Reporting period 2. August 1, 2022, to October 31, 2022

Objective I. Evaluate insecticide and fungicide efficacy in an ongoing and systematic way

(Team: Bruce Potter, Dr. Dean Malvick, and Dr. Robert Koch with additional University and Industry collaboration).

Submitted by Bruce Potter 11/30/2022

a) Foliar Fungicide

This project continues long-term standardized foliar fungicide trials in soybean across southern Minnesota. Study sites located at three University of Minnesota Research and Outreach Centers (ROCs) were evaluated for late-season disease in September. Soybeans were harvested by plot combine. Yield and moisture were normalized as the percent of site mean to compare results across sites.

MOISTURE	Combined	Lamberton	Waseca	Rosemount
Variety	**< 0.0001******	**0.0003******	**< 0.0001******	**0.0427*****
Fungicide	0.9171	0.8732	0.6000	**0.1492***
Variety * Fungicide	0.7692	0.5677	0.7534	0.6738
YIELD				
Variety	**0.0885****	**0.0894****	0.1820*	0.3416
Fungicide	0.6031	**0.0854****	**0.0819****	0.8433
Variety * Fungicide	**0.0844****	0.3260	**0.0282*****	0.686

p = 0.20*
p = 0.10**
p = 0.05***
p = 0.01****

Table 1. . Factorial ANOVA. Minnesota Uniform fungicide study -2022.

At all sites and overall, moisture differences among the three soybean varieties were observed but were not observed among the control and two fungicide treatments.

Yield differed (p=0.10) by variety and fungicide at Lamberton, and by fungicide at Waseca with a significant variety* fungicide interaction at the latter site. No yield differences were observed at the Rosemount site (Table 1). Fungicide treatments were sometimes numerically lower than the untreated control (Appendix A). Tukey's HSD (p = 0.10) did not detect significant differences among the three fungicide treatments at any site or overall.

The ROC study sites were not selected on the expectation of soybean disease (white mold, frogeye leaf spot, etc.). The 2022 growing season was dry over much of southern Minnesota and all study sites saw low levels of foliar disease. Not unexpectedly, there was little yield response to fungicide applications. As a result of two consecutive dry years, long-term significant yield benefits for fungicide application were reduced to 53% of the 19 site years.

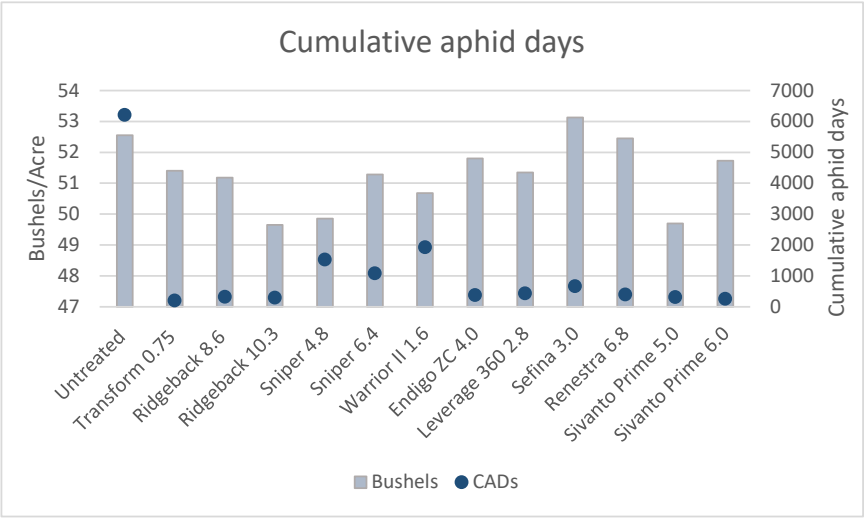
b) Soybean aphid foliar fungicide

This project supports the continued evaluation of insecticide compounds on soybean pests. An area for a soybean aphid insecticide study site was planted at the UMN Southwest Research and Outreach Center. Soybean aphid populations at this site were established by aphids from nearby buckthorn and neighboring fields.

Thirteen foliar insecticide treatments were applied on August 10 and aphid populations were rated at 0, 5, 7, 15, and 21 days after application.

Dry weather after the insecticide applications limited aphid population development. Dry soil conditions increased the spatial variability of both aphid population density and crop yield.

Insecticide applications did not impact yields due to few cumulative aphid days (< 7,000) in untreated plots (Figure 1).



