

IOWA SOYBEAN ASSOCIATION RESEARCH UPDATE

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Soybean Aphids:

Originating in eastern Asia, the soybean aphid (*Aphis glycines*) was first found in the United States, including Iowa, in 2000. Identification is rather simple since this is the only aphid species known to reproduce on soybeans in Iowa. Soybean aphids can be winged or wingless. Wingless aphids are pale yellow or green, while winged aphids have a black head and thorax with a dark green abdomen. Both forms have black cornicles (tail pipes). Aphids are piercing and sucking feeders of plant vascular (sap) tissues (Figure 1). They overwinter on buckthorn and generate winged offspring that migrate to soybeans in the spring. Once on soybeans, aphids reproduce asexually throughout the summer, and can produce 15 to 20 generations on soybeans per season. Aphid colonies can become quite large if conducive temperatures (approx 75F) and relative humidity (below 78 percent) persist. Because of their ability to overwinter in the Midwest, to migrate over long distances, and to reproduce asexually at very high rates, the soybean aphid is the most important soybean insect pest in Iowa. In addition to feeding injury and related plant damage, soybean aphids can vector plant viruses and have been shown to exacerbate infections and losses due to soybean cyst nematode.



Figure 1: The underside of a soybean leaf infested with multiple generations of soybean aphid feeding on plant vascular (phloem) tissues.

Control of Soybean Aphids:

Soybean aphid control is dependent upon scouting and determining if an outbreak will occur. If approximately 250 aphids per plant are found on 80% of the plants in a field, and that population is

rising over time from flowering through the R5 growth stage, university researchers and Extension experts recommend an insecticide treatment. Several insecticides are labeled for soybean aphid. Organophosphates and pyrethroids can be effective. By scouting fields, especially in late July and August, farmers can determine if and when an outbreak is occurring. Although several predatory insects that feed on aphids are found in soybean fields, this biological control is not always sufficient to prevent outbreaks. Parasitoid wasps are becoming more common in Iowa, spreading from releases conducted in and around the Great Lakes, but their numbers are not yet sufficient to prevent outbreaks. During the past several years, university researchers have sought naturally occurring aphid resistance to soybean aphids in native germplasm. This research has discovered several *Rag* (an acronym for **R**esistance to *Aphis glycines*) genes that have since been introgressed (bred) into soybean breeding lines and a very limited number of commercial varieties. Based on field research with soybeans containing one or more of these *Rag* genes, it seems that individual genes are not as effective in controlling aphids as multiple *Rag* genes in the same plant (called gene pyramiding). A very limited number of commercial varieties containing 2 *Rag* genes are available. In some cases, 2 *Rag* genes are effective in controlling aphid populations and protecting yield under field conditions without the use of seed- or foliar-applied insecticides.

Soybean Aphid Populations Showing Insecticide Resistance:

As with weeds and disease-causing pathogens, insect pests including soybean aphids can evolve resistance to insecticides over relatively short periods of time (3 – 5 years) when using the same insecticidal modes of action or active ingredients. In Minnesota and northern Iowa, soybean aphid populations are becoming increasingly resistant to pyrethroid insecticides. To manage soybean aphid populations and prevent the selection and build-up of insecticide resistant populations, farmers should adopt an integrated pest management strategy and vary the insecticides they use based on modes of action. This will involve cultural and agronomic practices, various insecticides, aphid predators and parasitoids, and soybean varieties with aphid resistance genes.

Integrated Soybean Aphid Management:

Farmers should scout their fields frequently in order to understand soybean aphid populations and the potential for yield loss. Now that soybean aphids are becoming resistant to insecticides, farmers should consider scouting both before and after an insecticide application. Scouting at the right time during the growing season (July-August) can help determine the optimal time to apply insecticide so an aphid outbreak does not occur. Scouting after an insecticide is applied can help confirm that the population is not resistant and the insecticide was effective. In some cases, this may involve working with university Extension entomology and agronomy experts to estimate soybean aphid populations and their likelihood to be resistant to pyrethroids. Insecticide applications must be at the full strength and with equipment that will deliver chemical to all plant surfaces if the full value of an insecticide is to be realized. By double-checking that the insecticide worked, farmers can avoid losing yield from a first time invasion of an insecticide-resistant population of soybean aphids. If possible, farmers should plant aphid resistant soybean varieties, especially those containing multiple resistance genes. Although seed-applied insecticides can lower the impact of an early soybean aphid outbreak, these insecticide treatments have a limited window of effectiveness following planting. An integrated approach, especially in areas where soybean aphids are known to cause problems, that includes soybean varieties with *Rag* resistance genes, seed treatments and scouting with careful insecticide use is best.

What Can Farmers Do For Long-Term Control of Aphids?:

Through the soybean checkoff, farmers in Iowa and across the Midwest have supported many years of basic and applied soybean aphid research. This support has contributed immensely to our understanding of soybean aphid biology and life cycles, biological and economic impacts on soybean growth and production, discovery and release of natural predators and parasitoids, and the discovery, characterization and out-licensing of soybean aphid resistance genes. Farmers should consider talking with their seed and technology providers in order to encourage them to continue breeding with resistance gene stacks and working to develop other integrated pest management solutions. Finally, farmers can continue to fund discovery and management solutions to control soybean aphids, especially in combinations with new cultural practices, like cover crops, and other insect pests and disease-causing pathogens.

In Summary:

Our understanding and management of soybean aphids has progressed at an impressive rate since their first appearance in Iowa and the Midwest approximately 17 years ago. However, like any organism in a biological system, soybean aphids can evolve, change and express diversity that can be selected for under any narrowly focused control strategy. Soybean checkoff, public and private funding for research & discovery and research & development have led to better understanding and effective pest management. At the same time, it is critical to maintain our investment in research and extension for this and all soybean pests.

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