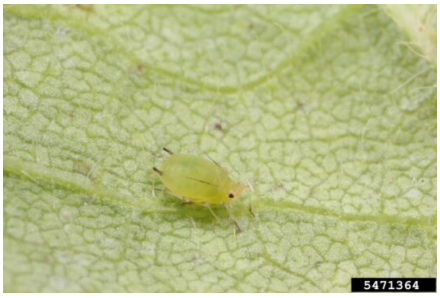
SOYBEAN APHID

Soybean Pests





Overview

The soybean aphid (*Aphis glycines*), is a native of Asia and was first documented in North

America in Wisconsin in July 2000. Since then, it has spread to nearly all soybean producing states. The highest risk for economic yield loss occurs in Illinois, Indiana, Iowa, Michigan, Minnesota, New York, Pennsylvania, Wisconsin, and Ontario, Canada, where cooler temperatures favor aphid development.

The soybean aphid feeds using sucking, needle-like mouthparts to extract plant juices. If aphids are present in large numbers, this feeding may cause a reduction in plant vigor and growth rates, as well as leaf puckering, reduced pod/seed counts, and ultimately reduced yield.

The risk of yield loss is greatest when aphid populations peak during the R1-to-R4 growth stages. During these stages, blooms and young pods are most susceptible to stress. Damage from aphid feeding also increases when growing conditions are less than optimum.

Aphid honeydew, produced as a waste product during feeding, promotes the development of sooty mold on leaf surfaces, which reduces the photosynthetic activity of the leaves and ultimately yield.

Although infestations can be sporadic and unpredictable, this aphid has demonstrated the capacity to cause significant yield loss if not properly managed. Minor yield loss first starts to justify the cost of treatment at about 650 aphids/plant, with yield loss increasing with increasing numbers of aphids above this level.

Aphids can transmit soybean viruses
A separate issue from the direct damage caused by aphid feeding is their ability to spread virus diseases, such as soybean mosaic virus, from plant to plant as they feed.

Virus infection that occurs in early growth stages presents the greatest risk of yield loss and reduced seed quality, compared to infection later in the season.

Life Cycle

The soybean aphid has a complicated life cycle that is completed on two very different plant species: soybean and the common buckthorn tree (*Rhamnus cathartica*).

Winter

Soybean aphids overwinter as eggs on buckthorn. In the early spring, two wingless generations are produced, followed by a winged generation that leaves the buckthorn and flies in search of soybean.

Although winged aphids are not strong flyers, they can move long distances by gliding

passively along wind currents. Spring migration usually occurs during soybean emergence. Soybeans located near buckthorn stands are more likely to get colonized by spring migrants.

Summer

During summer, the aphid population on soybean consists of females that give birth to live young females. These female nymphs mature in 5-7 days and begin producing their own young. Cycles of live births can result in up to 15 generations per season. Under favorable conditions, populations can double in just a few days. Daily temperature is a good predictor as to how quickly aphid populations increase. Population growth will be fastest at daytime temperatures between 75-80°F. Population growth will slow, stop, and may even decrease when temperatures are hot (greater than 90°F). This temperature effect explains why the aphid is not normally a production problem in southern growing regions.

The female nymphs do not have wings, but can produce winged aphids when conditions become crowded. Winged aphids may stay in the same field, fly to nearby fields, or migrate longer distances up to 6 miles per day.

Late summer and fall flight

In late summer, aphids mature into winged females and migrate back to buckthorn. They mate with winged males (the only time males are present) and lay eggs.

Scouting

Identification

Soybean aphids are small (< 1/16 inches), yellow-bodied insects with distinct black cornicles (sometimes referred to as “tailpipes”) at the end of the abdomen (Figure 1). They may be either winged or wingless.

