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Kelley J. Tilmon
South Dakota State University

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SOYBEAN APHIDS in South Dakota

Figure 1. Soybean aphids infesting a young trifoliolate.
Photo by Roy Scott (SDSU)

Kelley J. Tilmon
Assistant Professor, Entomology

The soybean aphid (*Aphis glycines*) is native to Asia. It was first detected in the U.S. in 2000, and quickly became the dominant insect pest in soybean throughout the Midwest. Soybean aphids feed by sucking fluids from the plant. Populations have the potential to increase rapidly, and heavy infestations can stunt plant growth and development, leading to significant yield loss.

Through the cooperative research efforts of land-grant universities, a great deal has been learned about the soybean aphid since its introduction, and with good scouting and management practices producers can significantly lower the risks associated with this insect pest

BIOLOGY AND LIFE CYCLE

The soybean aphid, like many aphid species, has a complex life cycle that involves different morphs (body types) and two host plant species. Through most of their life cycle soybean aphids are parthenogenic, meaning that they don't need to mate to reproduce. All the aphids are female, and they give live birth to all-female offspring that are themselves only days away from being able to reproduce. These features give soybean aphids the ability to increase very rapidly when conditions are right.



Figure 2. Aphids range from yellow to pale green. Dark-tipped cornicles ("tailpipes") are found on the abdomens of adults. Note the female in the upper left giving live birth to another female. Photo by Roy Scott (SDSU)



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Soybean aphids spend the winter as eggs on buckthorn, a shrub common in shelterbelts and woods in northern states. Buckthorn is a critical part of the soybean aphid life cycle—without this plant, they cannot spend the winter in a given area. Soybean fields with buckthorn nearby are often the first to be colonized by aphids in the spring, and these fields should be scouted early.

Aphid eggs hatch on buckthorn around April and populations build there, producing winged spring migrants that eventually colonize nearby soybeans—the summer host of the aphid. These winged founder females produce wingless offspring that can go through many generations throughout the summer. When conditions become locally crowded, many of the wingless aphids will give birth to winged morphs, which then fly out to colonize other areas. At the end of the soybean growing season the aphids will produce both male and female fall migrants (the only sexual generation), which fly to buckthorn to mate and lay eggs, completing the life cycle.

MANAGEMENT

IMPORTANCE OF SCOUTING

Regular scouting is a very important component of soybean aphid management. Aphid population levels can vary greatly from field to field, even on the same farm; two neighbors' soybean aphid situations may be very different. Often, aphid numbers in a given field will stay low all season long, and the cost of inexpensive “insurance” treatments is not justified (and, in fact, can lead to other problems—see below). On the other hand, sometimes aphid populations that start low can reach damaging levels very quickly. The only way to know which is happening is to maintain a regular scouting program.

WHEN AND HOW TO SCOUT

In South Dakota, the first aphids usually appear in soybeans around the first week of June, though these early populations are small and only occur in isolated pockets during most of June. Aphids are much more likely to reach the economic threshold (see Fig. 7, page 3) in July or August, and this is the most important time to scout regularly. Start actively scouting fields around the first week of July, and continue weekly through the end of August. Once soybeans have reached the R6 growth stage (full seed, when a pod on one of the four top nodes has green seeds that fill the pod to capacity), research has not shown a reliable yield gain from insecticide treatment, regardless of aphid density.

When scouting for soybean aphids, walk a broad U or X pattern through the field and examine 20 to 30 plants total, spread out over the field. Aphids can occur in “hot spots,” so it’s important not to make your decision based on just one spot that doesn’t represent the field as a whole. Pick a plant at random and count aphids, starting at the bottom and working your way up. Soybean aphids don’t drop off easily, so you can pull the plant up for easier examination if you choose. Pay special attention to the undersides of the leaves and the newest vegetation. Early in the season, aphids tend to occur on the newest vegetation at the top of the plant. Late in the season, they are often concentrated



Figure 3. Common buckthorn (*Rhamnus cathartica*)—leaves have toothed edges and curved veins. Dark berries may be present in the fall.

