2023 Soybean Aphid Control Product Impact on Yield

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Objectives were to demonstrate yield impact of aphid control products in soybean, display aphid control product portfolios from six industry collaborators, and provide an unbiased evaluation of entries to allow growers to benchmark competitive performance of aphid control products on the market. Growers should use the data set as a guide to visit with their crop consultants or local suppliers to determine an aphid control product, if any, that may provide the greatest aphid control and return on investment based on local supplier pricing and availability of products.

MATERIALS AND METHODS

Experiments were conducted on a fine-textured webster-clay loam soil with 6.0% organic matter and a 7.2 soil pH near Renville, Minnesota, in 2023. The study area has been a corn-soybean rotation for decades. Spring tillage was a field cultivator at 3" depth. Enestvedt untreated soybean was seeded 1.25 inches deep on 30-inch row spacings at 130,000 seeds per acre on May 26, emerging June 1. Since soybean seed was untreated, Renestra was applied at 6.8 fluid ounces as a blanket application for soil insect control at VE soybean June 1. Study was kept weed free with a preemergent application of Verdict + Zidua SC at 5 and 3.25 fl oz, respectively, on May 27 followed by a postemergence application of Liberty and Class Act NG at 32 fl oz and 2.5%v/v, respectively, on June 21. Treatments were applied August 3 to soybean at 168 aphids per plant, just above the economic threshold of 100 aphids per plant (Table 1). Treatments applied with hand boom sprayer in 20 GPA spray solution through AIXR11002 air-induction flat fan nozzles pressurized with CO_2 at 40 psi to the center two rows of four row plots 50 feet in length. All treatments included Masterlock adjuvant at 6.4 fluid ounces per acre.

Aphid data were collected from replications one, two, and three where five random plants per plot were counted one day before application, 6 DAA, and 14 DAA, on August 2, August 9, and August 17, respectively. Yield data were collected on October 3 utilizing a Hege 160 two-row small plot research combine equipped with a HarvestMaster large plot weigh hopper. The middle two rows of the four-row plot were harvested and samples were taken with moisture and test weights recorded using a Perten 5200-A moisture tester. Experimental design for yield data was a randomized complete block with 6 replications; however, aphid count data were collected and analyzed as a randomized complete block with 3 replications. Data were analyzed with GLM procedure of SAS (Statistical Analysis Software 2023, version 9.4M8, SAS Institute, Inc.) at alpha=0.10 and differences are determined with 90% confidence; meaning, if the study was repeated 100 times, that 90 times out of 100 we would expect treatments that are statistically similar (within one LSD value of each other) to continue to be similar.

Table 1. Application information for aphid control trials in 2023.

Description	168 Aphids per Plant
Application Code	A
Date	August 3
Time of Day	9:00 AM
Air Temperature (F)	88
Relative Humidity (%)	65
Wind Velocity (mph)	1
Wind Direction	NW
Soil Temp. (F at 6")	74
Soil Moisture	Dry
Cloud Cover (%)	5
Crop Growth Stage (avg)	R4

RESULTS AND DISCUSSION

Soybean yield was evaluated across six replications with each treatment randomized within each of the six replications to mitigate impact of field location and environment on the data set. From plant date on May 27 until August 10, the study received a cumulative rainfall of 2.2 inches across those first 75 days of soybean growth with no

single event exceeding 0.4 inches of rain. Data table has been displayed in order of greatest yielding treatment, to least yielding treatment (Table 2). Aphid arrival began around July 30, with threshold being reached August 2 as evidence of the 1 DBA (days before application) counts. No statistical significance observed from aphid counts 1 DBA, which indicates the aphid pressure was uniform across the study, an ideal scenario. Treatments separated themselves quickly into two tiers. Tier 1 included the most effective products that provided, on average, per plant aphid counts below 78 at the 6 and 14 DAA evaluation timings. Tier 2 included the products with efficacy impacted by group 3A pyrethroid insecticide resistance that appears to be at a frequency of 50% in the evaluated aphid population. However, both tiers out performed untreated check and demonstrates the high quality of the data provided by this study.

