2008 Insecticide Trials for Aphid Control

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Introduction

Soybean grown in Iowa has historically used low amounts of insecticide. However, an invasive insect pest has threatened soybean production in Iowa, with the arrival of the soybean aphid (*Aphis glycines* Matsumura). The soybean aphid causes yield losses from direct plant feeding, and has been shown to transmit several plant viruses. In Iowa, soybean aphids colonize soybean fields beginning in June and have produced outbreaks in July and August capable of reducing yields by nearly 25 percent. We know that the presence of the aphid is not enough to warrant the application of an insecticide; populations above 600 aphids/plant are needed to produce measurable yield losses. We have developed a recommendation that incorporates an economic threshold of 250 aphids/plant. However, we continue to be asked, "What products offer the most consistent control of soybean aphids?"

Materials and Methods

To answer this question, we have evaluated the ability of various insecticides to manage soybean aphids for the past five years at the Iowa State University Northeast Research Farm in Floyd County. During 2008 we had a late soybean aphid outbreak in which we evaluated 33 insecticides alone or in combination. We will present data for insecticides that are labeled for aphid control in Iowa soybeans (Table 1). We compare the ability of these insecticides to reduce aphid populations and protect yield by comparing with soybeans either left untreated or kept aphid free. These additional treatments control the impact of aphids on soybean growth. Our first control consisted of soybean grown without any insecticide. We refer to this as an untreated control. The second set of control plots was treated multiple times to prevent an aphid population from establishing. This is referred to as the 'aphid free' control. This was accomplished with a foliar insecticide that consisted of a combination of an organophosphate and a pyrethroid. We selected this combination as it can prevent spider mite outbreaks that can occur when pyrethroids are used alone. By comparing the untreated control to the aphid free control we can estimate the yield loss that occurred due to the soybean aphid. When aphid populations reach the economic threshold we can test the lower level to that of the 250 aphids/plant threshold to protect soybean yield.

We evaluated the performance of each insecticide within a randomized complete block design experiment with each product replicated six times (Table 1). Soybeans (NK 21-N6) were planted on May 19 using no-till production practices. Aphid populations averaged six aphids/plant 3 days prior to the application of the foliar insecticides on August 1. Following the application of the foliar insecticides, soybean aphid populations were assessed every 2 to 7 days for 21 days following insecticide application. At harvest, yields were recorded and corrected to 13 percent moisture. Soybean aphids were counted weekly (last week of May through the second week of September) on consecutive plants within each plot. The number of consecutive plants ranged from 5 to 20, with the number of plants counted determined by the proportion infested with aphids during the previous sampling date. When 0 to 80 percent of plants were infested with soybean aphid, soybean aphid on 20 plants were counted. When 81 to 99 percent of plants were infested, soybean aphid on 10 plants were counted. At

100 percent infestation, soybean aphid on five plants were counted. Plants were randomly selected from the center four rows within each plot. Seasonal exposure of soybean to aphids is reported based on the accumulation of 'aphid days.' Aphid days were calculated based on the number of aphids/plant counted between two sampling dates. We used analysis of variance (ANOVA) test to determine if the exposure of plants to aphids and yield differed among the various treatments.

Results and Discussion

During the 2008 growing season, aphid populations peaked on August 22 at 541 aphids/plant at the research farm. In general, all the insecticides applied reduced the exposure of plants to aphids compared with the untreated control, with the greatest reduction observed when a foliar insecticide was used. Note that the aphid free control did not reduce the exposure any more than a single foliar application of any of the products tested. This lack of a significant difference occurred despite applying insecticides on three different occasions. We observed the lowest yields when soybeans were left untreated (Figure 1). The foliar applied insecticides tested provided similar levels of soybean aphid control and yield protection. Overall, a single application of a foliar insecticide provided as much yield protection as four applications applied from June through August. The seed treatments we tested provided a lower level of aphid control and lower yields compared with foliar applied insecticides (Figure 1).