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Kelley Tilmon (SDSU)



Figure 4. Winged and wingless morphs

Roy Scott (SDSU)

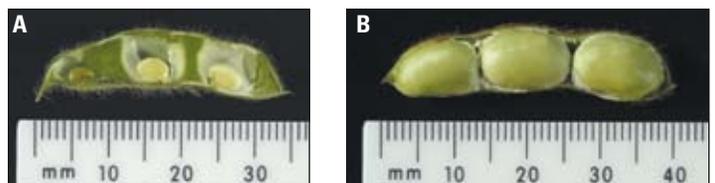
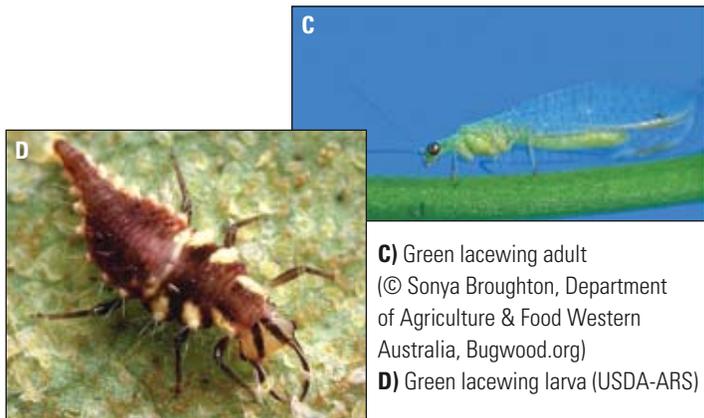


Figure 5. Soybean growth stages – **A)** Beginning seed (R5) – seeds are at least one-eighth-inch long in a pod from one of the top four nodes of the plant. The soybean aphid threshold applies through R5. **B)** Full seed (R6) – a pod on any of the top four nodes has seeds that fill the pod to capacity. By R6, there is no reliable yield gain from insecticide treatment. For more information about soybean growth stages, visit http://extension.agron.iastate.edu/soybean/production_growthstages.html. (Photographs used with permission from Iowa State University Extension publication Soybean Growth and Development (PM 1945), by Palle Pedersen.)

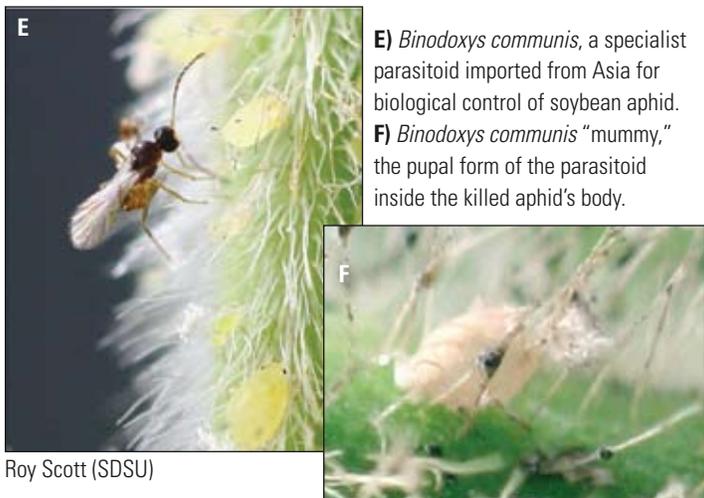


Figure 6. Many predatory insects help provide background suppression of soybean aphids. **A)** Asian ladybeetle adults range in color from pale orange-yellow to orange-red and vary greatly in the number of spots. A pattern of black dots resembling the letter “M” behind the head is typical. **B)** Asian ladybeetle larva (© Allen E. Knutson, Texas A&M University, Bugwood.org)

© Bill Ree, Texas A&M University, Bugwood.org



C) Green lacewing adult (© Sonya Broughton, Department of Agriculture & Food Western Australia, Bugwood.org)
D) Green lacewing larva (USDA-ARS)



E) *Binodoxys communis*, a specialist parasitoid imported from Asia for biological control of soybean aphid.
F) *Binodoxys communis* “mummy,” the pupal form of the parasitoid inside the killed aphid’s body.

Roy Scott (SDSU)

Roy Scott (SDSU)

in the lower canopy. Record counts and then either average the number of aphids/plant across all sampled plants, or determine if at least 80 percent of sampled plants are at or above the economic threshold. Producers who are near threshold should consider checking the field again before treatment (3–4 days after the initial treatment decision is made). If aphid numbers have decreased, or are still near the economic threshold and have not increased noticeably, or if many natural enemies such as ladybeetles are present, producers may wish to delay treatment, as populations can sometimes decline naturally before reaching damaging levels.

