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Soybean Aphid Efficacy Evaluation in Northeast Iowa

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Abstract

SOYBEAN, Glycine max (L.), grown in Iowa and most of the north central region of the United States, has not required regular insecticide use. The soybean aphid, Aphis glycines (Hemiptera: Aphididae), causes yield losses from direct plant feeding, and has been shown to transmit several plant viruses. In Iowa, soybean aphid can colonize soybean fields in June and has developed into outbreaks in July and August capable of reducing yields by nearly 40 percent.

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Introduction

SOYBEAN, *Glycine max* (L.), grown in Iowa and most of the north central region of the United States, has not required regular insecticide use. The soybean aphid, *Aphis glycines* (Hemiptera: Aphididae), causes yield losses from direct plant feeding, and has been shown to transmit several plant viruses. In Iowa, soybean aphid can colonize soybean fields in June and has developed into outbreaks in July and August capable of reducing yields by nearly 40 percent.

Materials and Methods

We established plots at the Iowa State University Northeast Research Farm, Nashua, Floyd County, Iowa. The treatments were arranged in a randomized complete block design with four replications, and soybean (Syngenta 05RM310021 and 07JR801843) was planted in 30-in. rows using no-till production practices on May 16. Each plot was six rows wide and 50 ft long. In total for 2012, we evaluated 29 treatments with products alone or in combination (Table 1). Treatments included foliar and seed-applied products and also host plant resistance for soybean aphid. Most products were insecticides but some fungicides were used in combination with insecticides.

Application techniques. The ideal foliar application would be when aphids exceeded the economic threshold of 250/plant. However, soybean aphid populations were very low at this location and most foliar applications were made to all six rows within each treated plot during beginning seed fill (Table 1). Foliar treatments were applied using a backpack sprayer and TeeJet (Springfield, IL) twinjet nozzles (TJ 11002) with 20 gallons of water/acre at 40 lb of pressure per square inch.

Estimation of soybean aphid populations and cumulative aphid days. Soybean aphids were counted on single plants at randomly selected locations within each plot. All aphids were counted on each plant. Summing aphid days accumulated during the growing season provides a measure of the seasonal aphid exposure that a soybean plant experiences. Cumulative aphid days (CAD) are calculated with the following equation:

$$\sum_{n=1}^{\infty} = \left(\frac{x_{i-1} + x_i}{2} \right) \times t$$

where x is the mean number of aphids on sample day i, x_{i-1} is the mean number of aphids on the previous sample day, and t is the number of days between samples i - 1 and i.

Yield and statistical analysis. Harvesting took place on September 26. Yields were determined by weighing grain with a grain hopper, which rested on a digital scale sensor custom designed for the combine. Yields were corrected to 13 percent moisture and reported as bushels/acre.

One way analysis of variance (ANOVA) was used to determine treatment effects within each experiment. Means separation for all CAD and yield treatments was achieved using a least significant difference test ($P \leq 0.10$).

Results and Discussion

No soybean aphid populations were observed in the untreated control prior to the August 10 application. A few aphids colonized the untreated control plots in late August. Cobalt

Advanced (13.0 fl oz) had significantly more CAD than all other treatments ($P < 0.56$; $F = 0.94$; df = 28, 3) (Table 1), but this is misleading because one plot within the treatment was colonized for a brief time before the foliar applications were made. This patchy infestation greatly influenced seasonal accumulation (Table 1). Note, treatments with the *Rag1* gene had the fewest CAD for 2012.

In 2012, aphid populations were very low. We included several established insecticides and a few new products marketed for soybean aphid. Most foliar products were effective at reducing CAD and protecting yield. We did not detect any thriving aphid populations three days after foliar application for any product.

There were some significant yield differences among treatments ($P < 0.0001$; $F = 14.53$; df = 28, 3) (Table 1). However, in the absence of heavy aphid pressure, we do not expect to see a yield response to insecticides. Therefore, our recommendation for soybean aphid management is to continue to scout soybean and to apply a full rate of a foliar insecticide when populations exceed 250 aphids/plant. One well-timed foliar application applied after aphids exceed the economic threshold will protect yield and increase profits in most situations. We would also strongly encourage growers to incorporate host plant resistance into their seed selection. At this time, we are not recommending insecticidal seed treatments for aphid management because of soybean aphid biology in Iowa. To date, most foliar insecticides are very effective at reducing soybean aphid populations if the coverage is sufficient. Achieving small droplet size to penetrate a closed canopy may be the biggest challenge to managing soybean aphid.

