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Soybean APHID FIELD GUIDE

2nd Edition

A visual aid for identifying, sampling and managing soybean aphid

Since 2000, soybean aphid has become the primary soybean insect pest in Iowa. This insect can cause significant injury and economic loss if left untreated. This publication reviews what is currently known about soybean aphid and suggests management strategies to protect yield.

Erin Hodgson and Matt O'Neal

Aphis glycines, *the soybean aphid*

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This publication is the result of a cooperative effort between the Iowa Soybean Association and the College of Agriculture and Life Sciences and Extension at Iowa State University.

Note: Information in this guide may be specific to Iowa. Those from outside Iowa should check with their state extension service for local information.

Soybean Growth Stages

Several growth stages can overlap within a soybean field. A growth stage begins when the majority (50 percent or more) of the plants in a field are at or beyond that stage.

Vegetative stages

VE: Emergence
VC: Unrolled unifoliolate leaves
V1: First unrolled trifoliolate leaf
V2: Second unrolled trifoliolate leaf
V(n): n-th unrolled trifoliolate leaf

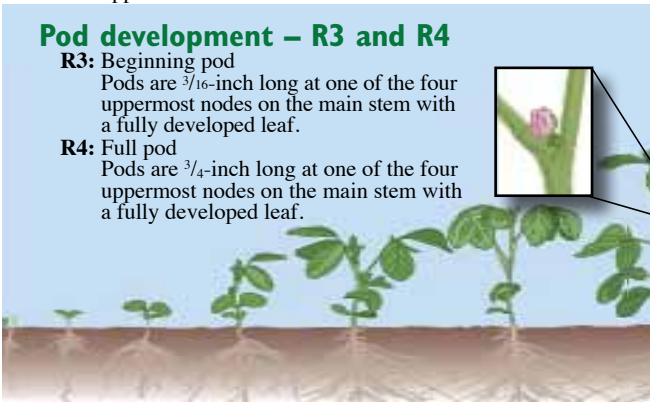
Reproductive stages

Bloom – R1 and R2

R1: Beginning bloom
Plants have at least one open flower at any node.
R2: Full bloom
Plants have an open flower at one of the two uppermost nodes on the main stem.

Pod development – R3 and R4

R3: Beginning pod
Pods are $^{3}/_{16}$-inch long at one of the four uppermost nodes on the main stem with a fully developed leaf.
R4: Full pod
Pods are $^{3}/_{4}$-inch long at one of the four uppermost nodes on the main stem with a fully developed leaf.



VE	VC	V1	V2	V3	

Seed development – R5 and R6

R5: Beginning seed
Seeds are $^1/_8$-inch long in the pod at one of the four uppermost nodes on the main stem.

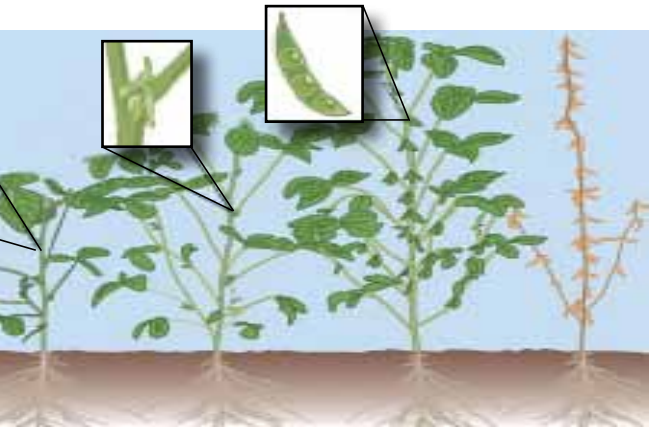
R5.5: Seeds are more than $^1/_8$-inch long, but not fully expanded in the pod.

R6: Full seed
Pods contain green seeds that fill the pod to capacity at one of the four uppermost nodes on the main stem.

Maturity – R7 and R8

R7: Beginning maturity
One pod on the main stem has reached its mature color (tan or brown).

R8: Full maturity
Ninety-five percent of the pods have reached their mature pod color.



