North Dakota Soybean Council
Technical Report – June 2022

Title: Best Pest Management of Pyrethroid Resistant Soybean Aphids and Soybean Gall Midge Survey

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Objectives:

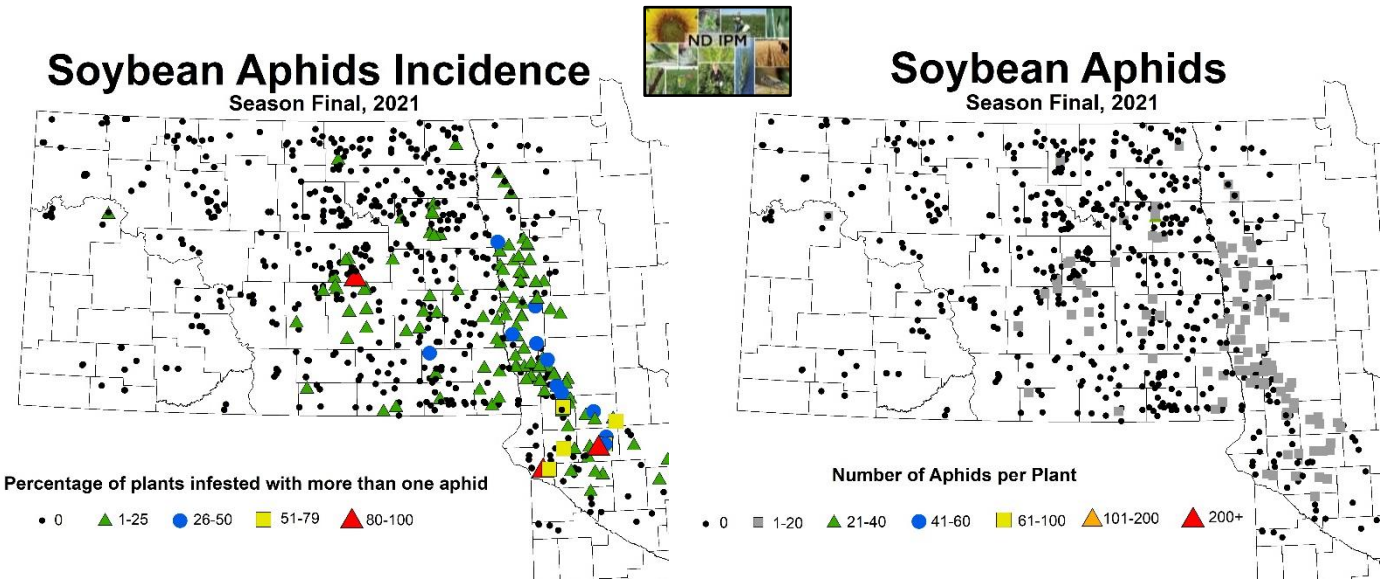
1) To determine which insecticides and mode of actions are the best tools for management of pyrethroid resistant soybean aphids.
2) To conduct survey work for the detection of the invasive soybean gall midge.
3) To develop extension outreach material on soybean insect pests for NSDC and growers.

Results

Objective One: Soybean aphid insecticide work

In the 2021 IPM Crop Survey, scouts observed zero soybean aphids in 91% of the soybean fields surveyed. The percent of plants infested with soybean aphids was low with an average of 11% of plants infested and the average number of aphids per plant was only 2 aphids per plant. Most of the positive fields were located near the Red River Valley of North Dakota. Soybean aphids never reached the economic threshold (E.T.) level in any of the soybean fields surveyed.

Since soybean aphid were not present at economic population levels in 2021, we used our soybean insecticide plots to conduct a grasshopper insecticide efficacy study, and evaluated some newer products like Vantacor.



Grasshopper Insecticide Efficacy Trial: Insecticides were tested for control of adult grasshoppers in late growth stage soybeans at the NDSU Agronomy Farm, Casselton, ND. Insecticide treatments, active ingredients, and application rates are listed in Table 1. A new insecticide, Vantacor (chlorantraniliprole), from FMC Inc. was tested at low, mid, and high rates and at a mid-rate tank mixed with bifenthrin to test its efficacy alone and in combination with a pyrethroid. Other treatments represent commonly used insecticide products and field rates.

