Soybean Aphid Efficacy Evaluation

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Erin Hodgson, associate professor
Greg VanNostrand, research associate
Department of Entomology
Kenneth Pecinovsky, farm superintendent

Soybean, *Glycine max* (L.), grown in Iowa and most of the north central region of the United States has not required regular insecticide usage. The 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 ISU Northeast Research Farm in Floyd County, Iowa. The treatments were arranged in a randomized complete block design with four replications, and soybean (Syngenta NK S25-E5 brand and Blue River Hybrid variety LD09-05484A) was planted May 24 in 30-in. rows using no-till production practices. Each plot was 6 rows wide and 50 ft long. We evaluated 31 treatments with products alone or in combination (Table 1). Treatments included foliar and seed-applied products and also host plant resistance (*Rag1* gene) for soybean aphid. 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. Soybean aphid populations were low at this location until late August 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 twinjet nozzles (TJ 11002) with 20 gallons of water/acre at 40 pounds of pressure/square in.

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 on October 11. 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 in bushels/acre. One way analysis of variance (ANOVA) was used to determine treatment effects within each experiment. Mean separation for CAD and yield treatments was achieved using a least significant difference test (alpha = 0.10).

Results and Discussion

In 2014, aphid populations were low until August. Plots were uniformly colonized by late July, and aphids eventually exceeded the economic threshold in August.

The untreated control had 305.0 ± 28.8 (± SEM; standard error of the mean) aphids/plant three days prior to the August 22 application, which also was the peak density for the season. Seeker (2.1 fl oz/acre rate) had the most CAD, but was not significantly different than the untreated control ($P < 0.5429$; $F = 0.95$; df = 26, 3) (Table 1). CruiserMaxx Vibrance improved aphid suppression but was not as effective as foliar insecticides. Most foliar insecticides were effective in reducing CAD, and there were some significant differences in CAD with the foliar insecticides on susceptible seed.

There also were some significant differences in yield among treatments, but many were not statistically different ($P < 0.0001$; $F = 6.44$; df = 26, 3). Overall, Cygon 4E (8.0 fl oz/acre rate) and Headline (12.0 fl oz/acre rate) had the highest yields. The lowest-yielding treatment was Pyrifluquinazon (1.6 fl oz/acre rate) (Table 1). The late-season accumulation of aphids may not have impacted yield, indicating a late-season application may not be cost effective.

Treatments with the *Rag1* gene performed well and were all below the economic injury level for CAD ($P < 0.8419$; $F = 0.43$; df = 3, 3) (Table 1). There were some significant yield differences for *Rag1*-containing treatments ($P < 0.0013$; $F = 10.38$; df = 3, 3), however we do not believe they were due to insect feeding (Table1). Using *Rag1* likely will suppress aphid populations and prevent economic injury in most areas of Iowa.

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.

We 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.

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Table 1. 2014 soybean aphid treatments, rates, and yields at Floyd County, IA.