R1	R3	R5	R8

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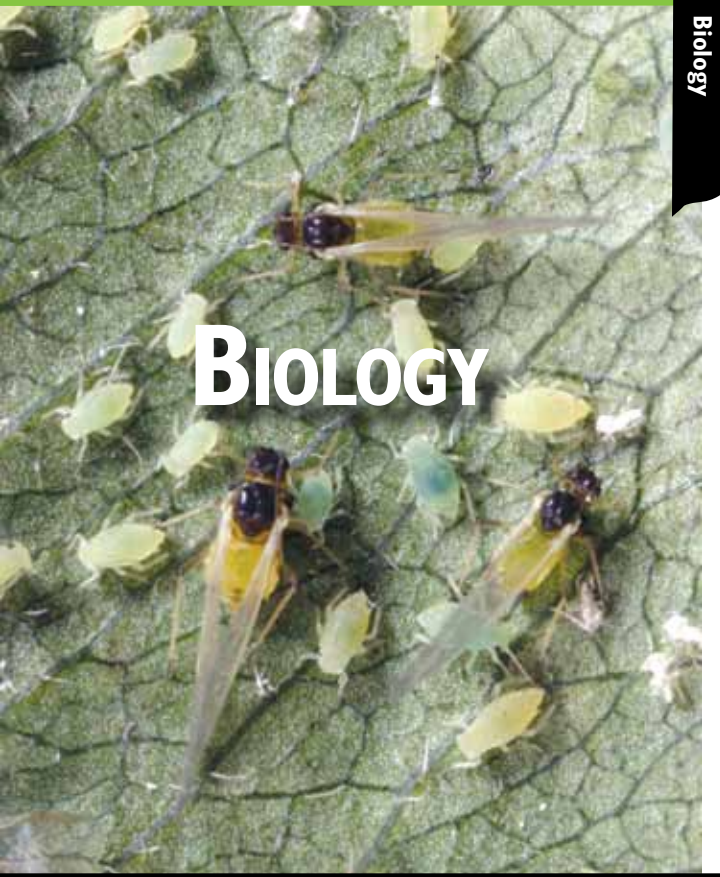
Growth stage R5.5

The soybean growth stage R5.5 occurs midway between R5 and R6 and is an important stage in soybean development. During this period, fixation of nitrogen peaks and then quickly declines. Leaf area, plant height and node number reach maximum levels, and nutrients and dry weight begin to relocate to developing seeds from leaves, petioles and stems.

Research suggests this period also marks the cutoff when an application of insecticide for aphid control typically will not be economically beneficial.

Seed development stages of soybean

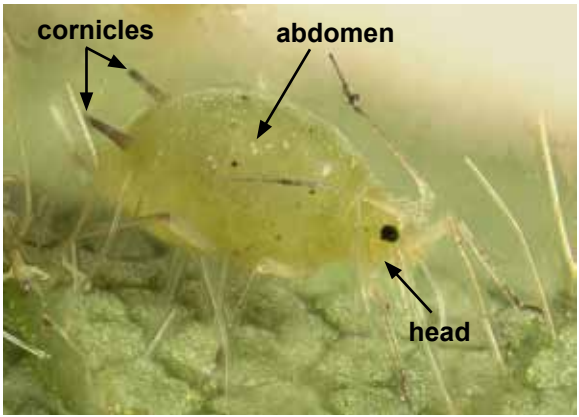
Biology



Soybean aphid has become the primary insect pest in Iowa soybean production. If left untreated, this insect can cause considerable yield loss to soybean, especially during years when drought and other stresses occur.

