Three Years of Soybean Aphid Activity in Northeast Iowa

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THREE YEARS OF SOYBEAN APHID ACTIVITY IN NORTHEAST IOWA

Brian J. Lang
Extension Crop Specialist
Iowa State University

Introduction

The first significant occurrence of Soybean Aphid activity in northeast Iowa was in 2001. Significant populations of aphids, in some cases exceeding 10,000 aphids per plant, were found across approximately 200,000 acres of soybeans in northeast Iowa. For those that treated for the pest, the typical yield response to foliar insecticide applications was about 10 bushel per acre. Net return to treatment averaged $35 per acre for an approximate recovery of $5 million of income from the potential $10 million of damage being caused by the pest. Not everyone treated for the pest because the potential damage from soybean aphid was largely unknown.

In 2002, soybean aphids once again appeared in northeast Iowa. Populations did not appear to approach levels where insecticide treatments would be recommended. However, the general presence of soybean aphid was noted across the entire state, not just northeast Iowa.

In 2003, seasonal activity of soybean aphid mirrored 2001, except significant populations were found across all of northeast Iowa and most of the rest of the state. However, aphid populations in northeast Iowa were about one-third of those in 2001.

For the last three years ISU Extension has conducted soybean aphid research in northeast Iowa. While current research is still far short of what is necessary to provide sound recommendations for management of this pest, the intent of this paper is to share the last three years of research from northeast Iowa and discuss patterns of seasonal aphid activity, occurrence of winged aphids, and the effectiveness of foliar insecticides and seed treatments on this pest. Combining this information with practical field experience, hopefully we can begin to develop reasonable control strategies for soybean aphid management.

The 2001 Experience

In early June of 2001, random scouting of soybean fields for soybean aphid was initiated in northeast Iowa. Aphids were immediately found in the Decorah area on V-2 stage soybeans. From this point on, aphids were monitored on a weekly basis in certain fields. One location was the John Rodecap farm just south of Decorah.

By July 11, increasing aphid populations appeared to have potential to harm the crop. On July 12, John Rodecap and ISU Extension established strip plots in two fields and applied three different foliar insecticides (Dimethoate, Pounce, and Warrior). About 90% control of aphids was observed on July 15 by all products. By July 20, obvious differences in crop health were observed among the treated and untreated strips. From July 20 through July 27 emergency field events were held for farmers and agri-businesses to recommend treating for this pest ASAP. At the time it was unknown what the response to treatment would be. No one had information on economic thresholds and potential damage for this pest in the United States. However, the season end result of this effort was described in the introduction.
On July 26, another treatment was added to the strip plot research. Treatments now included a single foliar insecticide application on July 12, a single application on July 26, and a 2-time application on July 12 and July 26. The aphid populations in the treated strips on July 12 appeared to be rebounding, which was the reason for splitting the strips with a second application on July 26. Weekly monitoring continued through late August when populations suddenly dropped to nearly zero. The strips were harvested on October 7.

Figure 1 provides seasonal trends of the soybean aphid and the average response to the three insecticide applications. The aphid scale used was adapted from aphid research in the Philippines, and was described by Dr. Larry Pedigo, ISU Entomologist, in the 2000 Integrated Crop Management Conference, Ames. The aphid activity followed a somewhat similar pattern to that describe in the information from China (Figure 2), demonstrating two peaks in aphid activity over the season. Table 1 includes yield results and estimated economic returns to treatments.

The 2002 Experience... Where's the Population Explosion?

This year's research plots were established for both conventional and organic soybean production. All three sites were within 7 miles of Decorah. John Rodecap continued to provide support for the project in his farm. The organic program was conducted with farmers Wayne Wangsness and Paul Hunter, both from Decorah.
Phenology of *Aphis glycines* on Soybean in China

![Phenology Diagram](image)

**Figure 2. Seasonal cycle of the soybean aphid in China.**

**Table 1. Soybean Aphid Plot Results, John Rodecap Farm, 2001.**

<table>
<thead>
<tr>
<th>Insecticide</th>
<th>Yield Date of insecticide application</th>
<th>Net profit to treatments Date of insecticide application</th>
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<td>Dimethoate</td>
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<td>41</td>
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<td>41</td>
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<tr>
<td>Check</td>
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</table>

Assumptions: Soybean value = $5.00/bu. Insecticide application charge = $5.00/acre. Dimethoate and Pounce = $5.00/acre. Warrior = $10.00/acre.

Very little aphid activity occurred in 2002. Figure 3 shows the season aphid activity from all three sites. Aphid populations peaked at about 700 per plant compared to about 10,000 per plant in 2001. Because of low aphid activity, no yield response was observed for any of the treatments. These treatments included:

**Conventional soybeans:** soybean seed treatments (Gaucho, Poncho, and Clothianidin), foliar insecticides (Baythroid, Pounce, and Warrior), combinations of seed treatments and foliar applications, and different timings of applications of foliar insecticides.

