 oz/1000 row ft (instead of Counter 20G), and the bifenthrin product for the liquid in-furrow application was Capture 1.5 LFR (applied at 17 oz/acre) rather than Bifenthrin 2EC. A completely randomized design was used with plots 10-ft wide (30-in row centers) by 25-ft long. Planting date was May 5 and the 8 bait traps were placed on April 20.

Plant stand data were recorded on May 25 and June 9 in a 20-ft section of each plot. Plant height, plant injury, and runt plant data were also recorded on these dates. Plots were harvested on October 12.

Results and Discussion:

Location 1: Suffolk, VA

Four wireworms were captured at the Suffolk location during the 9-day pre-plant trapping period, averaging 0.5 per trap. This is one-half the number requiring treatment (a soil insecticide or higher rate of seed treatment) as recommended by the Virginia Cooperative Extension publication, “2022 Pest Management Guide—Field Crops”.

Stands averaged 2.0-2.2 plants per row ft at 17 and 28 days after planting, with no difference between treatments (Table 1). Clothianidin (Poncho) treatments generally had shorter plants at the 28 day after planting assessment (Table 1). Moistures at harvest averaged 11.6%. Yields were not different and ranged from 144-166 bu/acre (Table 1).

Table 1. Plant stand¹, height², and yield³. Tidewater AREC, Suffolk, VA, 2022.

#	Treatment	Rate	Rate unit	Plants/row ft		Plant height (cm)		Bu/acre	Test weight (lb/bu)
				May 9 V3 17 DAP	May 19 V3-V5 28 DAP	May 9 V3 17 DAP	May 19 V3-V5 28 DAP		
1	Untreated			2.1	2.1	18.4	43.7 bc	160.2	56.10
2	Poncho 250	0.25	mg ai/seed	2.0	2.0	18.4	43.2 bc	161.0	56.33
3	Poncho 1250	1.25	mg ai/seed	2.1	2.1	18.5	42.4 c	157.0	55.77
4	Chlorantraniliprole 250	0.25	mg ai/seed	2.1	2.2	19.4	45.7 ab	165.7	55.35
5	Chlorantraniliprole 250 Teraxxa	0.25 0.015	mg ai/seed mg ai/seed	2.0	2.1	18.2	46.3 a	144.3	55.70
6	Counter	6	oz/1000 row-ft	2.1	2.1	17.6	44.5 abc	164.4	56.53
7	Bifenthrin	12.8	fl oz/a	2.1	2.1	17.8	45.3 ab	152.6	55.90
	LSD (P=0.05)			0.22	0.13	1.64	2.54	19.75	1.66
	P(F)			0.85	0.11	0.42	0.045	0.32	0.78

Means within a column followed by the same letter(s) are not significantly different (LSD, P=0.05).

¹Stand based on counting all live plants in a 10-ft section of row 2.

²Height based on 5 randomly selected plants from row 2 measured from soil level to the top of the tallest stretched leaf.

³Based on picking two rows per plot on September 23 with a Zum harvester and adjusting to 15.5% moisture.

Location 2: Blacksburg, VA

The Blacksburg location averaged 4 wireworms per trap (Table 2), all were identified as *Melanotus depressus* using the Steven Briggs key. This is four times the number requiring treatment as recommended by the 2022 Pest Management Guide—Field Crops. No white grubs were detected.

Table 2. Soil insects captured in buried bait traps, Blacksburg, VA—2022.

Trap	Wireworms	White grubs
1	4	0
2	2	0
3	2	0
4	14	0
5	0	0
6	5	0
7	0	0
8	5	0

All additional data at Blacksburg are summarized in Table 3. On May 25, the untreated seed had the fewest plants per row ft (1.5) and all insecticide treatments were statistically similar (approximately 1.7). There were no differences in plant height. Percent slug injured plants ranged from 18% (Capture) and 20% (Chlorantraniliprole with and without Teraxxa) to 47% (Force), with significant differences between treatments. May 25 also had treatment differences in percent runt plants, ranging from 0.7% (Capture) to 10.4% (insecticide-untreated seed).

For June 9, there were no differences in plant stand, height, or percent runt plants. Plant stand decreased slightly from the May 25 counts. There were fewer damaged plants on June 9 compared with the previous sample date, but data were not significant.

Yields were not statistically different. Untreated seed (102 bu/ac) and Capture (104 bu/ac) had numerically the lowest yields, and Poncho 250 (128 bu/ac) produced the highest yield numerically. Per current Extension recommendations, we still recommend the use of a seed treatment or in-furrow insecticide in Blacksburg given high pest pressures.

Table 3. Plant stand, height, damaged plants, runt plants, and yield. Blacksburg, VA, 2022.

	Stand: Plants per row ft (25 May) ^a	Stand: Plants per row ft (9 June)	Plant Height, cm (25 May)	Plant Height, cm (9 June)	% Damaged Plants (25 May)	% Damaged Plants (9 June) ^b	% Runts (25 May) ^c	% Runts (9 June) ^c	Yield Bushels per acre ^c
Untreated	1.48 ± 0.1b	1.38 ± 0.21	30.4 ± 2.30	75.8 ± 1.75	27.3 ± 11.0ab	0.87 ± 1.72	10.4 ± 6.02c	5.78 ± 4.81	102 ± 25.5
Poncho 250	1.75 ± 0.08a	1.56 ± 0.15	31.3 ± 2.55	77.6 ± 5.25	35.0 ± 12.0ab	6.19 ± 8.35	1.39 ± 1.61ab	5.95 ± 6.40	128 ± 19.9
Poncho 1250	1.66 ± 0.06ab	1.61 ± 0.07	31.3 ± 2.22	79.7 ± 2.53	30.0 ± 6.32ab	0.0 ± 0.0	2.99 ± 2.48abc	0.76 ± 1.52	122 ± 32.0
Chlorantraniliprole 250	1.65 ± 0.07ab	1.54 ± 0.11	33.5 ± 3.48	80.5 ± 3.81	19.8 ± 4.66a	7.56 ± 12.8	1.54 ± 1.78ab	5.01 ± 5.77	114 ± 20.2
Chlorantraniliprole 250 + Teraxxa	1.74 ± 0.16a	1.54 ± 0.25	32.0 ± 2.48	78.6 ± 0.57	19.8 ± 6.56a	1.04 ± 2.08	3.57 ± 1.25abc	3.00 ± 3.49	114 ± 25.1
Force 3G	1.74 ± 0.07a	1.64 ± 0.17	34.2 ± 1.43	80.1 ± 2.38	47.4 ± 17.3b	0.0 ± 0.0	7.82 ± 3.42ac	6.82 ± 6.57	123 ± 17.5
Capture LFR	1.71 ± 0.02a	1.55 ± 0.25	33.6 ± 2.35	77.9 ± 3.05	18.2 ± 5.88a	0.0 ± 0.0	0.71 ± 1.43b	3.45 ± 2.75	104 ± 9.95
Pr(>F)	P < 0.01	P = 0.557	P = 0.309	P = 0.375	P < 0.01	P = 0.151	P < 0.01	P = 0.607	P = 0.4666

Means not connected by the same letter are significantly different (Fisher's LSD Test, $P < 0.05$).

^aData were square root transformed to normalize variance before analysis; untransformed values are presented here.

^bData were arcsin square root transformed to normalize variance before analysis; untransformed values are presented here.

^cData were cube transformed to normalize variance before analysis; untransformed values are presented here.

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