Evaluation of insecticide seed treatments on two hybrid sweet corn varieties for the control of Seedcorn Maggot: Minnesota Results – 2021 (*not for publication*)

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Objective: Evaluate the efficacy of five different at-plant insecticide treatments on two different sweet corn hybrids for control of seedcorn maggot (DIPTERA: *Delia platura*).

Experimental design: This trial was conducted in 2021 on a silt loam soil at the University of Minnesota's Rosemount Research and Outreach Center, located 3.7 miles southeast of Rosemount, MN (GPS coordinates: 44.703039, -93.069785). Three plantings were established, on April 30, May 14, and June 1, respectively, to evaluate efficacy against the first, second, and third generations of the seedcorn maggot lifecycle. Within each planting, plots measured four rows wide by 30 ft long, with rows spaced on 30 in. centers, and 5 ft of unplanted space along rows separating replicates. Seed was planted using a 4-row planter equipped with a cone feeder. Each 30 ft. row received 45 seeds, for an approximate seed spacing of 8 in. Prior to planting, the field was prepared by spreading beef manure with wheat grass bedding at 18 tons per acre on April 14 and worked on April 16, and again on April 20 at 13.5 tons per acre and worked on April 22. After data collection, all plots were destroyed by disking on June 17.

Treatments: Two sweet corn hybrids were used in this experiment: Seminis SV1339SK was used for treatments 1-6, while Syngenta GS 1453 was used for treatments 7-12. All seed was treated with the fungicides Apron XL (0.32 fl oz/cwt), Dividend Extreme (5 fl oz/cwt), Maxim 4FS (0.08 fl oz/cwt), 42-S Thiram (5 fl oz/cwt), and Vitavax 34 (3.6 fl oz/cwt). Insecticide treatments were as follows: treatments 1 and 7 received no insecticide, treatments 2 and 8 received Cruiser 5FS (0.25 mg ai/seed), treatments 3 and 9 received Poncho 600 (0.5 mg ai/seed), treatments 4 and 10 received Fortenza (0.25 mg ai/seed), treatments 5 and 11 received Reatis (0.25 mg ai/seed), and treatments 6 and 12 received Entrust (0.25 mg ai/seed). See **Table 1** for treatment details.

Table 1. Treatment details

			Seminis SV1339SK						Syngenta GS 1453					
	Product Name	**Unit**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Fungicides	Apron Xl	fl oz/cwt	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32
	Dividend Extreme	fl oz/cwt	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
	Maxim 4FS	fl oz/cwt	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
	42-S Thiram	fl oz/cwt	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
	Vitavax 34	fl oz/cwt	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
Insecticides	Cruiser 5FS	mg ai/unit	.	0.25	.	.	.	.	.	0.25	.	.	.	.
	Poncho 600	mg ai/unit	.	.	0.50	.	.	.	.	.	0.50	.	.	.
	Fortenza	mg ai/unit	.	.	.	0.25	.	.	.	.	.	0.25	.	.
	Reatis	mg ai/unit	.	.	.	.	0.25	.	.	.	.	.	0.25	.
	Entrust	mg ai/unit	.	.	.	.	.	0.25	.	.	.	.	.	0.25

Treatment products are shown in rows, with treatment numbers and corresponding rates are shown in columns. Hybrid variety is shown above treatment numbers.

Evaluation: Stand counts were performed in the middle two rows of each four-row plot in all plantings at to evaluate seedling effects of either seedcorn maggot (SCM) damage or treatment-related delayed emergence. Stand counts were performed in the first planting on May 24 (24 days after planting, crop stage VE-V2), in the second planting on May 26 (12 days after planting, crop stage VE-V1), and in the third planting on June 14 (13 days after planting, crop stage V2-V3). In the second planting, seedling damage was assessed by walking four paces into each plot and digging up five seedling in row 1 of the plot, and recording the number that showed evidence of seedcorn maggot damage (defined as brown mushy seed or evidence of feeding holes in seed coat or shoot) and the number of seedcorn maggot larvae present on the seedlings. Seedcorn maggot adult flights were monitored by placing three yellow sticky card traps on the field edge on April 15 and replacing each card weekly through June 10. The number of adult seedcorn maggot flies present on each trap after collection was recorded.

