OBJECTIVE:
Efficacy evaluation of Sivanto® prime rates for the control of the soybean aphid.

CROP INFORMATION
Crop: Soybean (Glycine max)  
Cultivar: Asgrow AG1435
History:
2013: Soybean 2014: Corn 2015: Soybean 2016: Corn

PEST INFORMATION
Research plot areas adjacent to this site had soybean aphid populations documented resistant to synthetic pyrethroid insecticides during 2015 and 2016.

SITE INFORMATION
Location: University of Minnesota Southwest Research and Outreach Center Lamberton, Redwood County, Minnesota

This trial was placed in a small, bulk-planted soybean field. This was the first area at the Research and Outreach Center with relatively uniform soybean aphid populations at economic threshold.

Soil fertility (2016 sample):
Name: Ves loam
% OM: 6.8  pH: 7.6
P (bray): 324 ppm  K: 678 ppm  Zn: 7.7 ppm

PLANTING INFORMATION
Planting Date: 6/08/2017  Emergence Date: 6/13/2017
Planting Equipment: John Deere (Moline, IL) Max Emerge 2, 6-row vacuum planter.
Row Spacing: 30-inch  Seeding Rate: 160,000 seeds/acre  Seeding Depth: 1.5 inch
Soil Temperature: 64°F  Soil Moisture: Dry
Precipitation: Above-average growing season precipitation after planting

PLOT MAINTENANCE
Tillage Fall 2016: Disc Ripper  Tillage Spring 2017: Field cultivator
PRE Herbicide: 6/5/17  Dual II Magnum – 2.6 pts/A
POST Herbicide: 6/26/17  Cornerstone Plus –36 fl. oz /A, Fusilade – 3 fl oz/A, Battlestar – 0.75 pt/A
7/10/17  Cornerstone Plus –24 fl. oz/A, Fusilade – 3 fl oz/A
**Insecticide:** 8/4/17 *Treatments part of study*

**Insecticide application:** Tractor mounted plot sprayer - 15 GPA and 35 PSI

**HARVEST INFORMATION**

**Harvest equipment:** Plot combine (ALMACO, Nevada, IA).

The center two rows of each four-row plot were combined. Grain yields were adjusted to 13% moisture and 60 pounds/bushel.

**EXPERIMENTAL DESIGN**

**Study Design:** Randomized Complete Block  **Treatments:** 6  **Replications:** 4

**Plot Width:** 15 foot (six 30-inch rows)

**Treated Plot Width:** 10 foot (four 30-inch rows)  **Treated Plot Length:** 30 foot

**TREATMENTS EVALUATED**

The effect of five insecticides were compared to a no-insecticide control with respect to their effect on soybean aphid (SBA) populations and soybean yield. The insecticides and per acre rates tested were 4, 5 and 7 fl. oz. flupyradifurone (Sivanto® prime - Bayer Crop Science), 1.6 fl. oz. lambda-cyhalothrin (Warrior II® with Zeon Technology - Syngenta), and a 4 fl. oz./acre rate of thiamethoxam + lambda-cyhalothrin (Endigo® ZC - Syngenta).

Sivanto was recently labeled on soybean and is a Group 4D insecticide. This compound is primarily active against aphids, whiteflies and similar sucking insects. Similar to neonicitinoid insecticides (Group 4A), Sivanto can have limited translocation within plants but is reported to have a lower toxicity to bees.

Warrior II is a synthetic pyrethroid insecticide (Group 3A). Warrior II and other formulations and isomers of cyhalothrin, as well as pyrethroid insecticides in general, have been widely used for insect control in many Minnesota crops. Populations of soybean aphids documented resistant to the pyrethroid insecticides, lambda-cyhalothrin and bifenthrin, were observed at the study site during 2015 and 2016.

Endigo ZC is a premix of lamda-cyhalothrin and the neonicitinoid insecticide thiamethoxam, the latter also formulated as a common soybean seed treatment (e.g. Cruiser® - Syngenta).

Insecticides were applied after SBA had reached the 250 aphids/plant economic/action threshold. Plot alleys were cut into the most visually uniform part of the field with a tractor-mounted rotary tiller, 6-row plots were marked, and pre-treatment aphid counts were made.