**Organic soybeans:** Surround (a clay-base material to coat the leaves), Insecto (a diatomaceous earth product), Garlic + Fish oil surfactant, and Neemix (a compound with natural insecticidal properties extracted from a tree). The main goal with the organic products was to compare their ability to deter the pest from soybean. High aphid mortality was not expected.
Results of the conventional soybean study are provided in Figure 4. With the minimal aphid pressure, the main reason to show these results is to observe patterns of activity.

**Figure 3. Seasonal Soybean Aphid Populations at 3 Sites near Decorah, 2002**

**Figure 4. Effects of Seed Treatments and/or Foliar Insecticide Applications on Soybean Aphid, John Rodecap Farm, Decorah 2002**
These observations also included documenting winged aphid activity. As low as populations of aphids were, their overall activity and peak winged aphid activity occurred similar times during the season for all studies in 2002 and 2001 (Figure 5). Over-population was not required to stimulate winged-aphid activity; however, over-population may stimulate that response as well.

![Figure 5. Soybean Aphid Population Trends at 5 Sites Near Decorah, 2001-2002](image)

Results of the organic studies are shown in Figures 6 and 7. Products were applied at first sign of aphid presence and repeated every ten to fourteen days. Neemix appeared to have the only significant impact on soybean aphid, although still without a significant affect on soybean yield.

![Figure 6. Effect of Certified Organic Products on Soybean Aphids Paul Hunter Study, 2002](image)
The other intriguing pattern of aphid activity in 2002, which was similar to that in 2001, is the two-peak pattern of seasonal aphid populations. Even with the very low populations of 2002, the pattern of aphid activity was similar to that of 2001 at the Rodecap and Hunter farms. Initial occurrence of aphids at the Rodecap in 2002 (June 20) was about ten days later than in 2001 (June 10). Aphids appeared at week later (June 26) at the Hunter farm and another week later (July 2) at the Wangsness farm. Where the initial aphid presence did not show up until July (the Wangsness farm), only one peak in aphid activity followed. This concurs with aphid seasonal patterns south and west of the northeast Iowa area.

### The 2003 Experience... They’re Back!

In 2003, the initial appearance of soybean aphid (June 5) near Decorah was a little earlier than for the last two years. Studies were again established at the John Rodecap farm, and two sites on the Wayne Wangsness farm. The overall comparison of aphid activity and peak winged aphid occurrence for the seven studies over the last three years is illustrated in Figure 8. Once again, peaks in general aphid activity and winged aphid activity were similar for all seven sites over the three years. The aphid activity for just the 2003 studies is shown in Figure 9.

On the John Rodecap farm, treatments included seed treatments (Crusier, Gaucho, and Poncho), and foliar insecticide treatments (Baythroid and Warrior). Do to a rather wet spring; the soybeans were not planted until May 13, about two weeks later than for the previous two years.

Aphid populations mirrored the 2001 season except that they leveled off at about one-third the level (~3,000 aphids per plant). Ironically, initial foliar insecticide applications were applied on the same calendar date as in 2001. A second application was not applied because the aphids did not rebound as much in population following insecticide application as they did in 2001.
The seed treatments offered good control of aphids up to about mid-July (Figure 10), i.e. about eight weeks of control. For a field infested as early as this one was, that could offer a significant opportunity for control of this pest. For fields that are not initially infested until July, the benefit of a seed treatment may be questionable. However, for a field not planted until mid-June, a seed treatment may offer season-long control (i.e. control to mid-August).
Net return to treatments (Figure 11) showed little benefit. The lack of a significant yield response was a little surprising since many nearby farm demonstrations with treated and untreated foliar insecticide strips applied to similar aphid levels averaged eight bushel per acre benefit to treatment. Differences of this study to others might be do to a number of factors including varietal tolerance to aphids, plant health (soil moisture, fertility, disease, etc.), stage of maturity relative to treatments and aphid levels, or others.
Results of the organic studies for 2003 are shown in Figures 12 and 13. Products were applied at the first sign of aphid presence and repeated every ten to fourteen days through early August. Neemix appeared to have the only consistent impact on soybean aphid, and at one site also had a small yield response. But the cost of treatment greatly exceeded the benefit of a yield response.

Figure 12. Effects of Certified Organic Products on Soybean Aphids, Calmar 2003

Figure 13. Effects of Certified Organic Products on Soybean Aphids, Ossian 2003
So What Have We Learned?

In northeast Iowa, soybeans infested with soybean aphid in early to mid-June will probably exhibit peak activity in late July and again in early to mid-August. Fields initially infested later, such as in early July, will probably only exhibit one peak in activity in early to mid-August. However, predicting the level of activity does not appear to be possible at this time.

As of yet, environmental predictors of “high” level infestations are not clear. Comparisons of temperature and rainfall patterns for the three years of studies near Decorah do not provide solid clues as to why aphid levels in 2001, 2002, and 2003 were very high, very low, and intermediate, respectively. Figure 14 is seasonal precipitation data for the three years. All three seasons had below average rainfall. Current speculation suggests that higher rainfall may inhibit aphid activity; however, we had few aphids in 2002 with below normal rainfall.

