Soybean Aphid Efficacy Evaluation in Northwest Iowa

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Erin Hodgson, associate professor
Greg VanNostrand, research associate
Department of Entomology
Terry Tuttle, farm superintendent

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 30. In total, 30 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 at full pod set (Table 1). Foliar treatments were applied using a custom sprayer and TeeJet (Springfield, IL) flat fan nozzles (TJ 8002) with 15.5 gallons of water/acre at 40 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 24. 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

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 13 when plants were in the R5 growth stage. Soybean aphid populations averaged 25.6 ± 13.4 (± SEM; standard error of the mean) aphids/plant in the untreated control plots seven days prior to the August 13 application. Soybean aphid populations in the untreated control plots peaked August 25 at 123.3 ± 29.0 aphids/plant.

There were few significant differences in CAD among treatments ($P = 0.0002$; $F = 2.73$; $df = 29, 3$) (Table 1). The CAD for susceptible soybean treatments ranged from 185 to 2,690 with some significant differences among treatments. The untreated control, seed-applied treatments alone and the treatment containing Pyrifluquinazon SC (0.8 fl oz rate) had higher CAD compared with other treatments. However, all treatments were below a level that would translate to measurable yield losses from soybean aphid. Yield ranged from 72 to 81 bushels/acre with little significant difference among treatments ($P = 0.5277$; $F = 0.96$; $df = 29, 3$) (Table 1). We do not believe the differences in yield were due to soybean aphid seasonal exposure.

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, we are not recommending 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 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	-----	2,148.05 ± 597.86	GH	78.04 ± 1.57	ABCD
Lorsban Advanced EC	16.0 fl oz	205.30 ± 52.57	AB	75.99 ± 2.92	BCDE
Dimethoate 4E	16.0 fl oz	185.36 ± 37.91	A	71.87 ± 5.35	E
Warrior II CS	1.92 fl oz	579.31 ± 190.48	ABCDE	77.68 ± 1.96	ABCD
Mustang Maxx EC	2.8 fl oz	647.76 ± 249.79	ABCDE	75.18 ± 4.35	CDE
Tundra EC	3.2 fl oz	870.25 ± 382.84	ABCDEF	78.34 ± 1.17	ABCD
Tundra EC	4.8 fl oz	544.93 ± 298.25	ABCD	75.56 ± 1.69	BCDE
Cruiser 5FS	0.0756 mg	1,052.31 ± 348.29	BCDEF	78.29 ± 2.56	ABCD
CruiserMaxx Vibrance FS	0.0945 mg	1,563.37 ± 934.91	EF	76.94 ± 1.25	ABCDE
Transform WG	0.542 oz	261.43 ± 78.22	AB	74.91 ± 1.37	DE
Transform WG	0.8 oz	694.25 ± 252.29	ABCDE	78.26 ± 2.39	ABCD
Pyrifluquinazon SC	0.8 fl oz	2,690.45 ± 729.74	H	76.47 ± 2.06	ABCDE
Pyrifluquinazon SC	1.2 fl oz	1,233.87 ± 432.66	DEF	77.80 ± 1.31	ABCD
Pyrifluquinazon SC	1.6 fl oz	1,045.74 ± 396.72	ABCDEF	81.25 ± 1.34	A
Sefina DC	3.0 fl oz	1,436.88 ± 714.25	EFG	77.90 ± 1.56	ABCD
Carbine 50 WG	2.8 oz	627.53 ± 357.35	ABCDE	80.55 ± 1.58	AB
Warrior II CS +	1.92 fl oz	432.07 ± 294.61	ABCD	71.83 ± 3.81	E
Lorsban Advanced EC	16.0 fl oz				
Hero EC +	5.0 fl oz	331.97 ± 105.57	ABC	78.01 ± 1.76	ABCD
Dimethoate 4E	16.0 fl oz				
Cobalt Advanced EC	16.0 fl oz	282.58 ± 114.55	AB	75.34 ± 2.46	CDE
Cruiser 5FS +	0.0756 mg	405.44 ± 104.82	ABCD	78.08 ± 2.73	ABCD
Warrior II CS	1.92 fl oz				
CruiserMaxx Vibrance FS +	0.0945 mg	369.52 ± 46.94	ABC	80.15 ± 1.11	ABCD
Warrior II CS	1.92 fl oz				
Brigadier SC	6.1 fl oz	322.48 ± 97.50	ABC	76.05 ± 2.07	BCDE
Endigo ZCX	3.5 fl oz	1,421.68 ± 706.83	EFG	74.73 ± 3.99	DE
Endigo ZCX	4.5 fl oz	219.38 ± 53.89	AB	75.41 ± 3.36	BCDE
Argyle OD	4.0 fl oz	871.61 ± 367.59	ABCDEF	77.52 ± 2.36	ABCD
Argyle OD	6.0 fl oz	464.51 ± 151.40	ABCD	78.14 ± 1.79	ABCD
Leverage 360 SC	2.8 fl oz	1,149.34 ± 392.23	CDEF	77.65 ± 2.68	ABCD
Transform WG +	0.8 oz	807.58 ± 366.42	ABCDEF	75.19 ± 2.29	CDE
Tundra EC	4.8 fl oz				
Transform WG +	0.542 oz	276.67 ± 192.02	AB	78.43 ± 1.03	ABCD
Tundra EC	3.2 fl oz				
Transform WG +	0.4 oz	202.38 ± 110.11	AB	77.95 ± 3.16	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 ($P = 0.0002$; $F = 2.73$; df = 29, 3).

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

[e]Least significant difference for mean separation of yield ($P = 0.5277$; $F = 0.96$; df = 29, 3).