Insecticide applications were made with a tractor mounted plot sprayer, spraying the center four rows of each six row plot. This design protected against fine spray particle drift between plots and left a running check on each side of a plot. TeeJet 8001XR nozzles (TeeJet Technologies) placed on 15-inch centers applied 15 gallons per acre water at approximately 35 PSI.

**ASSESSMENT METHODS**

Soybean aphid populations were assessed on five randomly selected plants per plot (four plants per plot pre-treatment). Before aphids were counted, the plants were shaken to help eliminate any dead or
stupified, dying aphids. Plants were assessed the day insecticides were applied and then at 3, 7, 14, and 21 days after application.

RESULTS
Soybean planting was delayed by wet soil conditions at the study location. Rainfall was above normal early in the season and the site had good overall growing conditions. Unlike Northwest Minnesota, SBA populations were slow to develop at this southwest Minnesota location during 2017. Poor early season colonization rates and abundant natural enemies provided very limited areas to evaluate insecticides. The small size of the field, in which this study was placed, limited the number of comparisons that could be made.

Soybean aphid populations were consistently over the 250 aphid/plant economic/action threshold (ET) on August 4, averaging 444/plant through the study. Treatment means, probability and significant differences for this trial are presented in Table 1.

Three days after insecticide treatment (3 DAT), all insecticides reduced SBA populations below ET. The Warrior II and Endigo ZC treatments had somewhat higher remaining aphid populations (Table 1, Figure 1).

By 7 DAT, all three Sivanto rates and Endigo and had much lower aphid populations than the untreated control. Although below ET, the Warrior II treatment had the greatest SBA population. This relationship among treatments remained constant through 14 and 21 DAT. The aphids surviving the Warrior II treatment were highly aggregated/over dispersed potentially suggesting biotype clones.

SBA populations in the plots without insecticide peaked by August 11 (7 DAT) and slowly declined until August 25 (21 DAT). Thereafter, all insecticide-treated plots had few aphids and fungal diseases, present throughout the study period, greatly increased. This created pockets of very high SBA mortality and aggregated SBA infestations in the untreated plots. Additionally, SBA had begun moving to buckthorn by September 5. Because of rapidly deteriorating SBA populations, sampling was not continued after 21 DAT.

The untreated control accumulated more than 12,000 aphid-days during the 3 weeks where aphids were rated and additional aphid-days were accumulated before and after. All insecticides reduced SBA pressure. Yield impact on the untreated control was present but minimal (Table 1, Figure 2).
<table>
<thead>
<tr>
<th>Insecticide</th>
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<th>Aphid-days</th>
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<tr>
<td></td>
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<td>8/7</td>
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<td>Untreated control</td>
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<td>Endigo ZC 4 oz/a</td>
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<tr>
<td>Treatment Prob(F)</td>
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<td>0.0001 t</td>
</tr>
</tbody>
</table>

Means followed by same letter or symbol do not significantly differ (P=.10, Tukey’s HSD)

Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.

t = Means comparisons for aphid data are based on log<sub>10</sub> transformed data

Table 1. Yield and soybean aphid population response to three rates of Sivanto Prime, Endigo ZC and Warrior II. UMN Southwest Research and Outreach Center, Lamberton, MN 2017.
**CONCLUSIONS**

Unlike 2015-16, the 2017 SBA aphid populations sampled near this study were susceptible to both l-cyhalothrin and bifenthrin. However, based on these results, a portion of the SBA were not well controlled by Warrior II.

Foliar applications of neonicitinoid insecticides tend to produce slower SBA mortality, although feeding cessation may be fairly rapid. The lag in SBA mortality seen with Endigo ZC (Figure 1) may reflect reduced efficacy of the l-cyhalothrin component of the mix. Endigo ZC provide good SBA control. Insecticide pre-mixes and tank mixes can hide resistance issues associated with one of the products but they may not reduce selection pressure.

All three rates of Sivanto controlled aphids very well. These data suggest that when applied to economic threshold populations on a timely basis, Sivanto can provide an effective option for managing insecticide resistance in the SBA.

**ACKNOWLEDGEMENTS**

Matthew Wordes and Adam Hass provided valuable help in plot maintenance and root digs and the root rating process.

We would like to thank Bayer Chemical Corporation for research support of this study.

*Always read and follow label directions!*  
*Sivanto® prime, Endigo ® ZC, and Warrior II® with Zeon Technology are restricted use pesticides.*