Soybean Aphid Efficacy Evaluation in Northwest 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 Northwest Research Farm in O'Brien 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 May 16. In total, 27 treatments were evaluated with products alone or in combination (Table 1). Treatments included foliar and seed-applied products for soybean aphid.

Application techniques. The ideal foliar application would be when aphids exceeded the economic threshold of 250/plant. Foliar applications were made to all six rows within each treated plot August 16 (Table 1). Foliar treatments were applied using a custom sprayer and TeeJet (Springfield, IL) flat fan nozzles (TJ 8002) with 20 gallons of water/acre at 30 pounds 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 (adults, nymphs, and winged 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 15. 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. Mean separation for all CAD and yield treatments was achieved using a least significant difference test (alpha = 0.10).

Results and Discussion

The plots were initially colonized by soybean aphid in July, with exponential growth in August. There were a few other soybean insect pests present (e.g., Japanese beetle, colaspis beetle, thistle caterpillar, and stink bug), but economic populations were not evident. Natural enemies, such as beetles, flies, lacewings, and wasps were present throughout the reproductive stages, but did not significantly impact aphid populations. The threshold was met August 15 and plots were sprayed August 16. Plants were R5 (beginning seed set) at the time of the foliar application. Soybean aphid populations peaked September 5. In the untreated control treatments, aphid populations reached 1,783.3/plant ± 376.1 (± standard error of the mean).

There were some significant differences among CAD treatments, ranging from 2,372-36,827 (Table 1). Most of the CAD was accrued in late August and September after full seed set. The untreated control had the most CAD and had significantly more aphids than all other treatments. Treatments 5, 6, and 10 had generally more CAD than most other foliar insecticidal treatments. It is unknown if the aphids on the farm or within plots were pyrethroid resistant. As demonstrated in previous efficacy evaluations, when aphids peak after full seed set, yield losses are not as dramatic. Although the untreated control had numerically less yield than all other treatments, there was much overlap between treatments (Table 1).

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. 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.

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

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Table 1. 2019 soybean aphid treatments and rates at ISU Northwest Research Farm, Sutherland, O'Brien County, IA.

Treatment	Rate[a]	CAD ± SEM[b]	CAD-LSD[c]	Yield ± SEM[d]	Yield-LSD[e]
Untreated Control	-----	36,827.74 ± 7,228.56	G	52.63 ± 1.73	H
Lorsban Advanced EC	16.0 fl oz	5,760.34 ± 766.40	ABC	59.53 ± 1.79	BCDE
Dimethoate 4E	16.0 fl oz	5,320.97 ± 1,347.39	ABC	58.08 ± 2.17	DEFG
Warrior II CS	1.92 fl oz	17,287.58 ± 3,337.26	EF	55.25 ± 1.38	GH
Hero EC	5.0 fl oz	19,743.35 ± 7,568.03	F	54.43 ± 1.94	H
Brigade EC (A)	3.2 fl oz	20,240.54 ± 9,441.44	F	61.38 ± 0.70	ABCD
Brigade EC (B)	4.8 fl oz	5,007.24 ± 872.65	ABC	63.43 ± 0.99	A
UPL Lambda (A)	0.92 fl oz	8,476.13 ± 920.36	ABCD	60.15 ± 1.72	ABCD
UPL Lambda (B)	0.96 fl oz	11,782.27 ± 3,405.58	CDE	52.93 ± 3.14	H
Lambda-Cy EC	0.92 fl oz	17,186.71 ± 5,377.30	EF	53.53 ± 3.00	H
Cruiser 5FS	0.0756 mg ai/seed	16,983.81 ± 2,845.73	EF	58.93 ± 2.04	CDEF
CruiserMaxx Vibrance FS	0.0945 mg ai/seed	11,103.59 ± 778.21	BCDE	59.18 ± 1.03	CDE
Transform WG (A)	0.542 oz	6,089.26 ± 1,224.42	ABC	62.10 ± 1.18	ABC
Transform WG (B)	0.8 oz	3,282.44 ± 905.30	AB	59.15 ± 0.85	CDE
Pyrifluquinazon (A)	0.8 fl oz	8,851.28 ± 1,822.64	ABCD	55.43 ± 2.61	FGH
Pyrifluquinazon (B)	1.2 fl oz	10,307.50 ± 2,362.58	BCDE	55.40 ± 2.13	FGH
Pyrifluquinazon (C)	1.6 fl oz	14,283.49 ± 1,729.98	DEF	55.93 ± 1.72	EFGH
Sefina DC	3.0 fl oz 1.92 fl oz	5,570.71 ± 968.47	ABC	60.95 ± 1.90	ABCD
Warrior II CS and Lorsban Advanced EC	16.0 fl oz 16.0 fl oz	2,372.33 ± 579.22	A	58.23 ± 1.58	DEFG
Stallion SC	11.75 fl oz	7,517.73 ± 2,815.22	ABCD	58.43 ± 1.98	DEFG
Cobalt Advanced EC	16.0 fl oz	3,975.81 ± 1,492.00	ABC	59.70 ± 1.24	BCD
Cruiser 5FS and Warrior II CS	0.0756 mg ai/seed 1.92 fl oz	8,141.55 ± 1,596.03	ABCD	63.13 ± 1.23	AB
CruiserMaxx Vibrance FS and Warrior II CS	0.0945 mg ai/seed 1.92 fl oz	3,984.38 ± 791.71	ABC	63.73 ± 0.34	A
Brigadier SC	5.1 fl oz	4,691.71 ± 1,214.30	ABC	59.43 ± 1.47	CDE
Endigo ZCX (A)	3.5 fl oz	3,587.27 ± 639.99	AB	60.75 ± 1.17	ABCD
Endigo ZCX (B)	4.5 fl oz	4,675.85 ± 808.21	ABC	60.98 ± 2.26	ABCD
Sefina DC and Priaxor CS	3.0 fl oz 4.0 fl oz	6,625.17 ± 1,654.79	ABCD	60.28 ± 1.18	ABCD

[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 ($P<0.0001$; $F = 5.19$; df = 26, 3).
[d]Yield ± SEM; yield in bushels/acre ± standard error of the mean.
[e]Least significant difference for mean separation of yield ($P<0.0001$; $F = 4.30$; df = 26, 3).