UNIVERSITY OF MINNESOTA | EXTENSION

SW MN IPM RESEARCH - 2020

STUDY: 2020 Corn rootworm insecticide: seed and in-furrow liquid

INVESTIGATOR:
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OBJECTIVE:
Evaluate the efficacy of in-furrow liquid and seed applied insecticides against corn rootworm as compared to a granular in-furrow insecticide and a no-insecticide control.

SUMMARY OF RESULTS:
This study compared the effect of the following insecticides with an insecticide free control: two rates of Poncho® seed applied insecticide, Aztec® HC granular in-furrow, Index® liquid in-furrow, two rates of Force® Evo liquid, in-furrow, Capture® LFR® liquid in-furrow, and three rates of Ampex™ EZ liquid in-furrow. Plant stands, root lodging, root damage based on a 0-3 node injury score (NIS), consistency of control and corn yields were assessed.

Severe root injury and resultant lodging from western corn rootworm larvae feeding occurred in the study area.

- Significant differences in corn stand were not observed among treatments.
- Numerically, Aztec HC had the least lodging and lowest NIS.
- Aztec HC, Index, two rates of Force EVO, two rates of Poncho and Capture LFR had the least lodging (alpha = 0.05).
- The NIS of the three rates of Ampex EZ and Capture LFR were not different (alpha = 0.05) than the insecticide-free control.
- Yields were not significantly different among treatments (alpha = 0.05).
- Yields were negatively correlated with node injury scores and root lodging.

CROP INFORMATION
Crop: Corn (*Zea mays*) **Cultivar:** Lake Country LC 0488 VT2PRIB

Crop rotation history: 2016: Corn 2017: Corn 2018: Corn 2019: Corn

SITE INFORMATION
Location: University of Minnesota Southwest Research and Outreach Center near Lamberton, Redwood County, Minnesota

The study site has been in a continuous corn rotation for several years and managed for corn rootworm research. It has a history of high western corn rootworm populations and resistance to Cry3Bb1.

Rainfall was normal early in the season and above normal after insecticide application (***Figure 1***). Additional weather data can be obtained at https://swroc.cfans.umn.edu/weather.

Soil fertility (2018 sample):
Name: Amiret and Swan Lake loams

Soil test values (Fall 2018)
% OM: 4.7 **pH:** 6.0
P (bray): 21 ppm **K:** 104 ppm **Zn:** 1.0 ppm

PLANTING INFORMATION
Planting Date: 04/30/20
Planting Equipment: John Deere 7000 4 row vacuum planter with Precision Planting V-Set meters.
Row Spacing: 30-inch **Seeding Rate:** 34,000 seeds/acre **Seeding Depth:** 2.0 inch
Soil Temperature: 54° F **Soil Moisture:** Normal
Precipitation: Above-average growing season precipitation early and again late season. Slightly above average growing degree-days.

SITE MAINTENANCE
Tillage fall 2019: Disc Ripper **Tillage Spring 2020:** Field cultivator
PRE Herbicide: 04/20/20 Harness– 2.6 pt. / A
POST Herbicide: 06/12/20 Cornerstone Plus – 40 fl. oz. / A + Callisto 3.0 fl. oz. / A

Insecticide application: In-furrow liquid fertilizer and insecticide with modified 3Rive unit (FMC). In-furrow Aztec granules applied with SmartBox (AMVAC).

HARVEST INFORMATION
Harvest equipment: The center two rows of each plot were harvested 10/15/20 with an ALMACO (Nevada, IA) plot combine.

Harvested grain from plots was discarded 10/15/20.
EXPERIMENTAL DESIGN
Study Design: Randomized Block
Treated Plot Width: 10 foot (four 30-inch rows)
Treated Plot Length: 30 foot
Treatments: 11

TREATMENTS EVALUATED
Lake Country LC 0488 VT2PRIB corn seed with without an insecticide seed treatment was supplied by Valent. Insecticides were compared to a fungicide-only seed treatment to evaluate their efficacy against corn rootworm larvae (***Table 1***). The plots were planted on 4/30/20 with a modified vacuum planter. All treatments were applied with 5 gallons/acre of 10-34-0 liquid fertilizer.

ASSESSMENT METHODS
On May 28, V2 growth stage corn stands were assessed by counting emerged plants within the thirty-foot lengths of rows two and three.