Description

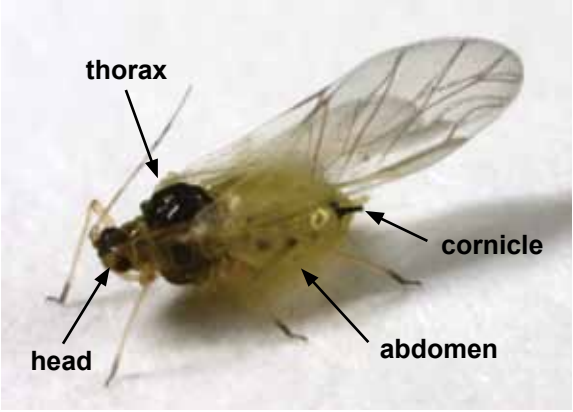
The soybean aphid, *Aphis glycines*, is the only aphid in North America that will develop large, persistent colonies on soybean. However, other common soybean arthropods may be confused with soybean aphid (see pages 50-52), so it is important to correctly identify soybean aphid to prevent unnecessary insecticide applications. As with most aphids, there are wingless and winged forms. Wingless soybean aphid adults are pear-shaped, about $^{1}/_{16}$-inch long, pale yellow or green and have dark cornicles or "tail pipes" near the end of the abdomen.



Wingless soybean aphid showing head, abdomen and cornicles.

Description

The winged form has a shiny black head and thorax with a dark green abdomen and black cornicles. Immature soybean aphids, or nymphs, go through four molts before reaching the adult stage. Nymphs shed white, cast skins on leaves and stems with each molt. Aphids feed on plant sap in the phloem through a piercing-sucking stylet that is tucked under the body while not feeding.



Winged soybean aphid anatomy showing head, thorax, abdomen and one of the cornicles.

Life History

Soybean aphid is native to eastern Asia, where it is an infrequent soybean pest. It was first detected in North America in Wisconsin in July 2000 and now occurs throughout the North Central United States and southern Canada. It is not known how this insect entered the United States, but historical records of other aphid interceptions by the United States Department of Agriculture suggest soybean aphid was most likely accidentally introduced.

Soybean aphid is now a major pest for soybean growers. In some years, aphid populations have exceeded several thousand aphids per plant.

Soybean aphid colony with winged and wingless aphids.

Host Plants

The primary host for soybean aphid is buckthorn (*Rhamnus* spp.), a small, woody shrub. It is considered the primary host because this is where soybean aphids sexually reproduce and overwinter. Buckthorn has egg-shaped leaves that are pointed at the tip and have a dark, smooth leaf surface. The leaf has finely toothed edges and three to five pairs of curved leaf veins. Mature buckthorn produces large, round berry clusters. The leaves and black berries persist into the fall.

Buckthorn is very common in wooded areas and river bottoms, and is used as windbreaks or even as an ornamental.

Host Plants

Eliminating buckthorn may reduce local overwintering soybean aphid populations, but this is impractical because winged aphids can migrate from other counties or states to infest soybean fields.

Buckthorn leaves with soybean aphids

Two soybean aphid eggs on buckthorn

Host Plants

Soybean is the most important secondary host for soybean aphid in the United States. Less important secondary, or summer, hosts include various types of clover. Secondary hosts will generally support many overlapping asexual generations of soybean aphid.

List of secondary host plants for soybean aphid in Iowa

Common name	Scientific name	Suitability
Soybean	*Glycine max*	++++
Crimson clover	*Trifolium incarnatum*	+++
Red clover	*Trifolium pratense*	+++
Berseem clover	*Trifolium alexandrium*	++
Kura clover	*Trifolium ambiguum*	++
White clover	*Trifolium repens*	+
White sweet clover	*Melilotus alba*	+
Yellow sweet clover	*Melilotus officinalis*	+

++++ = preferred host; +++ = suitable host; ++ = acceptable; + = poor host

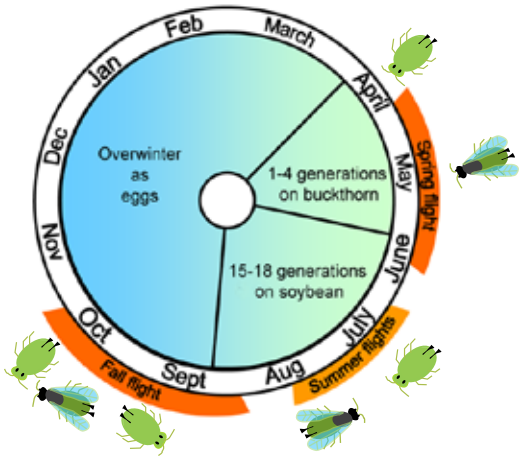
Life cycle

The seasonal cycle of soybean aphid is complex. Eggs are laid on buckthorn in the fall and are the overwintering, cold-hardy stage. Wingless, asexual females (sometimes called stem mothers) hatch in the spring when buckthorn buds burst. Stem mothers give live birth to several generations of asexual clones on newly expanded leaves. A winged generation is then produced and capable of flight to soybean. In general, aphids are considered weak flyers, but can move long distances (between counties or states) on air streams.