Treatment	Rate[a]	CAD ± SEM[b]	CAD-LSD[c]	Yield ± SEM[d]	Yield-LSD[e]
Untreated Control	-----	1,266.26 ± 320.92	BCD	57.69 ± 1.90	EF
CruiserMaxx Vibrance FS	62.5 g	599.89 ± 76.92	ABC	58.74 ± 0.62	BCDEF
Warrior II CS	1.92 fl oz	372.60 ± 151.56	A	60.01 ± 2.53	ABCDE
Warrior II CS	1.6 fl oz	352.15 ± 188.10	A	58.72 ± 2.29	BCDEF
Lorsban Advanced EC	16.0 fl oz	459.51 ± 167.87	ABC	58.91 ± 1.10	ABCDEF
Warrior II CS + Lorsban Advanced EC	1.92 fl oz 16.0 fl oz	1,280.77 ± 1,068.47	CD	59.75 ± 2.21	ABCDE
Endigo ZCX SC	4.5 fl oz	345.91 ± 102.53	A	60.54 ± 0.55	ABCD
Quilt Xcel SE	14.0 fl oz	687.28 ± 103.59	ABCD	59.93 ± 2.28	ABCDE
Quindigo ZE	14.0 fl oz	192.64 ± 44.92	A	60.19 ± 1.80	ABCDE
Cygon 4E	8.0 fl oz	271.73 ± 58.57	A	61.49 ± 2.02	A
Cygon 4E	16.0 fl oz	399.83 ± 229.98	ABC	59.14 ± 2.69	ABCDEF
Asana XL EC	9.6 fl oz	387.59 ± 34.70	AB	60.90 ± 0.51	ABC
Asana XL EC + Aproach SC	9.6 fl oz 6.0 fl oz	297.60 ± 111.99	A	60.13 ± 2.42	ABCDE
Seeker SE	2.1 fl oz	1,496.00 ± 1,228.07	D	61.10 ± 2.30	AB
Seeker SE	2.6 fl oz	407.35 ± 151.51	ABC	60.21 ± 1.73	ABCDE
Transform 50WG	1.0 oz	364.29 ± 110.27	A	57.94 ± 1.82	DEF
DoubleTake SC	4.0 fl oz	850.38 ± 240.72	ABCD	58.48 ± 1.39	CDEF
Hero EC	5.0 fl oz	488.99 ± 229.93	ABC	58.02 ± 2.37	DEF
Pyrifluquinazon SC	0.8 fl oz	287.50 ± 62.18	A	58.59 ± 3.13	BCDEF
Pyrifluquinazon SC	1.6 fl oz	981.65 ± 787.90	ABCD	57.06 ± 0.75	F
Pyrifluquinazon SC	2.4 fl oz	561.47 ± 210.28	ABC	59.78 ± 2.02	ABCDE
Leverage 360 SC	2.8 fl oz	263.62 ± 65.34	A	59.58 ± 1.77	ABCDEF
Leverage 360 SC + Headline EC	2.8 fl oz 12.0 fl oz	481.22 ± 86.39	ABC	60.15 ± 1.31	ABCDE
Brigade 2EC	3.0 fl oz	949.79 ± 341.14	ABCD	59.51 ± 2.24	ABCDEF
Headline EC	12.0 fl oz	389.07 ± 139.77	AB	61.44 ± 0.87	A
Orthene 97 ST	1 lb	179.63 ± 27.84	A	59.12 ± 2.22	ABCDEF
Cobalt Advanced EC	26.0 fl oz	241.63 ± 68.95	A	60.45 ± 1.00	ABCD
Rag1	-----	83.63 ± 20.19	A	44.82 ± 2.23	B
Rag1 + Cruiser 5FS	----- 0.0756 g	132.67 ± 24.27	A	47.46 ± 3.86	AB
Rag1 and Cruiser 5FS + Warrior II CS	----- 0.0756 g 1.92 fl oz	51.11 ± 23.70	A	48.74 ± 3.38	A
Rag1 + Warrior II CS	------ 1.92 fl oz	99.58 ± 54.45	A	45.42 ± 2.89	AB

[a]Foliar product rates are given as formulated product/acre, and seed treatments are given as grams active ingredient/per 100 kg seed.
[b]Cumulative aphid days ± standard error of the mean.
[c]Least significant difference for mean separation of cumulative aphid days (susceptible seed: $P < 0.5429$; $F = 0.95$; df = 26, 3; and *Rag1* seed: $P < 0.8419$; $F = 0.43$; df = 3, 3).
[d]Yield ± SEM; yield in bushels/acre ± standard error of the mean.
[e]Least significant difference for mean separation of yield (susceptible seed: $P < 0.0001$; $F = 6.44$; df = 26, 3; and *Rag1* seed: $P < 0.0013$; $F = 10.38$; df = 3, 3).