Data analysis: Evaluation data was analyzed in R version 4.1.2 (R-Core Team, 2021). Stand counts are reported as percentage of total seeds planted (45/row) that emerged by the count date. Larval counts were log(x + 1) transformed. All response variables were analyzed using analysis of variance of a fitted linear model. Means separation letter codes were generated using Tukey's HSD procedure (P<.05, package 'agricolae').

This research was funded in part by the Midwest Food Processors Association (MWFPA).

Results: Stand counts

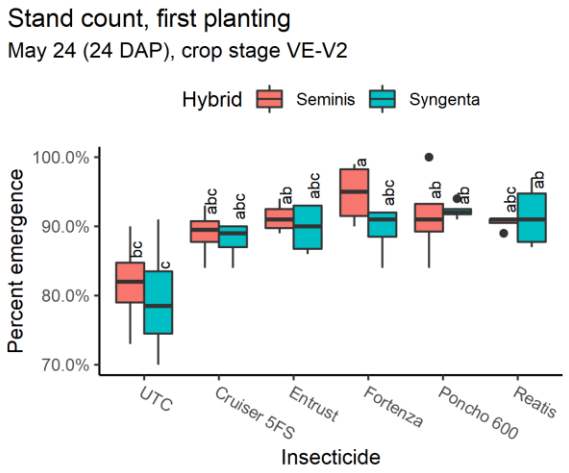
Seedling emergence was most strongly affected by the planting date (P<.0001) and insecticide (P<.0001), and there was a significant interaction between planting date and insecticide (or lack of), due in large part to differences in the untreated control performance across the different planting dates (**Table 2, Figures 1-3**). Hybrid variety was also a significant factor (P=.0028), with the Syngenta hybrid generally having lower seedling emergence versus the Seminis hybrid.

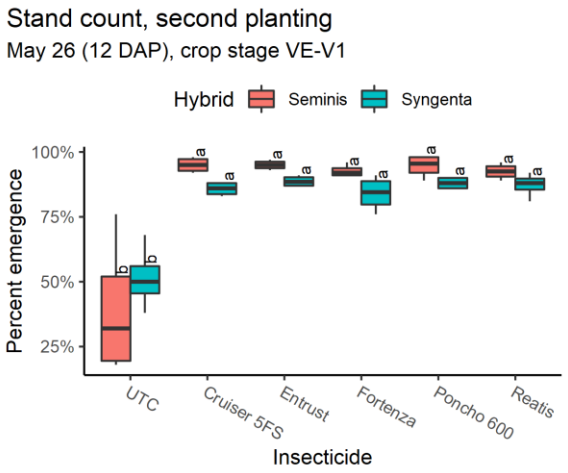
Table 2. Mean seedling emergence rates by planting date