Part of the soybean aphid population in this area remains resistant to pyrethroid insecticides and in this study bifenthrin and lambda-cyhalothrin insecticides applied alone accumulated more aphid days than other treatments.

Figure 1. Effect of foliar insecticides on soybean aphid (0-21 DAT) and soybean yield. Lamberton, MN 2022.

Objective II. Define the distribution and host range of the soybean gall midge within Minnesota. (Team: Bruce Potter and Dr. Robert Koch)

This project will **a)** Track changes in the distribution of soybean gall midge (SGM) across Minnesota environments and **b)** Examine alternative hosts and determine if additional Minnesota crops are at risk. This funding is requested as a second year to the project funded by the Minnesota Soybean Research and Promotion Council. It will complement other work funded work previously funded by the NCSRP.

a) Soybean surveys in MN counties adjacent to those previously found to be infested by soybean SGM revealed no new infested counties and populations in previously infested counties were low.

b i) Dry edible bean survey

Dry bean fields in several West Central Minnesota Counties with a history of SGM infestations (Swift, Yellow Medicine, Chippewa, and Lac Qui Parle) were surveyed. Two SGM-infested navy bean fields were found in Lac Qui Parle County on 8/12/22 (*Figure 2*). Soybeans near these dry bean fields were also infested. These represent the first in-field infestations of bean (*Phaseolus vulgaris*) and they followed shortly after infested sentinel bean plants were obtained in Rock County (see below). These field observations were confirmed to be soybean gall midge by DNA and emerged adults.

Figure 2. Soybean gall midge larvae in navy bean stem. Lac Qui Parle Co., August 2022. Photo: B. Potter

B ii) Prairie legume survey

Sweet clover and prairie legumes were surveyed in these same WC MN counties and in Rock, Lincoln, and Cottonwood in SW MN. No SGM larvae were observed on prairie legumes (lead plant, prairie clover, tick trefoil, etc.) during 2022.

b iii) Sentinel plants

The three potted soybean varieties used as sentinels placed in a soybean field during overwintering generation SGM adult activity were found to be infested by SGM larvae (See also 2021-22 Q1 report).

On July 18, during 1st generation adult activity, the same eighteen plant types were placed in the infested field. These potted plants were removed from the field and returned to the greenhouse on July 25 to allow any eggs to hatch and larvae to develop. Plants were dissected for the presence of larvae on August 1.

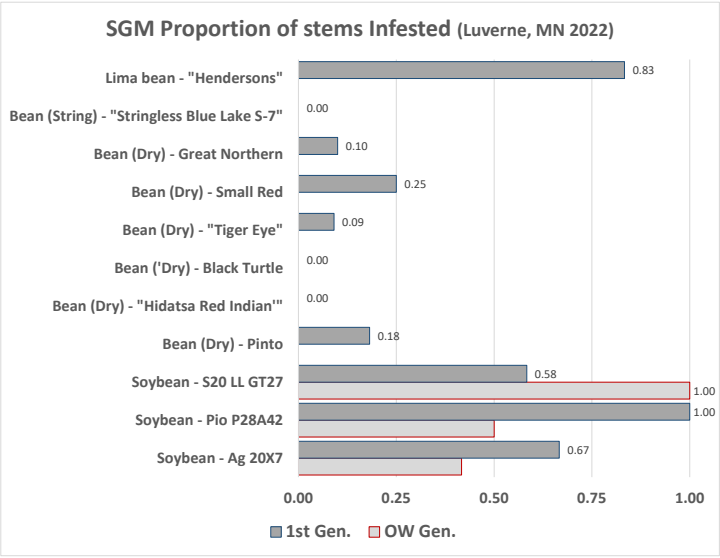


Figure 3. Proportion of Glycine max and Phaseolus sentinel stems infested by SGM while placed in a Rock Count soybean field during 2022.

SGM larvae were found in the stems of the three soybean varieties, four of the seven bean (*Phaseolus vulgaris*) cultivars, and lima bean (*Phaseolus lunetus*). Generally, the bean and lima bean sentinel plants had fewer larvae and a lower percentage of infested plants than soybean (Figure 3). These represent two new species as SGM hosts! Additionally, a dead, immature white larva was found in a single stem of Mung bean (*Vigna radiata*).

These results were initially reported in the Minnesota Extension Crop News https://blog-crop-news.extension.umn.edu/2022/10/soybean-gall-midge-not-just-for.html

Appendix A. 2022 University of Minnesota Uniform Fungicide Test results.