Soybean Aphid Efficacy Evaluation in Northeast Iowa

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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 usage. Soybean aphid, *Aphis glycines* (Hemiptera: Aphididae), is the most important soybean pest in Iowa and is capable of reducing yield by 40 percent. Nymphs and adults feed on sap within the phloem and can vector several plant viruses. In Iowa, soybean aphids have been a persistent pest that can colonize fields from June through September. Their summer population dynamics are dependent on weather and other environmental conditions.

Materials and Methods

Plots were established at the Iowa State University Northeast Research Farm in Floyd County, Iowa. Treatments were arranged in a randomized complete block design with four replications, and soybean (Syngenta NK S24-K2) was planted in 30-in. rows using no-till production practices May 22. Each plot was six rows wide and 50 ft long. In total, 27 treatments were evaluated with products alone or in combination (Table 1). Treatments included foliar and seed-applied products for soybean aphid. Some fungicides were used in combination with insecticides on seed-applied treatments

Application techniques. The ideal foliar application would be when aphids exceeded the economic threshold of 250/plant. Soybean aphid populations were low at this location until early September and foliar applications were made to the center four rows within each treated plot during beginning seed set (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/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 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. Plots were harvested October 20. Yields were determined by weighing grain with a 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. Mean separation for all CAD and yield treatments was achieved using a least significant difference test (alpha = 0.10).

Results and Discussion

In 2018, aphid populations remained low. Plots were initially colonized by soybean aphid in July, but populations remained low throughout the season. Uniform aphid colonization was established in late July and continued to build throughout August. However, there was not enough seasonal accumulation of aphids to exceed the economic injury level and therefore cause yield loss.

Foliar applications were made August 10 when plants were in the R5 growth stage, with the exception of the treatments containing Macho 2.0 FL, which were applied August 13. The untreated control had 6.9 ± 3.0 (± SEM; standard error of the mean) aphids/plant one day prior to the August 10 application and peaked August 21 at 43.7 ± 3.4 aphids/plant. There were some significant differences among CAD treatments, ranging from 41 to 681 ($P < 0.0001$; $F = 4.04$; df = 26, 3) (Table 1). Many foliar insecticides were effective in reducing CAD, and there were some significant differences in CAD with the foliar insecticides.

Sudden death syndrome (SDS) was observed in the field and was highly variable. Plots that were observed by farm staff to have 25 percent or greater plants showing SDS symptoms were excluded from the yield analysis. Among plots showing less than 25 percent visible symptoms of SDS, the yield ranged from 57 to 65 bushels/acre with some significant differences among treatments ($P = 0.2954$; $F = 1.18$; df = 26, 3) (Table 1). Although there were yield differences, researchers do not believe it was due to soybean aphid seasonal exposure. Overall, the treatment containing a foliar application of Brigadier SC had the highest yield. The lowest-yielding treatment was foliar application of Tundra (3.2 fl oz/acre rate) (Table 1).

The 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. To date, most foliar insecticides are 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.

Growers are strongly encouraged to incorporate host plant resistance into their seed selection. At this time, the project does not recommend insecticidal seed treatments for aphid management because of soybean aphid biology in Iowa.

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Table 1. 2018 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	-----	680.95 ± 99.98	D	61.69 ± 1.24	ABCD
Lorsban Advanced EC	16.0 fl oz	45.93 ± 7.42	A	61.51 ± 2.91	ABCD
Dimethoate 4E	16.0 fl oz	84.29 ± 11.55	A	62.55 ± 1.61	ABC
Warrior II CS	1.92 fl oz	257.68 ± 25.28	AB	62.91 ± 3.38	ABC
Mustang Maxx EC	2.8 fl oz	578.79 ± 232.43	CD	63.19 ± 3.36	ABC
Tundra EC	3.2 fl oz	199.26 ± 87.76	A	56.62 ± 1.43	E
Tundra EC	4.8 fl oz	133.56 ± 25.36	A	61.49 ± 3.67	ABCD
Cruiser 5FS	0.0756 mg	535.63 ± 142.98	CD	60.78 ± 1.57	ABCDE
CruiserMaxx Vibrance FS	0.0945 mg	524.45 ± 84.04	CD	59.02 ± 2.05	CDE
Macho 2.0 FL	2.0 fl oz	448.24 ± 277.12	BC	62.22 ± 4.36	ABC
Macho 2.0 FL	3.0 fl oz	80.25 ± 10.74	A	62.34 ± 2.39	ABC
Macho 2.0 FL	4.0 fl oz	168.92 ± 48.88	A	63.02 ± 1.57	ABC
Transform WG	0.542 oz	116.59 ± 66.18	A	62.95 ± 3.42	ABC
Transform WG	0.8 oz	80.05 ± 13.40	A	63.55 ± 1.96	ABC
Sefina DC	3.0 fl oz	122.87 ± 30.82	A	62.94 ± 3.54	ABC
Carbine 50 WG	2.8 oz	41.28 ± 5.19	A	57.19 ± 2.04	DE
Warrior II CS +	1.92 fl oz	79.34 ± 26.75	A	61.96 ± 2.47	ABC
Lorsban Advanced EC	16.0 fl oz				
Hero EC +	5.0 fl oz	80.46 ± 37.76	A	59.09 ± 5.02	CDE
Dimethoate 4E	16.0 fl oz				
Cobalt Advanced EC	16.0 fl oz	61.91 ± 14.22	A	60.33 ± 1.82	BCDE
Cruiser 5FS +	0.0756 mg	147.05 ± 52.06	A	60.48 ± 2.18	BCDE
Warrior II CS	1.92 fl oz				
CruiserMaxx Vibrance FS +	0.0945 mg	212.47 ± 94.13	A	60.36 ± 4.47	BCDE
Warrior II CS	1.92 fl oz				
Brigadier SC	6.1 fl oz	93.05 ± 52.88	A	65.42 ± 1.46	A
Endigo ZCX	3.5 fl oz	163.49 ± 70.96	A	64.39 ± 0.00	AB
Endigo ZCX	4.5 fl oz	80.24 ± 23.52	A	58.93 ± 0.47	CDE
Transform WG +	0.8 oz	42.03 ± 16.87	A	62.53 ± 3.84	ABC
Tundra EC	4.8 fl oz				
Transform WG +	0.542 oz	70.34 ± 12.28	A	60.00 ± 3.07	BCDE
Tundra EC	3.2 fl oz				
Transform WG +	0.4 oz	67.94 ± 18.63	A	61.49 ± 2.56	ABCD
Tundra EC	2.4 fl oz				

[a]Foliar product rates are given as formulated product/acre, and seed treatments are given as milligrams active ingredient/seed.

[b]Cumulative aphid days ± standard error of the mean.

[c]Least significant difference for mean separation of cumulative aphid days ($P < 0.0001$; $F = 4.04$; $df = 26, 3$).

[d]Yield ± SEM; yield in bushels/acre ± standard error of the mean.

[e]Least significant difference for mean separation of yield ($P = 0.2954$; $F = 1.18$; $df = 26, 3$).