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Table 1. 2012 soybean aphid treatments and rates at Floyd County, IA.

Treatment	Rate[a]	CAD ± SEM[b]	CAD-LSD[c]	Yield ± SEM[d]	Yield-LSD[e]
Untreated Control	-----	11.88 ± 11.88	A	55.53 ± 5.44	BCDEF
Rag1	-----	0.00 ± 0.00	A	53.37 ± 5.21	EF
CruiserMaxx Beans	56 (ST)	1.63 ± 1.63	A	58.13 ± 3.96	ABCD
Rag1 + CruiserMaxx Beans	----- 56 (ST)	0.00 ± 0.00	A	57.72 ± 3.83	ABCD
Rag1 + CruiserMaxx Beans + Warrior II CS	---- 56 (ST) 1.92	0.00 ± 0.00	A	54.69 ± 1.77	CDEF
Rag1 + Warrior II CS	------ 1.92	0.63 ± 0.63	A	54.94 ± 3.91	CDEF
Warrior II CS	1.92	1.63 ± 1.63	A	58.30 ± 4.04	ABCD
Lorsban Advanced EC	1 pt	0.00 ± 0.00	A	58.24 ± 5.34	ABCD
Dimethoate 4E	1 pt	0.00 ± 0.00	A	57.99 ± 3.57	ABCD
Cobalt Advanced EC	13.0	397.50 ± 397.50	B	56.08 ± 2.39	BCDE
Warrior II CS + Lorsban Advanced EC	1.6 16.0	0.00 ± 0.00	A	57.41 ± 4.74	ABCDE
Brigade 2EC	6.0	0.00 ± 0.00	A	56.34 ± 3.89	ABCDE
Belay SC	3.0	0.00 ± 0.00	A	57.04 ± 3.21	ABCDE
Belay SC	4.0	0.00 ± 0.00	A	59.25 ± 3.49	ABCDE
Belay SC + Brigade EC	2.0 2.3	4.88 ± 3.11	A	55.90 ± 3.63	BCDEF
Declare CS	1.02	0.00 ± 0.00	A	58.54 ± 4.01	ABC
Declare CS	1.28	1.88 ± 1.88	A	60.55 ± 3.13	A
Declare CS + Dimethoate 4E	1.02 4.0	1.63 ± 1.63	A	51.78 ± 4.70	F
Leverage 360	2.8	97.63 ± 95.47	A	58.02 ± 3.51	ABCDE
Leverage 360	2.8	0.00 ± 0.00	A	56.45 ± 3.47	ABCD
Leverage 360 + Stratego YLD	2.8 4.0	1.75 ± 1.75	A	54.17 ± 4.61	DEF
Fastac EC	4.0	1.63 ± 1.63	A	56.47 ± 4.66	ABCDE
Endigo ZC	4.5	1.63 ± 1.63	A	57.88 ± 3.87	ABCD
Quilt Xcel SE	13.0	0.00 ± 0.00	A	56.30 ± 4.68	BCDE
Warrior II CS + Quilt Xcel SE	1.92 13.0	0.00 ± 0.00	A	56.57 ± 5.57	ABCDE
Cobalt Advanced EC + Headline EC	24.0 12.0	54.38 ± 54.38	A	55.05 ± 6.29	CDEF
Besiege ZC	9.0	11.88 ± 9.83	A	57.18 ± 4.92	ABCDE
Asana XL	9.6	0.00 ± 0.00	A	56.03 ± 6.27	BCDE
Asana XL + Lannate LV	8.0 8.0	0.00 ± 0.00	A	56.07 ± 2.23	BCDE

[a]Foliar product rates are given as formulated product per acre, and ST (seed treatments) are given as grams active ingredient per 100 kg seed.
[b]CAD ± SEM; cumulative aphid days ± standard error of the mean.
[c]CAD-LSD; least significant different mean separation test for cumulative aphid days.
[d]Yield ± SEM; yield in bushels per acre ± standard error of the mean.
[e]Yield-LSD; least significant different mean separation test for yield.