ECONOMIC THRESHOLD

The economic threshold for soybean aphids is an average of 250 aphids per plant throughout the field (not just in isolated hot spots), provided treatment can be made within seven days. This threshold is supported through the R5 growth stage (beginning seed).

This threshold is based on several years of extensive research at South Dakota State University and at the land-grant universities in Iowa, Mich., Minn., Neb., N.D., and Wisc. Though some producers may feel that to avoid damage they should treat before aphids reach an average of 250/plant, the needed safety factor is actually already built into the economic threshold. The economic injury level, where yield loss justifies the cost of treatment, is around 675 aphids/plant, on average. The economic threshold of 250 aphids/plant is the decision point to plan for treatment, in order to keep aphids from reaching (higher) damaging levels. The economic threshold has a time-to-treatment buffer (seven days) incorporated into it, based on the population growth rate of the insects under field conditions.

Figure 7. Definitions of economic injury level and economic threshold

Economic Injury Level (EIL) = pest population that causes economic damage
Economic Threshold (ET) = point at which an increasing pest population needs to be controlled to keep it from reaching the EIL...it considers the pest population growth rate and logistics of insecticide application

OTHER FACTORS TO CONSIDER

Various environmental factors can influence soybean aphid populations. For example, aphid populations tend to not increase as quickly at high temperatures (consistently high daytime temperatures above 90°), though when temperatures cool they can resume fast growth. Also, very heavy rains can sometimes knock aphid populations down, by literally knocking them off the plants, reducing populations—though this effect is usually temporary. And natural enemies—the predators, parasites, and diseases of soybean aphids—also play a large role in general background suppression of aphids in many cases. Research is underway to better understand these factors and how they might play into management decisions.

Producers should avoid the temptation to apply prophylactic (insurance) treatments to sub-threshold soybean aphid populations, even when the products are inexpensive or a free re-application is guaranteed. Prophylactic spraying is not only an

unnecessary cost, but actually has the potential to cause outbreaks of other pests such as spider mites—a particular worry under dry/hot conditions—and may even worsen aphid problems. This is due in large part to the pesticide killing natural enemies that help provide significant background control. Prophylactic application of fungicides to soybean is also not recommended, because these products also kill the beneficial entomopathogenic (insect-killing) fungi that are shown to help keep soybean aphids and spider mites in check.

Tank-mixing a soybean aphid insecticide treatment with a glyphosate application is not a good approach. One reason is that glyphosate is typically applied when weeds are small in early summer, whereas soybean aphid treatment is seldom needed until mid-July through mid-August, after the residual of the first application has worn off. Further, an early-season application has the potential to create soybean aphid problems where none would have existed otherwise, by killing off natural enemies. Another reason to avoid tank mixes with soybean aphid insecticide and glyphosate is that the optimum droplet size and pressure are different for the two products. Optimal conditions for glyphosate application (large droplets and decreased pressure) will result in poor insecticide application (which typically requires higher pressure and volume and smaller droplets).

REGISTERED PESTICIDES

These are some of the insecticides labeled for control of soybean aphid. Be sure to check current labels for product uses and restrictions, and follow all label directions. Product brands

Figure 8. Some insecticides labeled for control of soybean aphid

Product	Compound	Class	Preharvest Interval (Days)
Asana XL*	esfenvalerate	pyrethroid	21
Baythroid 2*	cyfluthrin	pyrethroid	45
Dimethoate	dimethoate	organophosphate	21
Lorsban 4E*	chlorpyrifos	organophosphate	28
Mustang*	zeta-cypermethrin	pyrethroid	21
Mustang Max*	zeta-cypermethrin	pyrethroid	21
Nufos 4E*	Chlorpyrifos	organophosphate	28
PennCap-M*	methyl parathion	organophosphate	20
Pounce 3.2EC*	permethrin	pyrethroid	60
Proaxis*	gamma-cyhalothrin	pyrethroid	30
Warrior*	lambda-cyhalothrin	pyrethroid	30

*Restricted-use insecticide

are listed only for reader convenience and are not intended as endorsement.

OTHER SOURCES

More information about the soybean aphid and other pests of soybean can be found at <http://www.planthealth.info/> and at <http://www.soybeans.umn.edu/crop/insects/aphid/aphid.htm>.

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