Public-Private Partnership to Evaluate Aphid-Resistant Soybeans

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Introduction

Soybean aphid (*Aphis glycines* Hemiptera: Aphididae) is the most economically important insect pest of soybean in the North Central United States. An unmanaged aphid outbreak can reduce yield by 40 percent. Foliar insecticides are the most widely used management strategy to protect against yield loss from soybean aphids, but recent resistance to insecticides has been reported. Using varieties with aphid resistance genes (*Rag*) also is an effective strategy to suppress aphids and can replace insecticides. Additionally, a pyramid of two *Rag* genes offers more protection against aphids than a single *Rag* gene. This project partnered with Corteva™ Agriscience to evaluate elite soybeans with and without aphid resistance as a means to combat soybean aphid outbreaks.

Materials and Methods

The effects of host plant resistance on aphid population and yield was evaluated. Four varieties were tested in a randomized complete block design with six replicate blocks. Corteva™ varieties tested included a *Rag1*/*Rag2* variety and its susceptible isoline (*rag1*/*rag2*) as well as a *Rag1*/*Rag3* variety and its susceptible isoline (*rag1*/*rag3*). All varieties were glyphosate-tolerant. Seeds were planted in 30-inch rows at 140,000 seeds/acre May 30. Each plot was 16 rows x 50 ft long. Aphids were scouted bi-weekly July through September. The number of aphids/plant was converted to cumulative aphid days (CAD) as a way to estimate the seasonal exposure of plants to aphids. Soybean seeds were harvested October 19 and October 24. Seed yield was estimated and compared among all varieties.

Results and Discussion

Seasonal aphid exposure. The resistant varieties had lower aphid populations than the susceptible varieties (Figure 1). The resistant varieties had significantly fewer CAD than the susceptible varieties (CAD; $F_{3,20} = 58.03$, $P < 0.0001$) (Figure 2A) indicating effective aphid control without insecticide use. The two resistant lines controlled aphids similarly, as they did not significantly differ in CAD.

Yield. Seed yield varied significantly among the varieties ($F_{3,20} = 4.19$, $P = 0.0187$) (Figure 2B). The *rag1*/*rag2* susceptible variety had the highest seed yield (67.91 ± 1.03 bushels/acre) followed by *Rag1*/*Rag2* (64.90 ± 0.50 bushels/acre), then the *rag1*/*rag3* (64.08 ± 0.97 bushels/acre) susceptible variety, then *Rag1*/*Rag3* (63.32 ± 1.27 bushels/acre). No yield differences were detected within a pair of isolines, suggesting the resistance traits do not cause a yield drag. *Rag1*/*Rag3* seed yield was significantly lower than *rag1*/*rag2*.

Results suggest soybean lines developed by Corteva™ Agriscience with native resistance to the soybean aphid provide season-long protection.

Acknowledgements

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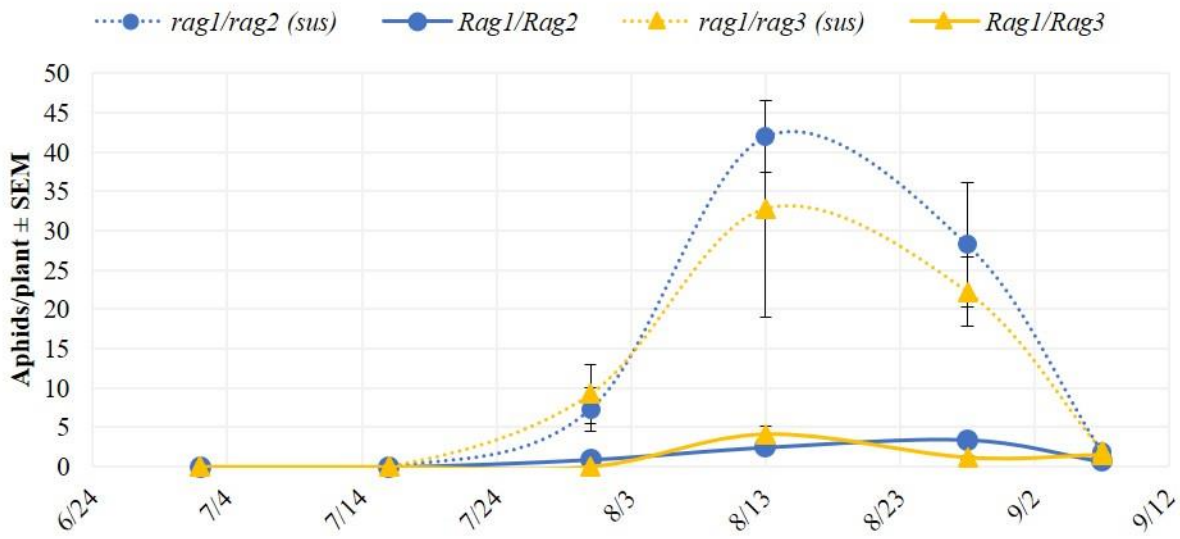