Winged aphids land on soybean and produce nymphs that begin new colonies. Small colonies of aphids occasionally are found from late May to mid June on early vegetative plants. It may take these early colonizing aphids several weeks to spread across a field. Fifteen to 18 generations of aphid can be produced on soybeans each year. Based on food availability and quality, the presence of natural enemies and crowding, soybean aphid will produce flushes of winged forms throughout the season. Migratory aphids produced in the summer can cause late-season infestations.

The optimum temperature range for reproduction and longevity is 72 to 77°F with relative humidity below 78 percent. The wingless forms are highly reproductive, generating five to eight nymphs a day. Field-based estimates of soybean aphid population growth

Life cycle



Soybean Aphid Life Cycle

suggest a colony can double in size every three to five days under optimal growing conditions. When temperatures exceed 81°F, the developmental time is lengthened; at 95°F, the lifespan is greatly shortened and no nymphs are produced.

In late summer, when soybean plants start to mature, winged females and males are produced. They migrate to buckthorn where mating takes place. The females lay eggs that overwinter at the base of buckthorn buds and will hatch the following spring.

Population Variation

Soybean aphid populations are highly variable. Populations exceeding 1,000 aphids per plant are common, while populations in nearby fields can be smaller and very patchy. Aphid populations are also highly variable from year to year. For example, approximately 2.9 million acres in Iowa were sprayed with insecticides in 2003 to reduce aphid populations. In contrast, only 50,000 acres were treated for soybean aphid in 2004.

Predicting aphid outbreaks has proven difficult. One way to predict if aphid will be problematic in any particular year is by monitoring winged soybean aphids as they fly between soybean fields during the summer and to buckthorn in the early fall. A suction trap network across the Midwest is used to monitor winged aphids (*www.ncipmc.org/traps/*). Suction traps help estimate overwintering population densities, providing insight into yearly population variation. However, other factors may influence whether any particular year or location will have an outbreak of soybean aphid.

When soybean aphid populations commonly exceed 1,000 aphids per plant, large numbers of winged aphids typically are trapped in July and early August. By late August, capture of winged aphids drops dramatically. Small numbers of male and female winged aphids

migrating to buckthorn will result in fewer overwintering eggs. This may lead to smaller numbers of aphid colonizing soybeans the following spring.

When soybean aphid population densities are lower, small numbers of winged aphids are trapped during July and August. In September, however, significantly more aphids (nearly 40 times more than in high aphid years) are typically trapped. Large numbers of winged aphids captured in the fall suggest large numbers of eggs will be laid on buckthorn. This may result in large populations of aphids the following spring.

Suction trap for monitoring winged aphids

Injury Symptoms

Soybean aphid feeds on plant sap in the phloem of leaves and stems of soybean. Heavily infested plants may have yellow or distorted leaves. As aphids feed, they excrete sticky, sugar-rich honeydew that can accumulate on leaves, stems and pods. These drops glisten in the sun and make the plant look shiny.

Excessive honeydew production promotes the growth of sooty mold. Sooty mold is a superficial growth appearing as a black, sooty film or crust on leaves and stems. It is not parasitic but lives off the sugar in

Black sooty mold on soybean can grow on aphid honeydew.

honeydew; however, it can interfere with the amount of light that reaches the plant, reducing photosynthesis. This can result in stunted plants and reduced seed counts, further lowering yields.

Severe aphid infestations can cause flowers and small pods to abort, reducing total pods per plant. Aphid feeding also competes with the soybean plant for nutrients, which reduces the number of seeds per pod and, less frequently, seed size.

Unsprayed (left) and sprayed soybeans (right) for aphid control. A heavy aphid infestation depletes plant nutrition and can reduce flower and pod development, negatively affecting yield.

