

## Soybean Aphids in South Dakota

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### Introduction

In South Dakota, soybean aphids, *Aphis glycines* Matsumura (Hemiptera: Aphididae), have been a serious pest of soybean since 2000<sup>1</sup>. Although soybean aphids are native to Asia, they successfully established populations in North America and are now found in 23 U.S. states and three Canadian provinces<sup>1</sup>. Since their discovery in the U.S., soybean aphids quickly became the most economically damaging soybean insect pest present in the Midwest and Great Plains. During soybean aphid outbreaks, heavily infested soybean fields may exhibit yield losses of approximately 40%<sup>1</sup>. As a result of the economic threat posed by soybean aphids, an extensive amount of research has been conducted to evaluate management strategies to prevent population outbreaks.

Much of the existing research has demonstrated that successful soybean aphid management stems from a well implemented scouting and management plan. Although soybean aphid management is still heavily reliant on the use of foliar, broad-spectrum insecticides, host plant resistance is available and effective<sup>1-3</sup>.



Figure 1. Apterous (wingless) soybean aphid nymphs and adults. Photo courtesy of Adam Varenhorst.

### Biology of Soybean Aphids

**Description.** Adult apterous<sup>a</sup> (wingless) soybean aphids are small (1/16th of an inch long), pear or teardrop-shaped insects. Soybean aphids are yellow to pale green with black tipped cornicles<sup>b</sup> (tailpipes) present on the dorsal<sup>c</sup> (backside) side of their abdomens (Fig. 1)<sup>1,4</sup>. As the summer progresses, soybean aphids that are much smaller and paler in appearance (nearly white in color) may be observed on soybean, especially on undersides of older leaves in the canopy. Throughout the growing season, both apterous and alated (winged) soybean aphids may be observed on soybean. Alate soybean aphids differ in appearance from their apterous counterparts. An alate soybean aphid will have a dark brown to black head and thorax and two pairs of translucent wings (Fig. 2)<sup>1</sup>. The wings are held over the abdomen in a tent-like manner. Although not commonly observed without using magnification, soybean aphids feed using a stylet (piercing-sucking mouthpart) that is held under their bodies when at rest<sup>4</sup>.

Soybean aphids may be present on the undersides



Figure 2. Alate (winged) soybean aphid. Photo courtesy of Adam Varenhorst.

of leaves, topsides of leaves, or on the stems. The colonies may be small with only a few soybean aphids per plant, or they may be large with thousands of soybean aphids per plant. Soybean that are heavily infested by soybean aphids will begin to change appearance as the exposure to the soybean aphids increases<sup>4</sup>. Heavily infested soybean plants will begin to show symptoms of drought stress and may have a darkened hue due to the growth of sooty mold (Fig. 3).

**Life Cycle.** Like many other species of aphids, soybean aphids have a complex life cycle. During their life cycle, soybean aphids utilize two different host plants. The primary host for soybean aphids is buckthorn (Fig. 4) and the secondary host is soybean. During the growing season, soybean aphids live on soybean where they reproduce asexually (without mating) producing clonal populations (populations that are nearly identical to the founder aphid). In addition, asexually reproducing soybean aphids give live birth to nymphs. The new nymphs will be able to reproduce within a few days, which allows for rapid population growth. During optimal weather conditions, soybean aphids can double their populations every 6-7 days<sup>5</sup>. On soybean, alate soybean aphids are produced when plant health begins to decline and populations become very large<sup>1</sup>. Although they are not particularly strong fliers, alate soybean aphids are able to travel as far as 225 miles by wind<sup>6</sup>.

In the fall, soybean aphids leave soybean and seek buckthorn; their primary host. To accomplish this, soybean aphids produce both male and female individuals that will search for buckthorn plants. Once on buckthorn, the male and female soybean aphids mate and the females will lay eggs on the buds of

the buckthorn plant. Soybean aphid eggs are able to withstand air temperatures down to -29° Fahrenheit. If temperatures are colder than that, ice crystals will form and destroy the viability of the eggs<sup>7</sup>. In the spring, the eggs will hatch and 2-3 generations of soybean aphids will live on the buckthorn host. In May to June, soybean aphids will leave buckthorn in search of soybean. During the summer, as many as 15 generations of soybean aphids have been observed on soybean<sup>1</sup>.

## Feeding and Injury to Soybean

Soybean aphids feed on soybean by using their piercing-sucking mouthparts. These mouthparts allow them to pierce plant tissues and feed on the soybean phloem. Typically, soybean aphids feed on the underside of leaves but they are capable of feeding on any part of the plant. Often, when soybean aphid populations are below the economic threshold, small colonies will be observed on the newest vegetative growth. As populations grow, soybean aphids will be found on the stems and, during severe infestations, on the tops of the leaves.