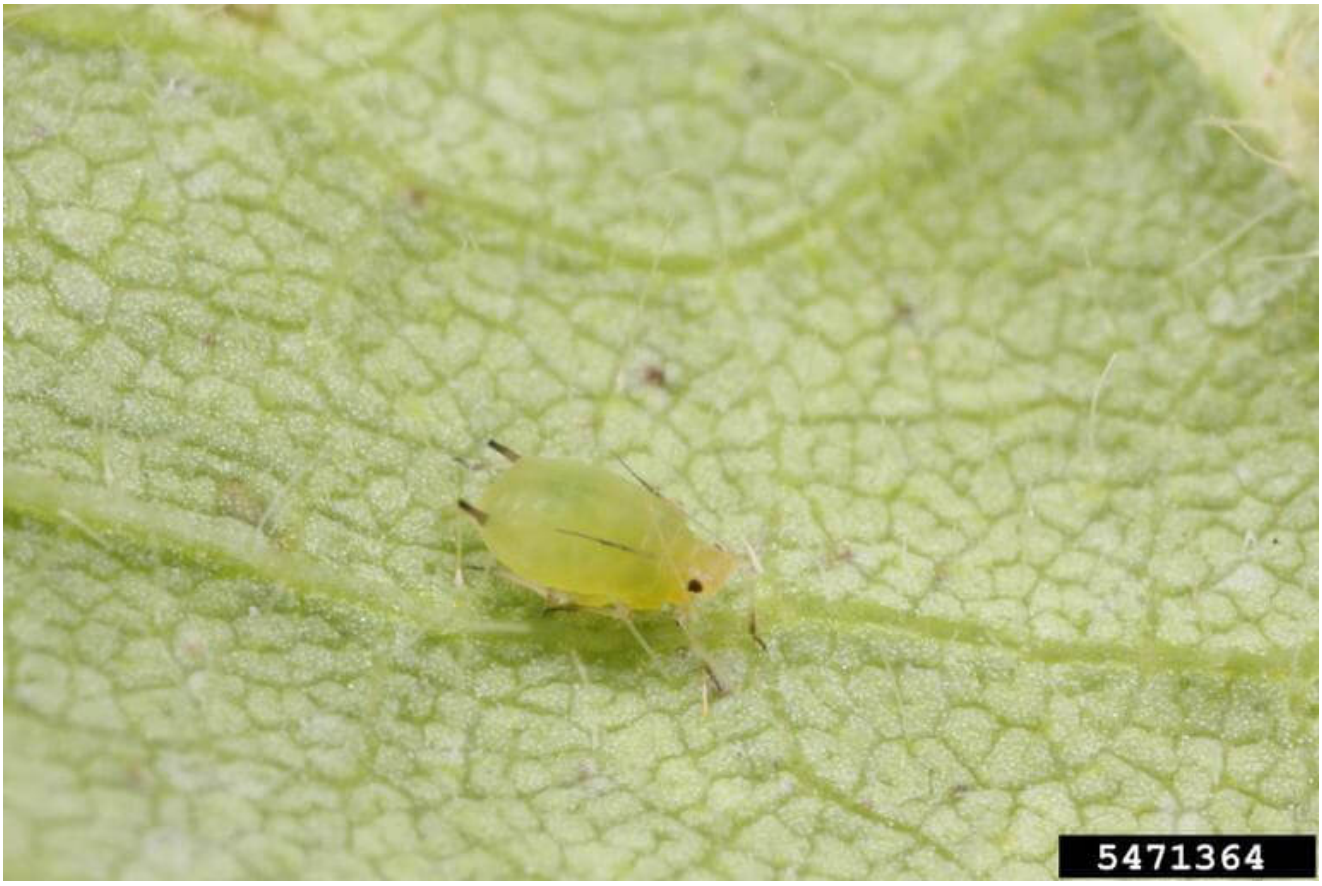


Figure 1. Soybean aphid wingless adult. Photo courtesy of IPMImages.org

Sampling Method

The soybean aphid is the only aphid in North America that will develop large, persistent colonies on soybean. However, other common soybean insects may be confused with soybean aphid, so it is important to correctly identify soybean aphid to prevent unnecessary insecticide applications.

Early-season scouting (May through mid-July) should focus on fields that have histories of early colonization by soybean aphids, particularly early-planted fields and fields near buckthorn, the overwintering host of soybean aphid.

More fields should be scouted as soybean aphid populations develop throughout the growing season and plants begin to enter reproductive stages. There may not be a need to visit every field every week, but enough fields should be checked to detect increasing aphid populations that require weekly sampling.

Aphid sampling consists of whole-plant counts of affected plants with a threshold of 250 aphids/plant on 80% of the scouted plants. Count 20-30 plants/field and be sure to sample

the entire field. Focus your counts on the undersides of leaves initially, though aphids will spread throughout the canopy when populations grow. When counting aphids, remember that soybean aphids colonizing the stem of the plant are an indicator of populations in excess of 400 aphids/plant (i.e. over threshold).

Take note of the presence of winged aphids, high predator activity, and/or diseased aphids. There are several beneficial organisms that act to regulate soybean aphid populations to varying degrees. These include Asian ladybird beetles and minute pirate bugs, and their presence should be noted when scouting a soybean field as well. These are all signs that the population may be in decline and/or may leave the field shortly. Scout these same fields again within a few days to note if populations are increasing or decreasing.