Virus transmission

Soybean aphid can transmit several viruses including alfalfa mosaic, bean yellow mosaic and soybean mosaic. Transmitting soybean mosaic requires less than one minute of aphid feeding. Symptoms of viruses include leaves with a mosaic pattern or mottled, bright yellow spots; distorted, wrinkled and puckered leaves and plant stunting. Symptoms are most evident on the younger leaves. Insecticides are ineffective in preventing aphid-transmitted viruses because aphids are capable of infecting plants before they die, and migratory aphids are constantly produced.

Alfalfa mosaic virus foliar symptoms

Soybean mosaic virus foliar symptoms

Scouting is critical for timely and effective management of soybean aphid.

Thresholds

The economic injury level and economic threshold are two important concepts that help explain the relationship between soybean aphid populations and yield loss. The **economic injury level** is the smallest number of insects that will cause economic damage (yield loss that equals the cost of control). The economic injury level is 654 aphids per plant during the R1 to R5.5 growth stages.

The **economic threshold** is a similar concept, but it is the smallest number of insects at which a management action should be taken to prevent an increasing pest population from reaching the economic injury level. The economic threshold for soybean aphid is **250 aphids per plant with increasing aphid populations**. Regular sampling is necessary to determine whether populations are increasing or decreasing within a field. This threshold applies until fields reach R5.5, when seeds are expanding in the pod (see page 4). The economic threshold should provide a seven-day lead time before the aphid population is expected to exceed the economic injury level and cause economic damage. Field populations that average fewer than 250 aphids per plant should not be sprayed, even with increased soybean prices and cheaper, generic insecticides. Yield losses are rarely

detected when populations are equal to, or fewer than, 250 aphids per plant. Therefore, the recommendation is to apply an insecticide when the economic threshold is reached and the aphid population is increasing.

Ants are commonly found on aphid-infested plants as they are attracted to the honeydew aphids produce. The presence of ants can help scouts find less visible colonies.

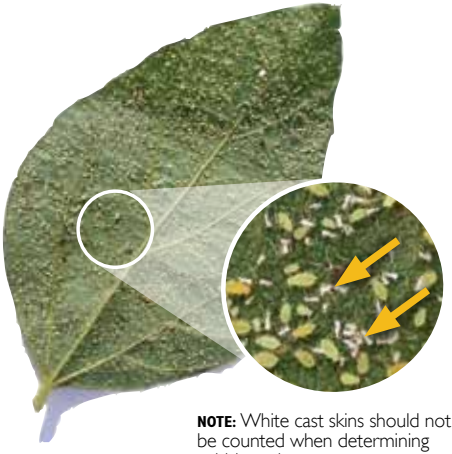
Field Scouting

Determining soybean aphid density is essential for every field. Conditions that favor soybean aphid development are cool temperatures, plant stress (particularly drought-stress) and the lack of beneficial insects or disease-causing fungi. Intense rainfall may kill many aphids by dislodging them from the plant.

Scouting guidelines

- Begin scouting the last week of June, especially in northeastern Iowa. Sample fields every seven to 10 days until plants reach growth stage R5.5, even if seed-applied or foliar insecticides have been used.
- For every 20 acres, examine at least 30 plants. Make sure sampled plants are from different areas throughout each 20-acre section.
- Early in the season, check for aphids on the youngest two or three trifoliolate leaves and stems. In the early reproductive stages, check both sides of the leaves, stems and pods throughout the canopy because aphids tend to move down the plant.
- Count all aphids (adults and nymphs), but do not count cast skins or look-alikes (see pages 50-52).
- Calculate the average number of aphids per plant.
- If the average number of aphids per plant is approaching or has reached the economic thresh-

old, the field should be sprayed within seven days. This provides enough time to check the field again in three to four days to be sure the population is growing. Remember, the threshold is based on field averages and not hotspots or field borders.