On July 15, tassel stage corn was similarly rated. Above-ground symptoms of corn rootworm damage to root systems were visible at that time. Lodged plants were counted and the percentage of lodged plants calculated.

Root feeding and lodging was severe in portions of this study. Six randomly selected VT stage plants were dug from each plot on July 29. The roots were soaked in water overnight and power washed and rated the following day. Five representative roots were selected and dissected. To determine the 0-3 node injury score (NIS), the number of roots and number of roots pruned within 1.5 inches of the stalk were counted for each node. Additionally, a control consistency score was calculated based on the percentage of the five sampled roots where the NIS was below 0.25.

Continued severe root lodging prevented any further assessments of plots until harvest. On October 15, a plot combine was used to obtain yields from the center two rows of each plot. Yields were adjusted to 56 pounds/ bushel and 15.5% moisture. The harvested grain from this study was discarded as per crop destruct.

RESULTS

Sample results and statistics are presented in ***Table 1.*** Some of these data did not meet the assumptions for analysis of variance. As a result, their significance was based on Kruskall-Wallis non-parametric one-way analysis of variance with a parametric analysis applied to the resulting ranks. Subsequent mean separations were based on Dunn's (p=0.05).

Corn stand and health: At the V2 stage, corn stands were similar and averaged 28,221 emerged plants/acre. Individual plant emergence was highly variable.

At tassel, stands averaged 30,551 and no differences among treatments were detected. Severe lodging reduced the ability to obtain accurate stand counts.

Efficacy against corn rootworm: Numerically, Aztec HC had much less lodging than other treatments although it was not significantly different (alpha = 0.05) from treatments other than untreated, and the three rates of Ampex EZ.

With the exception of Aztec HC, all insecticide treatments had node injury scores of more than 1 (one node pruned to within 1 ½ inches of the plant). The 0.5 mg/seed rate of Poncho, three rates of Ampex EZ, and Capture LFR had a NIS similar to the insecticide-free control.

Aztec HC kept NIS below 0.25 eighty-five percent of the time. All other treatments, including the control, had a NIS below a 0.25 threshold only twenty-five percent of the time or less.

Yield: Treatment yields ranged from 90.7 to 174.9 bushels/acre. These yield differences were not significant (alpha = 0.05) but numerically, Aztec HC had the highest yield. Yields of some individual plots were likely affected by both physiological losses and harvestability issues caused by lodging.

There was a significant negative correlation between yield and NIS (Pearson coefficient -0.5078, p = 0.0004) and lodging (Pearson coefficient = -0.6436, $p < 0.0001$).

ACKNOWLEDGEMENTS

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We appreciate the support provided by Valent® and AMVAC® that helped fund this study.

Ampex EZ is not currently labeled for use on Minnesota corn.

Products are mentioned for illustrative purposes only. Their inclusion does not mean endorsement and their absence does not imply disapproval.

For University of Minnesota Extension crop production information:
http://www.extension.umn.edu/agriculture/crops/