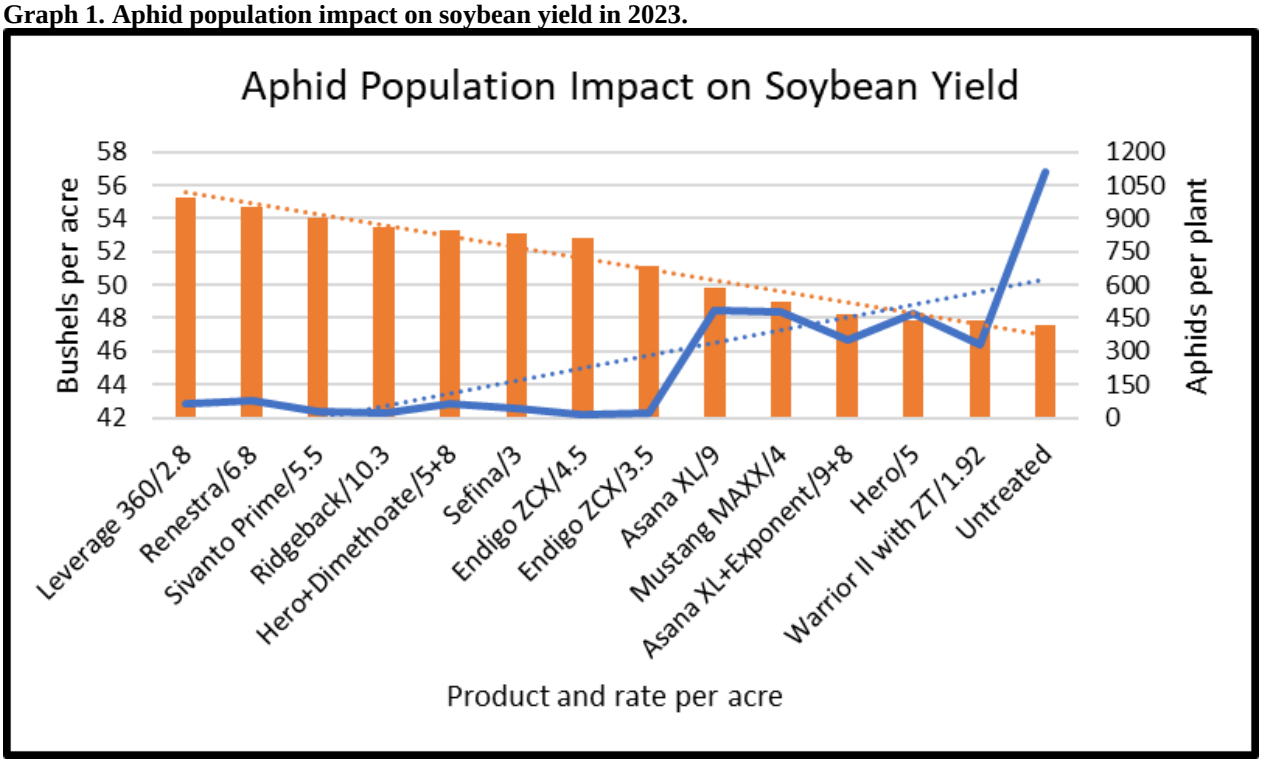
Table 2. Aphid control product impact on aphid population and soybean yield in 2023.