Although 2008 soybean aphid populations arrived late in the summer and did not reach economic thresholds until soybeans were in late reproductive growth stages, the trends observed are consistent with our past results. Again we observed little difference in performance among most of the foliar insecticides. The efficacy of the organophosphate (Dimethoate and Lorsban) and pyrethroid (Baythroid and Warrior) insecticides was indistinguishable from each other. Combining pyrethroid and organophosphate insecticides did not improve aphid control or soybean yield compared with either class of insecticide applied alone. This was true even for a pre-mixed product like Cobalt. However, when compared with the control treatment these tank mixes provided a small increase in yield when compared with the untreated control. The year 2008 represents the first year foliar nicotinoids were available in Iowa, and these products performed well either alone (Centric) or in combination with a pyrethroid (Leverage and Endigo) providing yield protection. The most important issue for effective soybean aphid management is the timing of a foliar-applied insecticide (250 aphids/plant) and not the product selected. This is truly remarkable given the comparison to the aphid-free control, which would represent an economic threshold (ET) of 10 aphids/plant.

Aphid populations exceeded the ET (250 aphids/plant) in the R6 stage, which exceeds the growth stage range at which the ET is applicable (R1-R5). The limited data set suggests that soybeans can tolerate a greater aphid population than the economic injury level (EIL) when the plant is in the later growth stages (R6 and on). Our data from 2008 suggest that yield loss did not occur when aphids exceeded the ET in the R6 stage. Note that the aphid population did not reach the EIL (654 aphids/plant). A better test would be when late-season aphid populations exceeded the EIL. That did not occur at this location. However, this small study suggests that our ET should be increased as the soybean plant matures past the R5 stage.

Compared to the foliar insecticides, the seed-applied insecticides did not provide as great a level of protection. Although we did observe some evidence of control between the untreated soybeans and the seed-treated soybeans, the variability among these treatments was great. Soybean aphid control

from seed applied insecticides is not sufficient to protect plants from aphid outbreaks that occur in July or August, especially for soybeans planted in May. McCornack and Ragsdale (2006) showed that seed-applied insecticides are effective on soybean aphid, however this efficacy only lasts for the first month after planting.

Our recommendation for soybean aphid management continues to be to scout your fields and to apply foliar insecticides when populations exceed 250 aphids/plant on 80 percent or more of the crop. This recommendation is most appropriate for soybeans in the R1 to R5 stage. As the plant passes the R5 stage, growers should consider increasing the ET they use. However, we still do not know to what extent yield losses occur when aphid populations exceed the EIL (654 aphids/plant) on soybeans past the R5 stage. We are not recommending seed-applied insecticides (seed treatments) for aphid management, and we are not recommending one insecticide over another. Over the five years we have been assessing insecticide efficacy Warrior, Baythroid, and Lorsban have performed equally well and the seed treatments have not prevented the need for a foliar insecticide in high aphid years. Multiple insecticide treatments have not protected yields compared with a single foliar insecticide application at 250 aphids/plant.

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Table 1. Insecticides and rates of the 2008 soybean aphid efficacy trials.

Product trade name	Rate[1]	Active ingredient	Timing of application[2]
Untreated control	---	---	---
Aphid free control[3]	1.9 oz	λ-cyhalothrin	
	4 oz	chlorpyrifos	10
250 aphids/plant[4]	1.9 oz	λ-cyhalothrin	250
Cruiser	50 g	thiamethoxam	Seed applied
Gaucho	62.5 g	imidacloprid	Seed applied
Baythroid XL	2.8 oz	β-cyfluthrin	Aug 1
Warrior II	1.9 oz	λ-cyhalothrin	Aug 1
Mustang Max	4 oz	ζ-cypermethrin	Aug 1
Hero	8 oz	ζ-cypermethrin + bifenthrin	Aug 1
Lorsban 4E	16 oz	chlorpyrifos	Aug 1
NuFos	16 oz	clorpyrifos	Aug 1
Dimethoate	16oz	dimethoate	Aug 1
Cobalt	13 oz	γ-cyhalothrin + chlorpyrifos	Aug 1
Baythroid XL +	2 oz +		
Lorsban 4E	8 oz	β-cyfluthrin + chlopyrifos	Aug 1
Centric	13 oz	thiamethoxam	Aug 1
Leverage	3.8 oz	β-cyfluthrin + imidacloprid	Aug 1
Endigo	2.8 oz	λ-cyhalothrin + thiamethoxam	Aug 1

[1]Rate is formulated product per acre for foliar products and as grams active ingredient per 100 kilograms of seed.
[2]Seed applied insecticides (SA) were applied to seeds prior to planting and foliar insecticides were applied when the average aphid/plant reached pre-determine levels represented by the number in this column.
[3]The aphid free control was treated with insecticides three times (July 22, August 1, and August 22). All other foliar treatments were applied once (August 1). [4]Applied August 22.