Management

Do not adjust the 250 aphids per plant threshold downward. It was created in the presence of damage by other insects, like Japanese beetles and bean leaf beetles, so it doesn't need to be adjusted for other pests. It was created with data taken during the biggest aphid outbreak years, so it doesn't have to be adjusted just because the current year is a "big aphid year."

The 250 threshold gives you five to seven days lead time to take action, or even to see populations drop from fungal infection or a heavy rain. Most critical, 250 is below the damage boundary – the lowest point where yield loss is detected. Experience shows that about 400 to 500 aphids per plant are needed before yield loss can even be detected by a yield monitor or in research trials. Minor yield loss first starts to justify the cost of treatment at about 650 aphids/plant, with yield loss increasing with increasing numbers of aphids above this level. In the time since the establishment of economic thresholds for soybean aphid, university-based research has continued to reconfirm the economic threshold and the relationship between aphid populations and crop loss. Although crop and input prices continue to increase, no consistent economic gain can be found with a reduced economic threshold for soybean aphid.

General Management Guidelines

- Look for the presence of aphid natural enemies such as lady beetles, green lacewings, insidious flower bugs, aphid mummies, fuzzy aphids, and other insect predators. Predators and parasitoids may keep low or moderate aphid populations in check. Often soybean aphids can be found by examining plants where lady beetles are observed.
- Take note of winged aphids or "broad-shouldered" nymphs. Nymphs with broad or

squared- off shoulders will become winged adults. A magnifying glass is helpful to see the “broad-shouldered” nymphs, but the winged adults are easy to see with the naked eye. If the majority of aphids are winged or developing wings, the aphids may soon leave the field and treatment can be avoided.

- If the plants are stunted or covered with honeydew or sooty mold and aphids are present at threshold levels, an insecticide treatment may still be of value, but the optimum time for treatment has passed.
- Good insecticide coverage and penetration is required for optimal control of soybean aphid because aphids feed on the undersides of the leaves and within the canopy. For ground application use high water volume (?15 gallons/acre) and pressure (?30 psi). Aerial application works well when high water volume is used (?3 gallons/acre).
- Several insecticides are labeled for soybean aphid. Pyrethroids have a relatively long residual, and work best at temperatures below 90° Organophosphates have a fuming action, and may work well in heavy canopies or high temperatures. The 250 threshold has worked well in R1 (beginning bloom) through R5 (beginning seed) soybeans. Spraying at or beyond R6 has not been documented to increase yield. Rotating modes of action should help delay the development of insecticide resistance.
- Spraying flowering soybean (R1 – R2) poses a threat to honey bees. Communicate treatment plans to nearby beekeepers and follow label precautions to minimize honey bee kills. When there is concern about honey bees, pyrethroids are the better insecticide choice and spraying late in the day is preferred.
- Use of insecticides for aphid management can have a negative effect on the beneficial insects in a field. Flare-ups of other pest problems, especially spider mites, may occur.

For current recommended insecticide treatments and rates, check with your state Extension office. Always read and follow label directions. Managing Aphids

Host Plant Resistance

Plant resistance is another soybean aphid management strategy. Certain soybean cultivars have genetic qualities that prevent them from being heavily damaged by the soybean aphid when compared to other soybean cultivars. These varieties use the *Rag* genes. Soybean aphids feeding on varieties with this resistance reproduce at a drastically slower rate and are less healthy. However, the soybean aphid can circumvent this resistance. Resistance has been documented to some of the earliest deployed genes (e.g., Rag1) in eastern states.

In light of this, growers should not rely on a single method of pest management and should continue to scout fields thought to be resistant.

These recommendations are the cooperative effort of researchers throughout the North Central states, funded with soybean checkoff dollars through the North Central Soybean Research Program and other state checkoff programs.

Biological Control

Aphids are slow-moving, succulent, and generally poorly protected from predators. Therefore, they have many natural enemies. The soybean aphid is only a sporadic pest in most of it's native range in China, Japan, and Korea because of the presence of parasites and predators that keep them in check.

The soybean aphid would be a far more damaging pest were it not for naturally-occurring biological control. For example, in a recent study of 22 locations in the north central region, more than 50% of aphid-infested fields were kept below threshold level by predators.

Even though the soybean aphid is a recently-identified pest in North America, aphid predators and parasites are already present in soybean fields and have the ability to delay or prevent severe outbreaks.