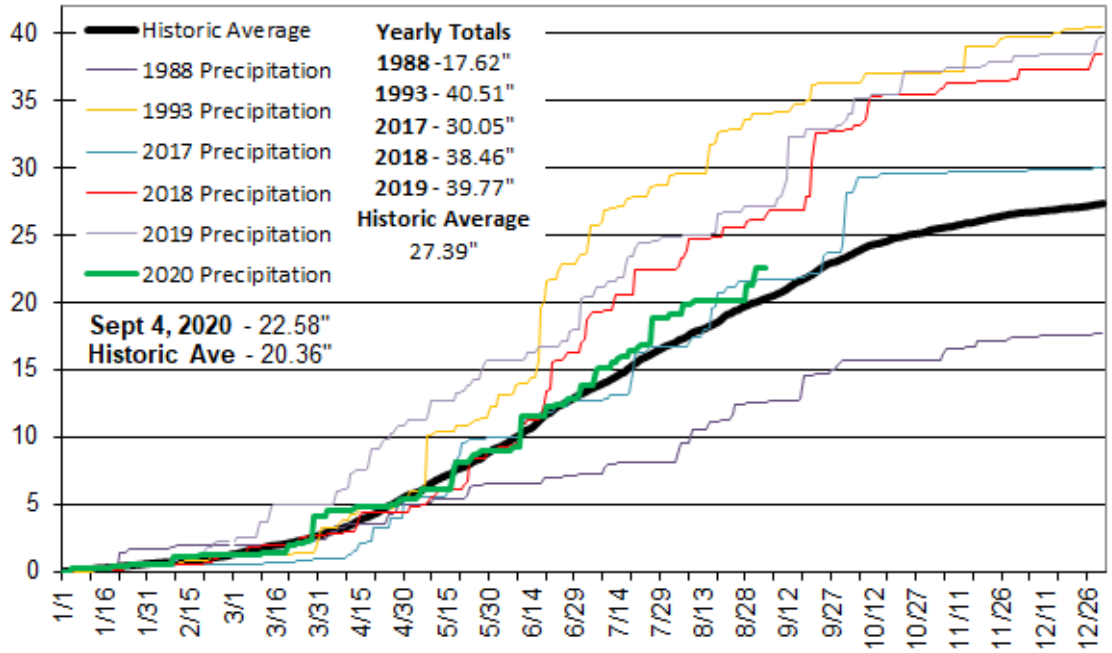

Figure 1. 1988, 1993, and 2016 – 2020 Yearly Totals vs. Historic Average (1961 - 2019).
See also: https://swroc.cfans.umn.edu/weather

				Stand	Stand	Lodging	Root injury	Consistency	Yield
				plants/acre	plants/acre	% plants	0-3 NIS	%	Bu./acre
Rating Date				5/28/20	7/15/20	7/15/20	7/29/20	7/29/20	10/15/20
Crop Stage				V2	VT	VT	R1	R1	R6
Treatment	Rate		Compound and Group						
1 NO INSECTICIDE	-	-	-	28168.8 -	30201.6 -	55.9 abc	1.8 abc	20 ab	141.7 -
2 INDEX	0.72	fl oz/1000 row-ft	chlorethoxyfos(1B) + bifenthrin(3)	26353.8 -	29620.8 -	21.1 cd	1.1 cd	20 ab	166.1 -
3 FORCE EVO	0.46	fl oz/1000 row-ft	tefluthrin (3)	28386.6 -	32089.2 -	42.4 bcd	1.3 bc	25 ab	157.3 -
4 CAPTURE LFR	0.98	fl oz/1000 row-ft	bifenthrin (3)	28386.6 -	30564.6 -	54.2 abcd	2.0 abc	20 ab	143.4 -
5 AMPEX EZ	0.69	fl oz/1000 row-ft	clothianidin (3)	28967.4 -	30492.0 -	59.2 abc	2.2 abc	10 ab	145.8 -
6 AZTEC HC	1.5	oz/1000 row-ft	tebupirimphos (1B) + cyfluthrin (3)	28459.2 -	30709.8 -	9.5 d	0.1 d	85 a	174.9 -
7 PONCHO	1.25	mg ai/seed	clothianidin (4A)	27225.0 -	29766.0 -	45.2 abcd	1.2 bcd	25 ab	153.9 -
8 PONCHO	0.5	mg ai/seed	clothianidin (4A)	27805.8 -	30056.4 -	53.5 abcd	1.7 abc	20 ab	135.6 -
9 AMPEX SC	0.86	fl oz/1000 row-ft	clothianidin (4A)	28822.2 -	31218.0 -	93.9 ab	2.6 abc	0 b	138.0 -
10 AMPEX SC	0.46	fl oz/1000 row-ft	clothianidin (4A)	28677.0 -	30346.8 -	93.9 a	2.8 a	0 b	90.7 -
11 FORCE EVO	0.57	fl oz/1000 row-ft	tefluthrin (3)	29185.2 -	31000.2 -	44.3 abcd	1.6 bc	10 b	132.9 -
Standard Deviation				1406.86	1381.19	24.319	0.66	21.23	32.22
CV				4.99	4.52	46.67	39.81	99.4	22.43
Treatment Prob(F)				0.2372	0.4401	<0.0001 *	<0.0001 *	0.0303 *	0.0947

** data do not meet assumptions for AOV, Significance based on Kruskal-Wallis non-parametric one-way analysis of variance w/ Dunn's all- pairwise comparisons*

Means followed by same letter or symbol do not significantly differ (P=.05, Tukey's HSD).

Mean comparisons performed only when AOV Treatment P(F) is significant

ψ *All treatments include 10-34-0 liquid fertilizer in-furrow at 5 gallons/acre, alone or as a carrier for liquid insectide*

Table 1. *Efficacy of insecticide against corn rootworm based on injury to corn roots, root lodging and grain yield.*