Adult grasshoppers were present at threatening numbers at the R4 growth stage. The grasshopper population consisted of three pest species: red-legged grasshopper (*Melanoplus femurrubrum*), two-striped grasshopper (*M. bivittatus*), and differential grasshopper (*M. differentialis*). Grasshoppers were sampled by slowly walking the center two rows of each plot, counting and recording the number of grasshoppers seen, and converting to number of grasshoppers per square yard. Grasshopper feeding (defoliation) was quantified by randomly sampling four trifoliates in the upper canopy in each plot and measuring percent leaf tissue loss using the BioLeaf smart device app.

Pre-spray grasshopper counts and defoliation sampling were conducted on August 13 at the R4 growth stage, and applications were made the following day. Post-application count and defoliation sampling were done at four and nine days after treatment (DAT). Plots were harvested on September 24.

Table 1. Treatment list.

Treatment	Insecticide Product(s)	Active Ingredients(s)	Application Rate
1	Hero	Bifenthrin +Zeta-cypermethrin	5 fl oz/acre
2	Sniper	Bifenthrin	4.8 fl oz/acre
3	Vantacor	Chlorantraniliprole	0.7 fl oz/acre
4	Vantacor	Chlorantraniliprole	1.2 fl oz/acre
5	Vantacor	Chlorantraniliprole	1.7 fl oz/acre
6	Vantacor + Sniper	Chlorantraniliprole + Bifenthrin (tank mix)	1.2 fl oz/acre + 4.5 fl oz/acre
7	Warrior II	Lambda-cyhalothrin	1.6 fl oz/acre
8	Warrior II	Lambda-cyhalothrin	1.92 fl oz/acre
9	Cobalt Advanced	Chlorpyrifos + Lambda-cyhalothrin	16 fl oz/acre
10	Endigo ZCX	Lambda-cyhalothrin + Thiamethoxam	4.5 fl oz/acre
11	Untreated Check	---	---

Results

Grasshoppers averaged 5.5 grasshoppers/yd^2 and percent defoliation averaged 11.2% prior to application. While the actual pre-spray counts revealed economically threatening grasshopper numbers, percent defoliation was somewhat low, and no pod feeding was observed during the duration of the trial. This may have been due to the rapid advancement in soybean maturity.

At 4 DAT, the untreated check had significantly more grasshoppers/yd^2 than all other treatments. Among insecticides, Vantacor at 0.7 fl oz/acre (low rate) had significantly more grasshoppers/yd^2 than all other treatments. However, the mid and high rates of Vantacor were not significantly different from all other insecticide treatments, including Vantacor + Sniper. Chlorantraniliprole works best against grasshopper nymphs, and results in slower mortality compared with pyrethroid and organophosphorus insecticides. However, chlorantraniliprole does cause grasshoppers to stop feeding, as evidenced by the

lack of significant differences among insecticide treatments for percent defoliation at 4 DAT. All insecticides had significantly less defoliation compared to the untreated check.

At 9 DAT, the untreated check had significantly more grasshoppers/yd^2 and greater percent defoliation than all insecticide treatments. There were no significant differences among insecticide treatments for grasshoppers/yd^2 and percent defoliation, indicating that by 9 DAT all insecticides had comparable efficacy.

There were no significant differences among all treatments for yield. The average number of adult grasshoppers per yard^2 was just below the Economic Threshold for adult grasshopper in field – 8-14 adult grasshoppers per yard^2. Percent defoliation, especially the lack of pod feeding, also was not great enough to cause detectable yield loss.

Our results indicate that all insecticides tested provided control of adult grasshoppers. Non-traditional grasshopper control chemistries, such as chlorantraniliprole, should continue to be examined, especially with the impending loss of chlorpyrifos and the need of additional insecticide modes of action.

Table 2. Grasshopper Efficacy Results for Insecticide Trial in Soybeans, 2021.

Trmt. #	Treatment	Application Rate fl oz / acre	Avg. Grasshoppers per yd^2		Avg. Defoliation %		Yield bu/acre
			4 DAT	9 DAT	4 DAT	9 DAT	
1	Hero	5	0.3 a	1.0 a	7.5 a	9.7 a	36.3 a
2	Sniper	4.8	0.5 a	1.3 a	12.2 a	6.6 a	35.2 a
3	Vantacor	0.7	3.3 b	1.8 a	9.8 a	8.8 a	35.9 a
4	Vantacor	1.2	1.8 a	2.0 a	14.4 a	10.5 a	39.3 a
5	Vantacor + Sniper (tank mix)	1.2 + 4.5	0.5 a	0.8 a	8.3 a	7.5 a	34.4 a
6	Vantacor	1.7	1.3 a	2.0 a	7.5 a	10.9 a	38.3 a
7	Warrior II	1.6	0.5 a	0.8 a	14.0 a	12.4 a	37.8 a
8	Warrior II	1.92	0.5 a	3.0 a	9.1 a	12.9 a	33.6 a
9	Cobalt Advanced	16	0.8 a	1.3 a	6.7 a	8.9 a	39.1 a
10	Endigo ZCX	4.5	0.3 a	3.3 a	7.7 a	10.2 a	32.9 a
11	Untreated Check	-	5.5 b	4.3 b	23.3 b	18.9 b	34.7 a

Objective Two: Survey work for the detection of the invasive soybean gall midge.