Strategies to maximize biological control
Entomologists are working on a multi-pronged approach to maximize the impact of biological control in soybean fields, including:

- **Importation of specialist natural enemies** to augment resident natural enemy populations. This is called "classical biological control", in which the native range of an introduced pest is explored to identify natural enemies for importation into the United States. A major advantage of this form of biological control is that once it is established, it is free of charge to growers.
- **Implementing ways to maximizing the effectiveness of natural enemies already present,** by maintaining a favorable environment for beneficials and considering the abundance of natural enemies in treatment decision-making. Read more about conserving natural enemies»
- **Integrating biological control with other management strategies.** Treatment thresholds may need adjusting to account for the contribution of host resistance and beneficials.

Resources

Biological Control of Insects and Mites: An introduction to beneficial natural enemies and their use in pest management
University of Wisconsin Cooperative Extension Publication A3842, 2018
https://learningstore.uwex.edu/Biological-Control-of-Insects-and-Mites-An-Introduction-to-Beneficial-Natural-Enemies-and-Their-Use-in-Pest-Management-P1392.aspx

Biology and Economics of Recommendations for Insecticide-Based Management of

Soybean Aphid
Plant Health Progress, 2016
https://soybeanresearchinfo.com/wp-content/uploads/2019/03/PHP-RV-16-0061.pdf

Biology of the soybean aphid, Aphis glycines, in the United States
Journal of Integrated Pest Management, 2011
https://soybeanresearchinfo.com/wp-content/uploads/2019/03/SBA_biology_Tilmon2012.pdf

Economic threshold for soybean aphid
Journal of Economic Entomology 100:1258-67, 2007
https://soybeanresearchinfo.com/wp-content/uploads/2019/03/Aphid_economicthreshold.pdf

The Effectiveness of Neonicotinoid Seed Treatments in Soybean
Purdue University, 2016
https://www.edustore.purdue.edu/item.asp?Item_Number=E-268-W#.VpAR51J7gxI

Evidence for Soybean Aphid (Hemiptera: Aphididae) Resistance to Pyrethroid Insecticides in the Upper Midwestern United States
Journal of Economic Entomology, 2017 (abstract)
https://www.ncbi.nlm.nih.gov/pubmed/28961778

Host Plant Resistance for Soybean Aphid
Erin Hodgeson, Iowa State University, 2014
http://www.plantmanagementnetwork.org/edcenter/seminars/soybean/HostPlantResistance/

Management of Insecticide-resistant Soybean Aphids
University of Minnesota Extension, Iowa State University Extension, North Dakota State University Extension, South Dakota State University Extension, 2018
https://www.ag.ndsu.edu/publications/crops/management-of-insecticide-resistant-soybean-aphids/e1878.pdf

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Management Recommendations for Soybean Aphid in the United States
Journal of Integrated Pest Management, 2012
https://soybeanresearchinfo.com/wp-content/uploads/2019/03/SBA_mgmt_Hodgson_2012.pdf

Measuring the Benefit of Biological Control for Single Gene and Pyramided Host Plant Resistance for Aphis glycines Management

Journal of Economic Entomology, 2012
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One Gene Versus Two: A Regional Study on the Efficacy of Single Gene Versus Pyramided Resistance for Soybean Aphid Management.
Journal of Economic Entomology, 2014
https://www.ncbi.nlm.nih.gov/pubmed/28961778

Scouting for Soybean Aphid
University of Minnesota, 2015
https://soybeanresearchinfo.com/wp-content/uploads/2019/03/sba_scouting.pdf

Scouting Soybean Aphids
University of Wisconsin, 2013
https://www.youtube.com/watch?v=gZTzbroDnws

Soybean Aphid
Northern Plains IPM Guide, 2016
https://wiki.bugwood.org/NPIPM:Aphis_glycines_(soybean)

Update on Soybean Aphid Biological Control
Thelma Heidel-Baker, Iowa State University, 2014
http://www.plantmanagementnetwork.org/edcenter/seminars/soybean/BiologicalControl/

Soybean Aphid Field Guide, 2nd edition
North Central Soybean Research Program, Minnesota Soybean Promotion Board, and Iowa State University Extension, 2018
https://store.extension.iastate.edu/product/12817

Soybean Aphid Management Using Neonicotinoid-Treated Seed
Christian Krupke, Purdue University, 2014
http://www.plantmanagementnetwork.org/edcenter/seminars/soybean/NeonicotinoidTreatedSeed/

A Visual Guide to Counting Soybean Aphid
North Central Soybean Research Program, 2014
https://soybeanresearchinfo.com/wp-content/uploads/2019/03/SBA-Count-Card.pdf

Visual Guide to the Number of Soybean Aphids per Leaflet
University of Wisconsin
https://soybeanresearchinfo.com/wp-content/uploads/2019/03/aphid_visual.pdf

SOYBEAN RESEARCH & INFORMATION NETWORK

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