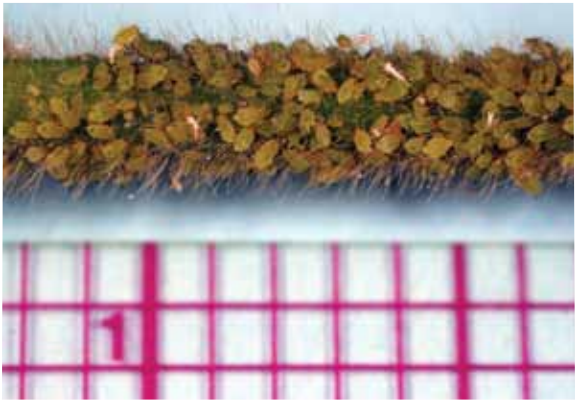
NOTE: White cast skins should not be counted when determining aphid numbers.

Scouting tips

- If no aphids are found on a plant, remember to include the zero count when calculating average estimated aphid densities in a field.
- Develop a mental reference for gauging aphid populations on soybean plants by first counting small colonies. This will help establish what 100 aphids looks like (see page 25).

- Large numbers of aphids on the stems and pods indicate populations approaching or exceeding the economic threshold. As a point of reference, a colony that covers all sides of a stem for one inch will contain 250 to 300 aphids (see page 25).
- It is valuable to estimate the number of beneficial insects (see pages 45-48).
- Check for fuzzy, bloated or off-color aphids. This may be an indication the colony is infected with a fungal pathogen (see page 49) or parasite.
- If most of the aphids are winged or will be winged as adults they may leave the field and the population will rapidly decline. A hand lens is required to detect wing pads on developing nymphs that will become winged adults.
- Look for ants or lady beetles on soybean; they often indicate the presence of aphids. Lady beetles feed on aphids while ants tend to the aphids and "milk" them for honeydew (see page 21).
- Scout within seven days after an insecticide application to determine the efficacy of the spray and possible reinfestation of fields. Continue to check fields every seven to 10 days through R5.5.

Approximately 115 aphids on leaflet



A colony that completely covers all sides of a stem for one inch will contain 250 to 300 aphids.

Speed Scouting

Speed Scouting is a sampling plan to help make treatment decisions and is an alternative to counting all the aphids on a plant. Speed Scouting can greatly decrease sampling time in a field, though fields still must be scouted on a regular basis (every seven to 10 days) from the last week in June through R5.5. It uses "infested" and "non-infested" soybean plants, rather than the average number of aphids per plant, to determine if an insecticide is needed. If a plant has fewer than 40 aphids, it is considered non-infested. However, if the plant has 40 or more aphids, it is considered infested. There is no need to count additional aphids after 40 on an infested plant.

Speed Scouting is NOT a new economic threshold! The economic threshold is 250 aphids per plant with increasing aphid populations through R5.5.

Speed Scouting directions

(see worksheet on page 28)

1. Select the first plant at random. If fewer than 40 aphids are on the entire plant, mark a minus [-] for that non-infested plant. If at least 40 aphids are on the plant (STOP COUNTING when you reach 40 – this is the speedy part), mark a plus [+] for that infested plant.

2. Choose a direction at random and walk 30 rows or paces to the next plant.
3. Repeat Step #1 until 11 plants are sampled in different areas of the field.
4. Make a decision using the total number of infested plants (the total number of pluses).
5. If you must "continue sampling" (seven to 10 plants with a plus), sample five more plants and use the new total number of plants (16) to make a decision.
6. If you need to continue sampling look for aphids in additional sets of five plants until 31 plants are sampled. Remember, always use the total number of plants to make a decision.
7. If no decision can be made after sampling 31 plants, resample the same field in three to four days.
8. A "TREAT" decision should be confirmed a second time three to four days later. If confirmed, apply an insecticide within three to four days.
9. If a "DO NOT TREAT" decision is reached, continue to sample the field every seven to 10 days until plants reach growth stage R5.5.

Speed Scouting for Soybean Aphid

For blank forms and an interactive example, go to www.soybeanaphid.info

Directions for Speed Scouting:

1. Go to a plant at random and start counting aphids. If fewer than 40 aphids are on the ENTIRE plant, mark a minus [-] for that non-infested plant. If you reach 40 aphids, STOP COUNTING (this is the speedy part!) and mark a plus [+] for that infested plant.