Figure 1. Aphid populations on four Corteva™ Agriscience varieties. Solid lines represent aphid-resistant varieties carrying pyramid *Rag* genes and dotted lines represent aphid-susceptible isolines. Aphid populations did not reach the economic threshold (250 aphids/plant) in 2018.

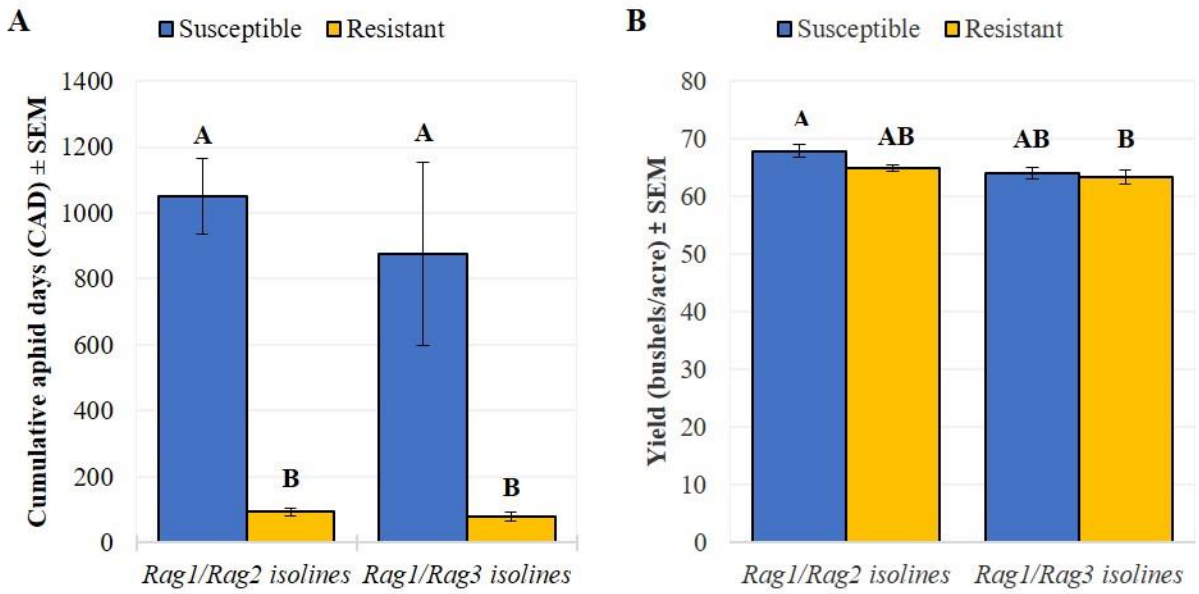

Figure 2. Season-long exposure of plants to soybean aphids (A) and yield (B) for each of the four Corteva™ Agriscience varieties. Variety had a significant effect on cumulative aphid days (CAD) and yield. *Rag*-varieties experienced significantly lower CAD compared with aphid-susceptible varieties. No yield differences were detected within a pair of isolines. The *Rag1*/*Rag3* resistant variety yielded significantly less than *rag1*/*rag2*.