Figure 14. Seasonal Accumulated Rainfall in the Decorah Area.

Maybe temperature is a key. Literature about soybean aphid suggests that they prefer cooler than normal summer conditions. Not knowing what the degree day base temperature for soybean aphids might be, we compared base 41 degree F starting January 1 for the last three years. Figure 15 shows degree day accumulations from January 1 over the summer period. Ironically, the worst season with soybean aphids (2001) was also the warmest, and the 2002 season was the coolest of the three years.

We also compared the initial dates for the last three years for when we reached 1,000 degree days in the Decorah area. These dates come pretty close to initial occurrences of soybean aphid in the area, and would suggest that over-wintering of the aphids is occurring nearby. Yet we cannot find any evidence of over-wintering activity, i.e. finding any eggs over-wintering on Buckthorn. Where aphids do not over-winter, seasonal migration becomes an important issue. Much of the
Aphid activity and patterns of activity south and west of Decorah appeared to occur about two to three weeks later than for that around Decorah. The first peak of winged aphid activity around Decorah in mid-July may represent a significant component of aphid dispersal and infestation to other parts of the state... as would any other area of the country with early season infestation of this pest. I am not trying to draw solid conclusions here. I just want to compare patterns of activities, environment, etc. to provide some base information for discussion.

Figure 15. Degree Days (base 41 °F), from January, Decorah Area.

Next, what should the economic threshold be? Over the last three years, we have seen positive economical responses with foliar insecticide treatments to soybeans with as few as 200 aphids per plant (with expectations of an increasing population), and no economical response with as many as 3,000 aphids per plant. In addition, the benefit of developing an economical threshold is to target treatment of a potential problem before the population reaches its maximum level. Yet we have no way of knowing if 200 or more aphids per plant earlier in the season will develop into high populations later in the season. Data in Figures 3, 9, and 16 help illustrate this dilemma. Table 2 is a summary of the data points in Figure 16 that help illustrate the large variation that can exist in aphids per plant and subsequent range in yield response to treatment.

What about no-till, row width, population density, etc? These are more questions that currently lack adequate research. This year in Howard County ISU Extension with the Riceville FFA established a study with varied plant populations and row widths. Table 3 summarizes the results of this study. The best overall treatment was to use a final stand of 150,000 plants per acre and to treat for the aphids. The last column of the table shows the benefit of treating for aphids under each treatment of plant population and row width. The results are similar to a study conducted by the University of Wisconsin in which the lower population stand (100,000 plants per acre) showed less return to treatment then for the higher population stands. It supports the importance of establishing a full, healthy stand to help tolerate this pest.
Figure 16. Soybean yield response to soybean aphid control. Data points are for northern Iowa with circled points from NE Iowa.

![Graph showing soybean yield response to soybean aphid control.](image)

\[
y = -0.3092x + 12.878 \\
R^2 = 0.135
\]

Table 2. Soybean yield response to soybean aphid control. 32 strip trials across northern Iowa.

Prepared by Todd Vagts, ISU Extension Crop Specialist.

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<th>County</th>
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<th>Non-Treated</th>
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<th>Insecticide</th>
<th>Application Method found</th>
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Average 42.7 32.9 9.8 08/11/03 06/04/03 2750
Finally, what products should be used to control the pest? Once again, more studies are required to provide accurate information about which insecticide products are most effective. Also, at what rate of insecticide, method of application, nozzle type, spray pressure, etc. should be used? Most mainstream insecticides appear to be effective. Currently, my personal observations lean towards favoring Lorsban and Warrior as top choices, not that other products can’t do as well, but these two products have shown very good consistency. Lorsban seems to provide the best initial kill of aphids, and Warrior seems to provide longer residual control. The key words being “seems to.” We need more research!

Spray technique is also guess-work at this time. However, lacking research, if I lean again on personal experience, I would prefer twin flat fan nozzles at maximum allowable pressure for the nozzle selection, and applied with at least 20 gallons per acre water carrier.

We still have an incredible knowledge gap with this pest. Keep an open mind, try some strip trials on your own, and share your experiences. Most “new” insect pest problems require at least 10 years of research before reliable repeatable recommendations can be made. This was year 3 for most of us. The limited public funds at this time for research is slowing progress, but with cooperation of on-farm trials, maybe we can speed up this timeline. Most of the information provided in this paper would not have been possible without on-farm cooperation from John Rodecap, Wayne Wangsness, Paul Hunter, and the Riceville FFA. Their efforts are greatly appreciated... as is help from the Bayer Corporation for supplying treated soybean seed and helping with planting and harvest on the Rodecap farm.

**Reporting Strip Trial Data**

ISU Extension is still very interested in receiving any 2003 strip trial data on soybean aphid. If you have such information, please submit it to the following site for state-wide tabulation: [http://www.extension.iastate.edu/carroll/crops/aphid_treatment_form.htm](http://www.extension.iastate.edu/carroll/crops/aphid_treatment_form.htm)