Soybean Aphid Efficacy Evaluation in Northeast 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. 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 aphid has been a persistent pest that can colonize fields from June through September. Its 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 variety and Blue River Hybrid 28ARC5 variety) was planted in 30-in. rows using no-till production practices on May 11. Each plot was six rows wide and 50 ft long. In total, 25 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. 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 (Springfield, IL) twinjet nozzles (TJ 11002) with 20 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 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 5. 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 2015, aphid populations were low until August. Plots were uniformly colonized by late July, however there was not enough

seasonal accumulation of aphids to exceed the economic injury level and therefore cause yield loss.

Most foliar applications were made on August 19 when plants were in the R5 growth stage. A few foliar applications received a targeted application on July 15 when plants were in the R1 growth stage. The untreated control had 5.2 ± 1.3 (± SEM; standard error of the mean) aphids/plant seven days prior to the August 19 application and peaked on August 26 at 32.1 ± 7.9 aphids/plant. Our two Agrimek treatments had the most CAD and were significantly different than the untreated control (Table 1). Many 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. Overall, Transform WG (1.0 fl oz/acre rate) had the highest yields. The lowest-yielding treatment was Warrior II (1.92 fl oz/acre rate) (Table 1). The late-season accumulation of aphids did not impact yield, indicating a late-season application may not be cost effective.

Treatments with the *Rag2* gene performed well and all were below the economic injury level for CAD (Table 1). There were some significant yield differences for *Rag2*-containing treatments, however we do not believe these were due to insect feeding (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 Floyd County, IA

Treatment	Rate[a]	CAD ± SEM[b]	CAD-LSD[c]	Yield ± SEM[d]	Yield-LSD[e]
Susceptible soybean					
1. Untreated Control	-----	723.38 ± 106.69	CDEF	66.77 ± 0.70	ABC
2. CruiserMaxx Vibrance 6.77FS	62.5g	887.93 ± 186.84	EFG	66.35 ± 0.66	ABC
3. Warrior II 2.08CS	1.92 fl oz	714.73 ± 218.30	CDEF	63.19 ± 1.24	D
4. Warrior II 2.08CS	1.6 fl oz	551.16 ± 109.78	BCD	64.48 ± 1.54	CD
5. Warrior II 2.08CS[f]	1.6 fl oz	885.91 ± 212.67	EFG	66.79 ± 0.82	ABC
6. Lorsban Advanced 3.76EC	16.0 fl oz	151.27 ± 27.84	A	66.06 ± 0.77	ABC
7. Warrior II 2.08CS + Lorsban Advanced 3.76EC	1.92 fl oz 16.0 fl oz	170.52 ± 18.54	A	66.10 ± 0.85	ABC
8. Cobalt Advanced 2.63EC	16.0 fl oz	284.63 ± 45.41	AB	66.80 ± 1.75	ABC
9. Endigo ZC 2.06SC	3.5 fl oz	311.21 ± 152.85	AB	67.41 ± 1.66	AB
10. Endigo ZC 2.06SC	4.0 fl oz	248.46 ± 52.82	AB	65.04 ± 1.35	BCD
11. Quindigo 3.15ZE	14.0 fl oz	185.98 ± 38.40	A	66.91 ± 1.86	ABC
12. Hero 1.24EC	5.0 fl oz	634.74 ± 106.67	CDE	65.47 ± 1.57	ABCD
13. Brigade 2EC	3.0 fl oz	292.98 ± 53.63	AB	64.92 ± 1.41	BCD
14. Agri-Mek 0.7SC	2.5 fl oz	1,176.14 ± 324.93	GH	65.73 ± 1.31	ABCD
15. Agri-Mek 0.7SC	3.5 fl oz	1,301.30 ± 174.23	H	64.90 ± 2.40	BCD
16. Cygon 4E	8.0 fl oz	223.95 ± 32.28	A	64.94 ± 1.67	BCD
17. Cygon 4E	16.0 fl oz	189.70 ± 49.14	A	66.39 ± 1.83	ABC
18. Transform 50WG[f]	0.75 oz	861.99 ± 243.49	DEFG	67.85 ± 0.96	A
19. Transform 50WG[f]	1.0 oz	852.67 ± 189.28	DEF	67.65 ± 0.36	AB
20. Transform 50WG[f]	1.5 oz	999.23 ± 217.79	FGH	65.15 ± 0.69	ABCD
21. Transform 50WG	0.75 oz	409.70 ± 115.16	ABC	65.72 ± 1.87	ABCD
Host plant resistant soybean					
1. *Rag2*	-----	284.71 ± 45.81	a	59.62 ± 1.27	ab
2. *Rag2* + CruiserMaxx Vibrance 6.77FS	----- 62.5g	292.13 ± 118.60	a	57.26 ± 1.14	b
3. *Rag2* and CruiserMaxx Vibrance 6.77FS Warrior II 2.08CS	----- 62.5g 1.92 fl oz	180.22 ± 74.25	a	59.53 ± 1.47	ab
4. *Rag2* + Warrior II 2.08CS	------ 1.92 fl oz	268.06 ± 79.14	a	60.35 ± 1.58	a

[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: $P < 0.0001$; $F = 7.31$; df = 20, 3; and *Rag2* 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: $P < 0.0201$; $F = 4.64$; df = 3, 3; and *Rag2* seed: $P < 0.1073$; $F = 2.47$; df = 3, 3).
[f]Applied on July 15 when plants were at R1.