Small populations of soybean aphids have negligible impacts on soybean health and vigor. However, large populations can overwhelm the soybean plant and reduce vegetative growth as well as hinder pod and seed development. As mentioned previously, this can reduce yields by as much as 40%<sup>1</sup>. In addition, the honeydew (sugary byproduct) that the soybean aphids produce encourages the growth of sooty mold, which can further reduce the photosynthetic capacity of soybean. Soybean aphids are also known to transmit viruses to soybean, which include *Soybean mosaic virus* and *Alfalfa mosaic virus*. However, in South



Figure 3. Sooty mold growth on soybean leaf. Photo courtesy of Christina DiFonzo, Michigan State University, Bugwood.org.



Figure 4. European buckthorn (*Rhamnus cathartica*). Photo courtesy of Richard Webb, Bugwood.org.



Dakota, the transmitted viruses are less of a concern than the soybean aphid populations in terms of yield impact.

## Management

**Scouting.** Effective soybean aphid management relies on routine scouting to avoid population outbreaks. Because soybean aphid populations can reach economically damaging levels very quickly, it is important to evaluate fields on a weekly basis from June through August. Soybean aphid populations can vary dramatically between fields and even within a field, making it important to evaluate each field individually and multiple areas within each field.

When scouting for soybean aphids, it is important to cover as much of the field as possible. To do this, soybean plants should be scouted by walking the entire field in a “W” or “Z” pattern. On each leg of the scouting pattern, 20-30 plants should be examined for the presence of soybean aphids. Plant examinations should begin at the base of the plant and move toward the top. Each leaf should be examined as well as the stem. Often, the presence of ants (Fig. 5) or lady beetles on the soybean plant can be an indication of nearby soybean aphid colonies. Ants will protect aphids from predators and collect the honeydew that is produced by the soybean aphids<sup>8</sup>.

If soybean aphids are present, they should be counted to determine the population level. It is important to note that if swollen soybean aphids (Fig. 6) or black soybean aphids (Fig. 7) are observed, they are actually parasitized soybean aphids and should not be counted. If soybean aphids are present, the field should be re-evaluated within seven days. If the populations

were near the economic threshold, the field should be re-evaluated within three to four days. This will prevent soybean aphid populations from greatly exceeding the economic threshold and also prevent an unnecessary insecticide application. In some cases, soybean aphid populations naturally decline due to unfavorable weather conditions, natural enemies, or entomopathogenic<sup>f</sup> fungi<sup>l</sup> (insect fungal disease).

Scouting worksheets and mobile applications exist to help speed up the process and assist with recordkeeping.

**Economic Threshold.** The economic threshold for soybean aphids is a field average of 250 soybean aphids per plant with at least 80% of the scouted plants being infested. When the economic threshold is reached, it is recommended that insecticide management occurs within five days. This threshold applies to vegetative soybean through the R5 growth stage. When soybean reach R6 (full seed, pods on one of the top four nodes has green seeds that fill the pod



Figure 6. Tan soybean aphid mummy.  
Photo courtesy of Adam Varenhorst



Figure 5. Ant tending soybean aphids.  
Photo courtesy of Adam Varenhorst.



Figure 7. Black soybean aphid mummies.  
Photo courtesy of Adam Varenhorst.

to capacity) the observed yield loss due to soybean aphids is greatly reduced. Although there may be a desire to reduce the economic threshold to populations below 250 aphids per plant, there is extensive research that indicates that it is not profitable<sup>1</sup>.

## Evaluating Management Success

If soybean aphid populations are treated using foliar insecticides, the fields should be re-scouted within seven days to ensure that soybean aphid populations were reduced. If soybean aphid populations persist, a second foliar application may be necessary. It is crucial that the insecticide selected for the second application belongs to a different insecticide class with a different mode of action. This will reduce the likelihood for insecticide resistance to develop.

Soybean aphid populations that are resistant to pyrethroid insecticides exist in South Dakota and neighboring states. Because of their rapid lifecycle and ability to produce clones, it is important to report populations that are suspected to be resistant to pyrethroids and other classes of insecticide. Due to these resistant populations, we also recommend avoiding insecticides with the lambda-cyhalothrin or bifenthrin active ingredients.

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## Entomological or Related Terms

<sup>a</sup> Apterous- Wingless form.

<sup>b</sup> Cornicles- Appendages present on the abdomen of soybean aphids.

<sup>c</sup> Dorsal- Referring to the back of the aphids.

<sup>d</sup> Alate- Winged form.

<sup>e</sup> Stylet- Piercing-sucking mouthpart.

<sup>f</sup> Entomopathogenic- Greek origin entomon, refers to insect, and pathogenic, which denotes causing disease.