Soybean Aphid Efficacy Evaluation

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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. 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 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 S25-E5 brand and Blue River Hybrid variety 28ARC5) was planted in 30-in. rows May 27. In total, we evaluated 22 treatments with products alone or in combination (Table 1). Treatments included foliar and seed-applied products and also 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 per 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 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 2016, 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 August 9 when plants were in the R5 growth stage. Soybean aphid populations averaged 282.4 ± 92.4 (± SEM; standard error of the mean) aphids/plant in the untreated control plots one day prior to the August 9 application. Soybean aphid populations in the untreated control plots peaked August 30 at 705.3 ± 172.0 aphids/plant.

There were few significant differences in CAD among treatments ($P < 0.0001$; $F = 6.29$; $df = 11, 3$) (Table 1). The CAD for susceptible soybean treatments ranged from 3,513 to 16,221, and there were some significant differences among treatments. The untreated control and treatments with just pesticidal seed treatments had significantly more CAD compared with all other treatments. Yield ranged from 70-92 bushels/acre with some significant differences among treatments ($P < 0.0001$; $F = 14.07$; $df = 11, 3$) (Table 1). We believe some of 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.

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. 2016 soybean aphid treatments and rates at ISU Northwest Research Farm.

Treatment	Rate[a]	CAD ± SEM[b]	CAD-LSD[c]	Yield ± SEM[d]	Yield-LSD[e]
Untreated Control	-----	15,107.80 ± 3,341.58	C	70.28 ± 1.21	F
Cruiser 5FS	79.95g	12,692.86 ± 4,075.01	C	78.30 ± 1.51	E
Cruiser 5FS + Warrior II 2.08CS	79.95g 1.6 fl oz	3,866.14 ± 916.06	AB	84.54 ± 1.19	D
Clariva Complete 6.77FS	203.45g	16,220.64 ± 3,423.83	C	71.32 ± 2.16	F
Clariva Complete 6.77FS + Warrior II 2.08CS	203.45g 1.6 fl oz	4,776.24 ± 430.37	AB	87.24 ± 2.20	BCD
Warrior II 2.08CS	1.92 fl oz	4,264.30 ± 796.25	AB	89.11 ± 1.44	ABC
Lorsban Advanced 3.76EC	16.0 fl oz	3,838.70 ± 592.00	AB	87.32 ± 1.99	BCD
Warrior II 2.08CS + Lorsban Advanced 3.76EC	1.92 fl oz 16.0 fl oz	3,566.03 ± 999.91	AB	92.40 ± 1.71	A
Hero 1.24EC	5.0 fl oz	7,903.52 ± 2,225.09	B	85.22 ± 1.43	CD
Hero 1.24EC + Dimethoate 4E	5.0 fl oz 16.0 fl oz	4,756.72 ± 750.78	AB	86.26 ± 2.22	BCD
Brigadier 2SC	6.1 fl oz	4,072.56 ± 856.11	AB	89.74 ± 2.69	AB
Carbine 50WG	2.8 oz	3,512.73 ± 497.21	A	89.00 ± 2.55	ABC

[a]Foliar product rates are given as formulated product/acre, and seed treatments are given as grams active ingredient/100kg seed.
[b]Cumulative aphid days ± standard error of the mean.
[c]Least significant difference for mean separation of cumulative aphid days ($P<0.0001$; $F = 6.29$; $df = 11, 3$). Means followed by the same letter do not differ.
[d]Yield ± SEM; yield in bushels/acre ± standard error of the mean.
[e]Least significant difference for mean separation of yield ($P < 0.0001$; $F = 14.07$; $df = 11, 3$). Means followed by the same letter do not differ.