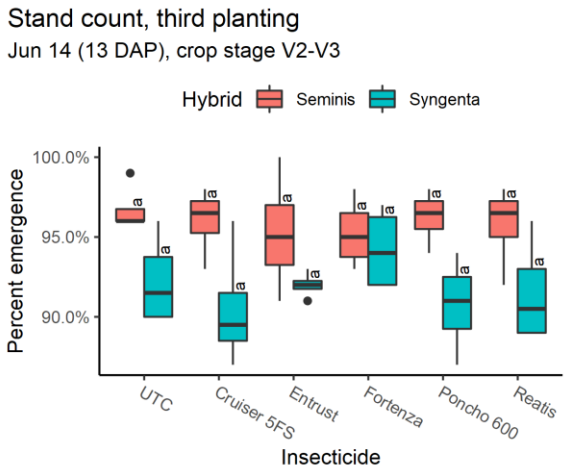
Trt	Trt	First planting				Second planting				Third planting			
No	**Description**	**Mean**	**±**	**SD**	**HSD**	**Mean**	**±**	**SD**	**HSD**	**Mean**	**±**	**SD**	**HSD**
1	Seminis | UTC	81.9%	±	6.9%	bc	39.4%	±	26.9%	b	96.4%	±	1.7%	a
2	Seminis | Cruiser 5FS	89.2%	±	3.7%	abc	95.0%	±	2.6%	a	95.8%	±	1.9%	a
3	Seminis | Poncho 600	91.7%	±	6.4%	abc	94.4%	±	4.3%	a	96.1%	±	1.4%	a
4	Seminis | Fortenza	94.7%	±	4.3%	a	92.8%	±	2.1%	a	95.3%	±	1.9%	a
5	Seminis | Reatis	90.6%	±	1.1%	abc	92.5%	±	3.1%	a	95.6%	±	2.4%	a
6	Seminis | Entrust	91.4%	±	2.5%	abc	95.0%	±	1.4%	a	95.3%	±	3.7%	a
7	Syngenta | UTC	79.4%	±	9.0%	c	51.4%	±	12.5%	b	92.2%	±	2.7%	a
8	Syngenta | Cruiser 5FS	88.1%	±	2.6%	abc	85.8%	±	2.3%	a	90.3%	±	3.8%	a
9	Syngenta | Poncho 600	92.5%	±	1.4%	ab	87.8%	±	2.6%	a	90.8%	±	3.3%	a
10	Syngenta | Fortenza	89.7%	±	3.7%	abc	83.9%	±	6.9%	a	94.2%	±	2.3%	a
11	Syngenta | Reatis	91.4%	±	4.9%	abc	87.2%	±	4.7%	a	91.4%	±	3.2%	a
12	Syngenta | Entrust	89.7%	±	4.2%	abc	88.6%	±	2.3%	a	92.2%	±	0.9%	a
	P < F	**0.0051**				**< .0001**				**0.0088**			

Means followed by same letter codes are not significantly different (Tukey's HSD, P=.05).

Figures 1-3. Stand counts by planting date







Due to a significant interaction between the performance of the insecticides and the planting date, seedling emergence rates for each planting date should be inspected separately. In **Table 3** below, the first row shows the baseline seedling emergence rate estimated for a Seminis hybrid with no insecticide treatment. Across all three plantings, the Syngenta hybrid performed slightly worse than the Seminis hybrid. All insecticides were effective in increasing the emergence rate in the first and second plantings, though the effect was most pronounced in the second planting where emergence was improved by over 40% over the untreated control plots. Seedling emergence was high across all plots in the third planting.

Table 3. Emergence estimates by factor

Effect	Planting 1	Planting 2	Planting 3
Baseline: Seminis Hybrid No insecticide	82.5%	51.1%	95.9%
Syngenta Hybrid	-1.4%	-4.0%	-4.0%
Insecticide Cruiser 5FS	7.9%	44.9%	-1.3%
Insecticide Entrust	9.9%	46.4%	-0.9%
Insecticide Fortenza	11.5%	42.9%	0.2%
Insecticide Poncho 600	11.2%	45.8%	-1.0%
Insecticide Reatis	10.4%	44.4%	-0.9%

The first row provides the baseline emergence case, and subsequent rows reflect an estimated difference in emergence relative to the baseline case. Effect estimates are derived from a fitted linear model.