A total of 588 soybean fields in 48 counties was surveyed to detect soybean gall midge larvae from 2 July to 9 September in ND in 2021. The most intense survey was conducted in counties of the central and eastern part of the state. The only counties that were not surveyed were Bowman, Golden Valley, Stark, Billings and Dunn (Figure 1). The soybean crop stages were between the late vegetative stages and R7 (beginning maturity).

Results from the 2021 soybean gall midge survey were negative for all soybean fields surveyed in North Dakota (Fig. 1). Data were mapped using ArcMap to show its absence. Maps were posted weekly on the IPM website under soybean.

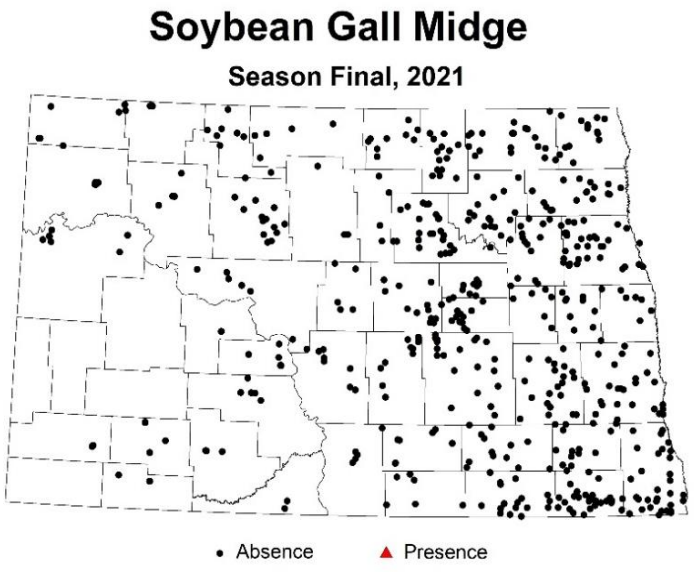


Figure 1. Survey of soybean gall midge in soybean fields 2021.

Objective Three: To develop extension outreach material on soybean insect pests for NSDC and growers.

A large banner of major insect pests of soybean (Fig. 2) was developed and delivered to the NDSC. We displayed the soybean insect banner at the ND Corn & Soybean Expo 2022 in Fargo. For NDSU Extension, three soybean insect banners were made: one for the Fargo campus, the North Central REC and the Langdon REC for extension outreach. The *Soybean Insect Diagnostic Series* will require more time due to the amount of work and people involved. It will cover IPM of the major insect pests including soybean aphids, spider mites, foliage-feeding caterpillars, bean leaf beetles and grasshoppers. It is expected to be completed this winter.

Figure 2. New soybean insect banner displayed at ND Corn & Soybean Expo in February 2022 at the Fargo Dome (courtesy of Veronica Calles-Torrez).

Selected Outputs:

Koch, R., E. Hodgson, J. Knodel and A. Varenhorst. 2022. Management of Insecticide-resistant Soybean Aphids E1878 (revised). Multistate publication with University of Minnesota Extension, Iowa State University Extension and Outreach, NDSU Extension and SDSU Extension.

Knodel, J.J. 2022. First detection of soybean aphids. NDSU Extension Crop and Pest Report #8 (June 23, 2022).

Knodel, J.J. 2021. Soybean aphids and spider mites starting. NDSU Extension Crop and Pest Report #8 (June 17, 2021).

Calles-Torrez, V., and J.J. Knodel. 2021. Soybean gall midge update in North Dakota. NDSU Extension *Crop and Pest Report* #9 (June 24, 2021).

Knodel, J.J., A. Friskop, P.B. Beauzay, and S. Markell. 2021. 2021 IPM Crop Survey- soybean and sunflower. NDSU Extension *Crop and Pest Report* #19 (September 23, 2021).

Calles-Torrez, V., P. Beauzay, A.H. Knudson, and J.J. Knodel. 2020. Soybean gall midge and white-mold gall midge in soybean. Bull. E2006. NDSU Extension, Fargo, ND.