Evaluation of Aphid-Resistant Soybean

RFR-A2045

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Introduction

The soybean aphid (*Aphis glycines* Hemiptera: Aphididae) is the most economically important insect pest of soybean in the north central region of the United States. Using varieties with native aphid resistance genes (named *Rag*) can effectively suppress aphid populations and can be used as an alternative to insecticides. Although this tool is highly effective, *Rag* varieties are not widely used by soybean farmers, partly because of their limited availability. This project evaluated soybean varieties with and without aphid resistance genes as a means to combat soybean aphid outbreaks.

Materials and Methods

The effects of host-plant resistance on aphid population and soybean seed yield were evaluated. Four near-isogenic varieties (maturity group 1.9) developed at the University of Illinois Urbana-Champaign were evaluated in a randomized complete block design with four replicate blocks. Varieties included a susceptible variety without any *Rag* genes; a 2-gene *Rag1+Rag2* pyramid variety; a 2-gene *Rag1+Rag3* pyramid variety; and a 3-gene *Rag1+Rag2+Rag3* variety. Seeds were planted in 30-in. rows at 140,000 seeds/acre May 11. Plots were 12 rows x 30 ft long. Aphids were scouted at least twice monthly from June through August. The number of aphids/plant was converted to cumulative aphid days (CAD) to estimate the seasonal exposure of plants to aphids. Soybean seeds were harvested September 26. Seed yield was estimated and compared among all treatments.

Results and Discussion

Seasonal aphid exposure. Soybean aphid populations did not exceed the economic threshold (i.e. 250 aphids/plant) in 2020. Overall, the susceptible variety had higher aphid populations than the resistant varieties (Figure 1). The soybean variety ($F_{3,9} = 7.22$; $P = .01$) had a significant effect on aphid populations. Resistant varieties had fewer CAD than the susceptible variety (Figure 2A) indicating effective aphid control. The three resistant varieties controlled aphids similarly to each other, as these did not differ significantly in CAD.

Yield. Seed yield was significantly different among varieties ($F_{3,9} = 5.50$; $P = .020$) (Figure 2B). The aphid-resistant *Rag1+Rag2+Rag3* variety had the highest seed yield (58.60 bu/A) followed by the *Rag1+Rag2* variety (55.90 bu/A), then the susceptible variety (48.2 bu/A). Despite having the lowest yield, the *Rag1+ Rag3* variety did not significantly differ from the susceptible and *Rag1+Rag2* varieties.

Overall, the results suggest soybean lines with native resistance to the soybean aphid provide season-long aphid suppression and yield protection.

Acknowledgements

Thanks to Greg VanNostrand, Ashley Dean, and several undergraduates for help in data collection, as well as Terry Tuttle, farm superintendent. This research was funded in part by the North Central Soybean Research Program.