2. Walk 30 rows or paces at random to find the next plant. Repeat Step #1 until 11 plants are sampled in different areas of the field. Total the number of infested plants [+] to make a treatment decision.

3. If you must "CONTINUE SAMPLING" (7-10 plants with a [+]), sample 5 more plants and use the new total number of plants to make a decision.

4. If no decision is reached, sample additional sets of 5 plants until 31 plants are sampled. Remember, always use the total number of infested plants [+] to make a decision. If no decision can be made after sampling 31 plants, resample the same field in 3-4 days.

Field Location: _____

Average Plant Stage: _____

Date: _____

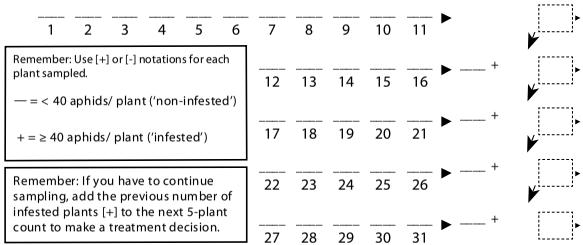
Treatment Decision: _____

Field Notes: _____

_____

_____

_____



DO NOT TREAT, resample in 7-10 days	CONTINUE SAMPLING 5 more plants	TREAT, confirm again in 3-4 days
6 or less	7 to 10	11 or more
10 or less	11 to 14	15 or more
14 or less	15 to 18	19 or more
18 or less	19 to 22	23 or more

Speed Scouting was originally developed by Erin Hodgson, Brian McCornack and David Ragsdale, University of Minnesota Entomology

Integrated Pest Management

Scouting and timely management tactics are necessary to successfully manage soybean aphid and protect yield. The most effective management of soybean aphid is through Integrated Pest Management (IPM) – the use of multiple strategies applied at the proper time.

Host Plant Resistance

Aphid-resistant soybean varieties suppress aphid growth and reproduction on the plant, causing soybean aphid populations to increase more slowly compared to growth on susceptible varieties. This type of resistance is called antibiosis. During outbreaks, aphid-resistant varieties can yield more than susceptible varieties even without the use of insecticides.

Soybean aphid-resistant varieties will NOT be aphid-free.

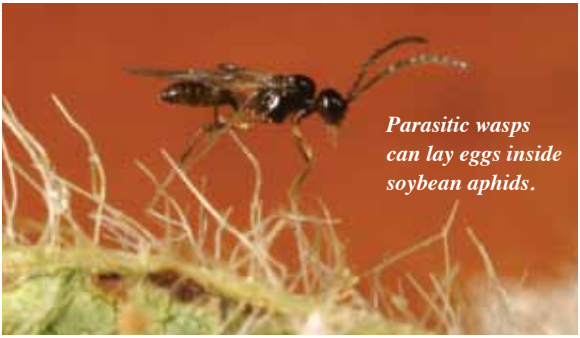
Soybean varieties containing the *Rag1* gene can be grown without a refuge because the gene was not produced through genetic engineering. Resistant plants will have fewer aphids compared to susceptible plants, but will not be aphid-free. Growers should regularly scout fields to determine aphid population densities.

The application of foliar insecticides on aphid-resistant varieties may still be necessary if aphids exceed the economic threshold. Regardless of host plant resistance, continue to scout and use the treatment threshold of 250 aphids per plant. Remember, aphid populations may develop more slowly in fields with aphid-resistant soybeans, but can still cause yield loss with favorable conditions.

Considering Natural Enemies

Do not apply an insecticide when aphids are not present or are below the economic threshold. Insecticides kill beneficial insects (see pages 45-48) and may harm pollinating insects. Applying "just in case" insecticides can allow aphid populations to rebound quickly and thrive in the absence of natural enemies. Rebounding aphid populations may require an additional insecticide treatment later in the season.

The habitat near fields may influence the number of beneficial insects in those particular fields. Improving landscape diversity, or incorporating several different types of plants into the landscape, will encourage migration of beneficial insects to soybean. Most predator and parasitoid adults eat nectar, so having flowering plants bloom early in the season can promote natural control in soybean and other field crops.



