Soybean Aphid Efficacy Evaluation in Northwest Iowa

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Erin Hodgson, associate professor
Greg VanNostrand, research associate
Department of Entomology
Josh Sievers, 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. The soybean aphid, Aphis glycines (Hemiptera: Aphididae), is the most important soybean insect 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 Northwest Research Farm in O'Brien County, Iowa. Treatments were arranged in a randomized complete block design with four replications, and soybean (Syngenta NK S25-E5 variety and Blue River Hybrid 28ARC5 variety) was planted in 30-in. rows on May 27. In total, 22 treatments were evaluated with products alone or in combination (Table 1). Treatments included foliar and seed-applied products and host plant resistance (*Rag2* gene) 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. 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 lb 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 (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 on October 14. 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 2015, aphid populations were low. We included several established insecticides and a few new products marketed for soybean aphid. We did not detect any thriving aphid populations after foliar application for any product.

Most foliar applications were made on August 24 when plants were in the R5 growth stage. A few foliar applications received a targeted application on July 21 when plants were in the R1 growth stage. Soybean aphid populations averaged 24.8 ± 5.6 (± SEM; standard error of the mean) aphids/plant in the untreated control plots four days prior to the August 24 application. Soybean aphid populations in the untreated control plots peaked on September 5 at 151.3 ± 73.0 aphids/plant.

There were few significant differences in CAD among treatments (Table 1). The untreated control had significantly more CAD than all other treatments and was significantly different than many foliar insecticides. The pyrifluquinazon application (6.4 fl oz/acre) had the highest yield of our treatments, but was not significantly different than many other treatments.

Treatments with the *Rag2* gene performed well and all were below the economic injury level for CAD. Although there were some significant differences among *Rag2*-containing treatments, aphid pressure was not enough to impact yield (Table1). Using *Rag2* 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 would 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. 2015 soybean aphid treatments and rates at O'Brien County, IA.

Treatment	Rate[a]	CAD ± SEM[b]	CAD-LSD[c]	Yield ± SEM[d]	Yield-LSD[e]
Susceptible soybean					
1. Untreated Control	-----	2,326.38 ± 508.32	E	66.55 ± 1.68	F
2. CruiserMaxx Vibrance 6.77FS	62.5g/100 kg	1,036.62 ± 314.62	ABC	67.19 ± 0.05	F
3. Warrior II 2.08CS	1.92 fl oz	1,086.98 ± 176.81	ABC	69.15 ± 1.90	CDEF
4. Warrior II 2.08CS	1.6 fl oz	936.01 ± 122.65	ABC	70.07 ± 1.44	BCDE
5. Warrior II 2.08CS[f]	1.6 fl oz	218.85 ± 41.39	A	70.44 ± 0.40	BCDE
6. Lorsban Advanced 3.76EC	16.0 fl oz	2,113.91 ± 1,375.14	DE	68.42 ± 0.68	EF
7. Warrior II 2.08CS +	1.92 fl oz	1,363.81 ± 510.77	BCDE	71.62 ± 0.60	ABCD
Lorsban Advanced 3.76EC	16.0 fl oz				
8. Cobalt Advanced 2.63EC	16.0 fl oz	657.35 ± 112.02	AB	70.74 ± 0.40	BCDE
9. Endigo ZC 2.06SC	3.5 fl oz	944.64 ± 174.92	ABC	72.21 ± 0.65	AB
10. Endigo ZC 2.06SC	4.0 fl oz	1,166.41 ± 90.34	ABC	72.58 ± 0.44	AB
11. Quindigo 3.15ZE	14.0 fl oz	1,045.80 ± 235.11	ABC	72.58 ± 0.80	AB
12. Transform 50WG[f]	0.75 oz	639.40 ± 61.90	AB	70.99 ± 0.77	BCDE
13. Transform 50WG[f]	1.0 oz	445.58 ± 101.58	AB	69.04 ± 2.80	DEF
14. Transform 50WG[f]	1.5 oz	422.45 ± 115.77	AB	71.52 ± 0.53	ABCD
15. Transform 50WG	0.75 oz	842.63 ± 346.27	AB	71.82 ± 1.13	ABC
16. Pyrifluquinazon SC	2.4 fl oz	1,038.89 ± 248.15	ABC	70.98 ± 0.90	BCDE
17. Pyrifluquinazon SC	3.2 fl oz	1,865.04 ± 319.16	CDE	72.52 ± 0.89	AB
18. Pyrifluquinazon SC	6.4 fl oz	838.52 ± 133.25	AB	74.13 ± 1.02	A
Host plant resistant soybean					
1. *Rag2*	-------	716.40 ± 213.51	a	69.02 ± 1.05	a
2. *Rag2* +	-------	321.09 ± 74.44	b	67.26 ± 1.48	a
CruiserMaxx Vibrance 6.77FS	62.5 g				
3. *Rag2* +	-------	213.96 ± 51.45	b	68.09 ± 0.31	a
CruiserMaxx Vibrance 6.77FS +	62.5 g				
Warrior II 2.08CS	1.92 fl oz				
4. *Rag2* +	-------	411.34 ± 91.75	b	69.01 ± 1.07	a
Warrior II 2.08CS	1.92 fl oz				

[a]Foliar product rates are given as formulated product/acre, and seed treatments are given as grams active ingredient/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: $P < 0.0832$; $F = 1.62$; df = 17, 3; and *Rag2* seed: $P < 0.0551$; $F = 3.25$; df = 3, 3). Means within a column followed by the same letter do not differ ($P \leq 0.05$). Capital letters refer to differences in product treatments, lower case letters refer to differences in plant resistance treatments.

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

[e]Least significant difference for mean separation of yield (susceptible seed: $P < 0.0017$; $F = 2.78$; df = 17, 3; and *Rag2* seed: $P < 0.5360$; $F = 0.90$; df = 3, 3). Means within a column followed by the same letter do not differ ($P \leq 0.05$). Capital letters refer to differences in product treatments, lower case letters refer to differences in plant resistance treatments.

[f]Applied on July 15 when plants were at R1.