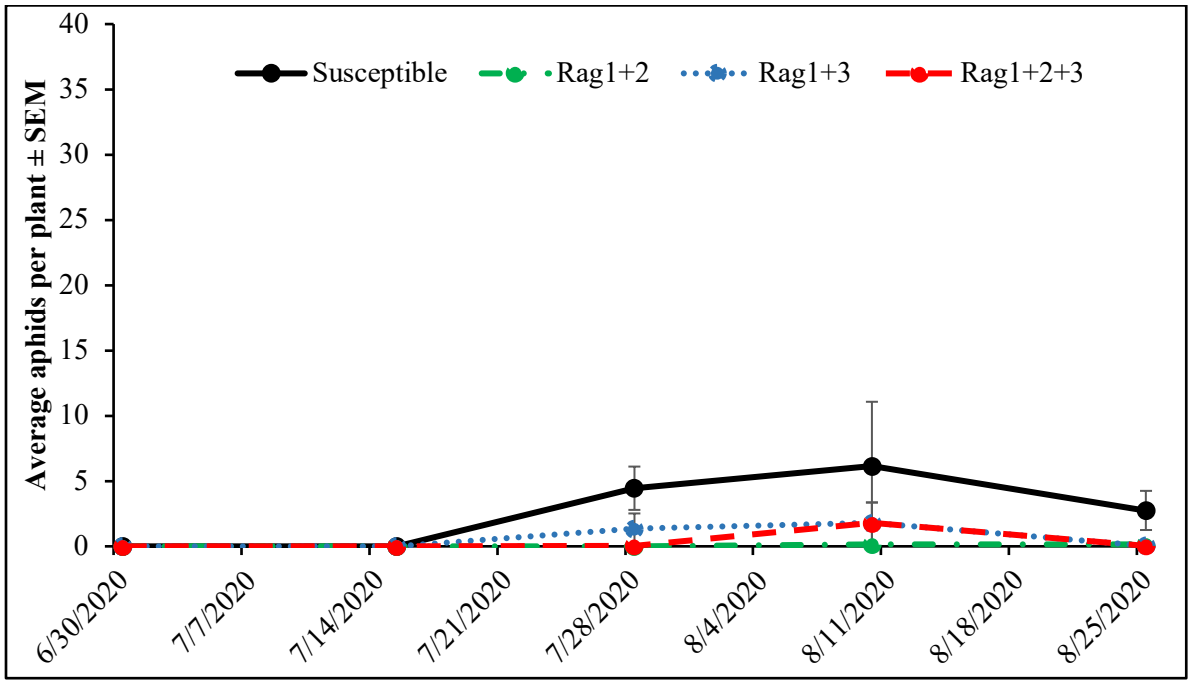

Figure 1. Aphid populations on the four MG 1.9 University of Illinois varieties. Aphid populations did not exceed the economic threshold (250 aphids/plant, horizontal dashed line) on any variety in 2020. *Rag* pyramid varieties had few aphids.

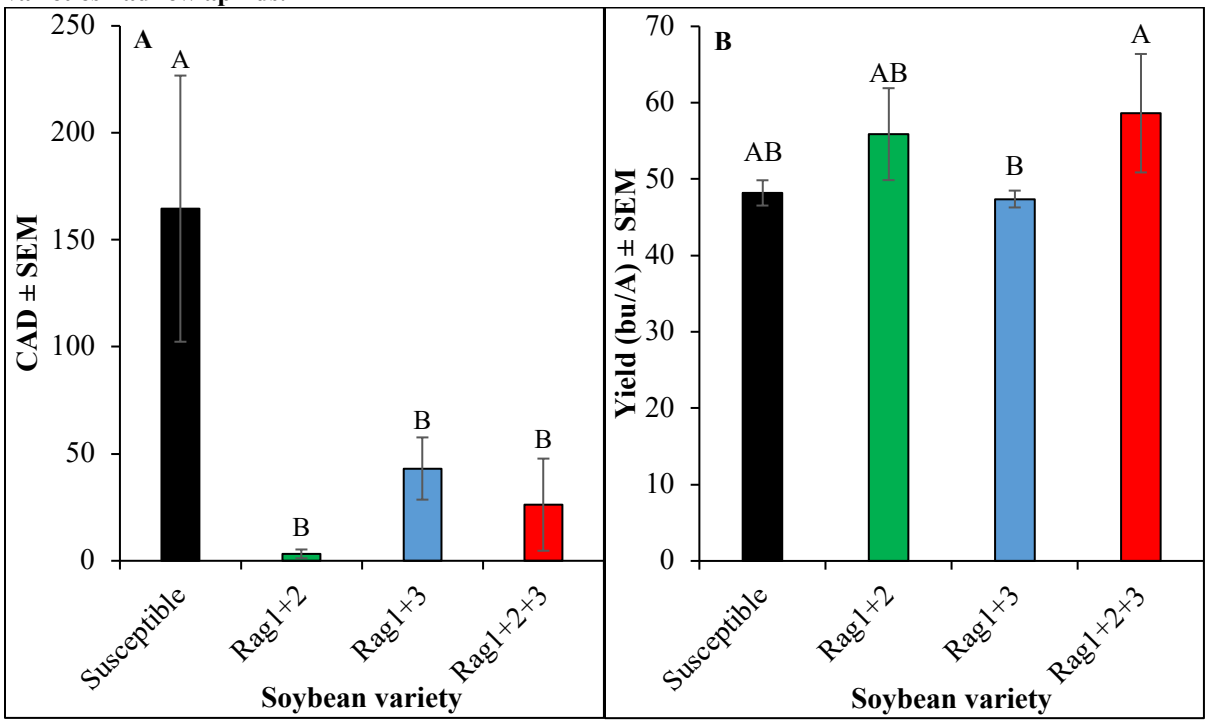

Figure 2. Season-long exposure of plants to soybean aphids CAD (A) and yield (B) for each of the four MG 1.9 University of Illinois varieties. Different letters indicate significant difference (P < 0.05). Variety had a significant effect on CAD and yield. *Rag*-varieties experienced significantly lower CAD and generally had higher seed yields compared with the aphid-susceptible variety.