		App.	Aphids Counts			Harvest	
Treatment[a]	**Rate**	**Code[b]**	**1 DBA**	**6 DAA**	**14 DAA**	**Yield**	**Company**
	oz/A* or fl oz/A		/Plant	/Plant	/Plant	Bu/A[c]	
TIER 1							
Leverage 360+Masterlock	2.8+6.4	A	187	66	78	55.3	Bayer
Renestra+Masterlock	6.8+6.4	A	63	78	8	54.7	BASF
Sivanto Prime+Masterlock	5.5+6.4	A	141	30	27	54.0	Bayer
Ridgeback+Masterlock	10.3+6.4	A	176	19	18	53.5	Corteva
Hero+Dimethoate+Masterlock	5+8+6.4	A	157	66	65	53.3	FMC
Sefina+Masterlock	3+6.4	A	217	44	5	53.1	BASF
Endigo ZCX+Masterlock	4.5+6.4	A	190	16	10	52.8	Syngenta
Endigo ZCX+Masterlock	3.5+6.4	A	172	23	11	51.1	Syngenta
TIER 2							
Asana XL+Masterlock	9+6.4	A	196	485	142	49.8	Valent
Mustang MAXX+Masterlock	4+6.4	A	177	481	303	49.0	FMC
Asana XL+Exponent+Masterlock	9+8+6.4	A	213	349	236	48.2	Valent
Hero+Masterlock	5+6.4	A	210	468	332	47.9	FMC
Warrior II with ZT+Masterlock	1.92+6.4	A	136	332	296	47.9	Syngenta
UNTREATED							
Untreated Check	-	-	146	1109	531	47.6	-
LSD (0.1)			**NS**			**3.4**	

[a]PRE treatment applications contained no additional adjuvants.
[b]Application codes refer to the information in Table 1.
[c]Bu/A=Soybean yield in bushels per acre corrected to a standard moisture of 13.5%.

Correlation can be applied to many data sets, however, not all data sets should be considered for correlation and the statistical value of correlation can become meaningless if used inappropriately. The correlation value ranges from -1 to +1; a value of 0 means no correlation, a negative value demonstrates a negative relationship between two data sets (moving in different directions), and a positive value demonstrates a positive relationship between two data sets (moving in the same direction). The further from "0" the correlation value is, the stronger the relationship; so the closer to -1 the more negative the correlation relationship and the closer to +1 the more positive the correlation relationship. The correlation between the 6 DAA aphid count data and soybean yield is -0.78 indicating there is a strong negative correlation between higher aphid populations in the data set that is consistently resulting in lower yields (Graph 1). The value of this strong correlation reiterates the importance of controlling aphids in soybean and applying products at an economic threshold between 100-200 aphids per plant. This strong correlation also suggests there was little impact on the data set from any other pest or disease and increase the confidence growers can have making decisions on aphid control based on this data set.

Graph 1. Aphid population impact on soybean yield in 2023.



CONCLUSION

Aphids continue to be an economically impactful pest in soybean. The difference between controlling soybean aphid that has reached economic threshold with a tier 1 product compared to the untreated check can be a yield difference of 3.5 to 7.7 bushels of soybean per acre. At $13.00 per bushel the economic impact can be calculated between a $45.50 to $100.10 loss per acre based on the results of this singular study.

Resistance in aphid populations continues to be a challenge. New modes of actions or premixed products with multiple modes of action included in a single jug can help in combating resistance. Overuse of any single mode of action without the addition of a second family of insecticides for multiple cropping seasons can create or grow resistance in aphid populations. It is critical for a grower to know if they have a resistant aphid population prior to selecting a product for aphid control. A product from tier 2 applied to a known pyrethroid resistant population could reduce yield compared to a tier 1 product between 1.1 and 3.0 bushels of soybean per acre. At $13.00 per bushel economic impact can be calculated between a $14.3 to $36.00 loss per acre. Growers should consider spending an additional $14.00 per acre to move from a pyrethroid insecticide to a new mode of action or premixed product when pyrethroid resistant populations are present.

Growers should use the data set as a guide to visit with their crop consultants or local suppliers to determine an aphid control product, if any, that may provide the greatest aphid control and return on investment based on their aphid population resistance, if any, and on local supplier pricing and availability of products.

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