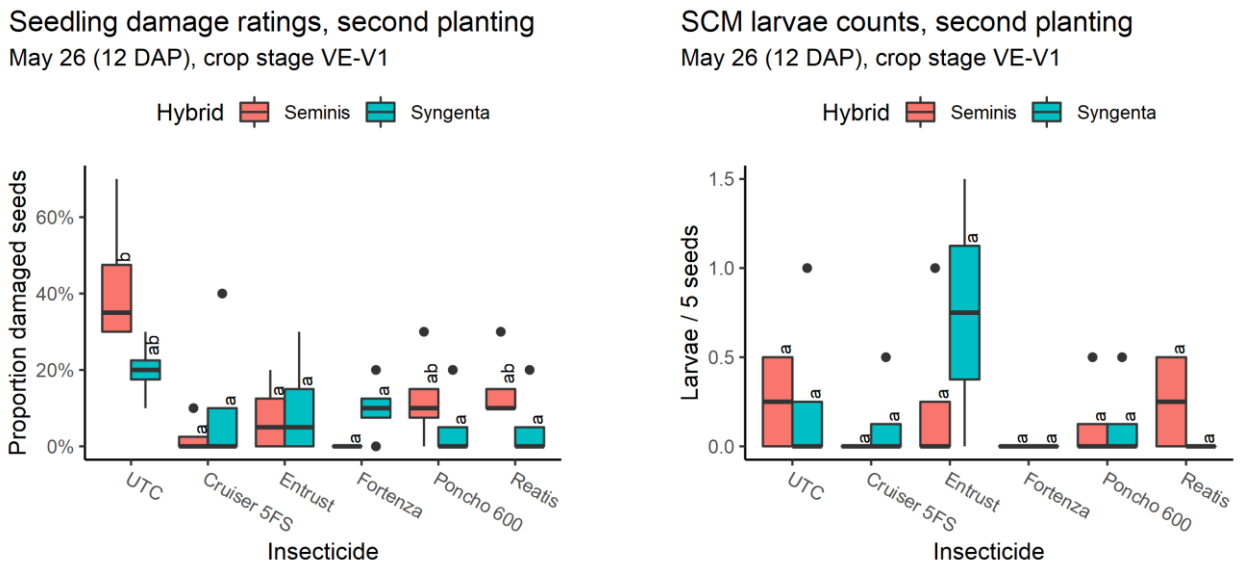
Results: Seedling damage and maggot counts

Some differences in seedling damage and seedcorn maggot larval counts were observed between hybrids, but the effect varied (**Table 4, Figures 4-5**). In the untreated control, the Syngenta hybrid suffered lower seedling damage than the Seminis hybrid (though not significantly so). There was a significant difference in seedling damage between insecticide treatments (P = .0007), with Cruiser and Fortenza performing best on the Seminis hybrid and Poncho and Reatis performing best on the Syngenta hybrid. Larval counts per 5 seedlings were low and no significant differences between hybrids or treatments were observed.

Trt	Trt	Prp seeds damaged				Larvae / 5 seeds			
No	Description	Mean	±	SD	HSD	Mean	±	SD	HSD
1	Seminis | UTC	42.5%	±	18.9%	b	0.25	±	0.29	a
2	Seminis | Cruiser 5FS	2.5%	±	5.0%	a	0.00	±	0.00	a
3	Seminis | Poncho 600	12.5%	±	12.6%	ab	0.13	±	0.25	a
4	Seminis | Fortenza	0.0%	±	0.0%	a	0.00	±	0.00	a
5	Seminis | Reatis	15.0%	±	10.0%	ab	0.25	±	0.29	a
6	Seminis | Entrust	7.5%	±	9.6%	ab	0.25	±	0.50	a
7	Syngenta | UTC	20.0%	±	8.2%	ab	0.25	±	0.50	a
8	Syngenta | Cruiser 5FS	10.0%	±	20.0%	ab	0.13	±	0.25	a
9	Syngenta | Poncho 600	5.0%	±	10.0%	a	0.13	±	0.25	a
10	Syngenta | Fortenza	10.0%	±	8.2%	ab	0.00	±	0.00	a
11	Syngenta | Reatis	5.0%	±	10.0%	a	0.00	±	0.00	a
12	Syngenta | Entrust	10.0%	±	14.1%	ab	0.75	±	0.65	a
		P < F		**0.0035**				**0.18**	

Means followed by same letter codes are not significantly different (Tukey's HSD, P=.05).

Figures 4-5. Seedling damage rating and seedcorn maggot larvae counts



Results: Seedcorn maggot adult captures

Two generations of adult seedcorn maggot flights were observed during this trial, with the first peaking on April 29, reaching a minimum on May 20, and peaking again through June 4 and 10. From this data we can see that the first planting (April 30) coincided with the peak first generation SCM flight, the second planting (May 14) coincided with the tail end of the first adult flight, and the third planting (June 1) coincided with the early part of the second generation SCM flight.