Parasitic wasps can lay eggs inside soybean aphids.

Cultural Practices

The impact of cultural practices on soybean aphid is limited for conventional soybean production. Row spacing, tillage and planting date have limited to no impact on the abundance of soybean aphids. The use of cover crops and living mulches however, can increase the abundance of soybean aphid predators and reduce soybean aphid populations and limit outbreaks. These practices may be most appropriate for organic soybean production.

Row spacing, tillage and planting date do not affect soybean aphid populations.

Insecticides

Optimal soybean aphid control and yield protection includes using the appropriate insecticides, applying them properly and applying them at the right time. Foliar insecticide applications should manage more than 98 percent of the aphids. There are no perfect insecticides, but there are factors that may influence product selection. The best insecticide is one that provides the greatest efficacy (percent control), the most residual activity (extended control), the least environmental impact (mortality of beneficial insects) and the least cost to the producer.

Many insecticides are labeled for use on soybean aphid ("Chinese aphid" on some labels). Read and follow all label directions and take special note of the pre-harvest interval (PHI) that determines how many days must pass between the insecticide application and legal harvest. Current insecticides labeled for soybean aphid control have a PHI between 21 and 45 days (see page 39).

Insecticide timing

The ideal timing of insecticide applications for aphid control varies from year to year. Fields should be sprayed before the economic injury level is reached. Using the economic threshold (see page 20) should provide time to schedule an insecticide application before the population exceeds the economic injury level.

Yield response to insecticide applications will depend on when soybean aphid populations reach the economic threshold. If reached during bloom and pod development (growth stages R1-R4), insecticides provide the largest and most consistent yield protection. If the threshold is reached near or after soybeans have reached the R5.5 growth stage (see page 4), insecticides will not provide consistent economic benefits because seed fill is nearly complete.

Applying insecticides before the threshold is reached, or in the absence of aphids, may eliminate beneficial insects (see pages 45-48). If insecticides are applied after the economic injury level is reached, there is approximately one-half bushel yield loss per acre for each day spraying is delayed. Heavy honeydew, sooty

Scout fields within seven days after an insecticide application to determine how well the treatment worked.

mold and stunted plants are indicators that the economic injury level has been exceeded; thus, the optimum time for an insecticide application has passed.

Fields in Iowa seldom need two insecticide applications per year if sprays are based on the economic threshold. When aphid populations reach the economic threshold twice before R5.5, soybeans will benefit from both insecticide applications.

Insecticide spray coverage

Aphids can be effectively managed with either ground or aerial applications of insecticide. Thorough spray coverage is important to maximize insecticide efficacy because soybean aphids feed on the underside of leaves. If coverage is poor, the remaining aphid population may rebound and reach the economic threshold during the same season. High spray volume (15 to 20 gallons per acre for ground applications and 3 to 5 gallons per acre for aerial applications) and droplet size have the greatest impact on coverage. Choose a nozzle that produces medium to fine droplet sizes of 350- to 200-micron at the appropriate ground speed, pressure and spray volume.

You can expect a two-bushel per acre loss from driving over the soybean plants after canopy closure.

Insecticide performance and evaluation

Numerous foliar and seed treatment insecticides have been evaluated for management of soybean aphid. Generally, foliar-applied insecticides provide better protection against soybean aphid.

Organophosphate, pyrethroid and neonicotinoid insecticides all provide effective control. However, there may be certain conditions that favor one class over another.

Pyrethroid insecticides provide consistent control and their performance is enhanced during cool temperatures. Under drought-stress or hot conditions, growers are discouraged from using pyrethroids, as they tend to cause an increase in spider mite populations.

Lorsban®, an organophosphate insecticide, exhibits a vapor action, especially during high temperatures. This can improve coverage in tall plant canopies and narrow-row or drilled soybeans. Although organophosphates have activity against adult spider mites, they have poor activity against spider mite eggs.

Seed treatments

Cruiser® (thiamethoxam), Gaucho® (imidacloprid), NipsIt INSIDE® (clothianidin) and Poncho® (clothianidin) are systemic seed treatments that are absorbed into the plant during germination. These insecticides concentrate in the actively growing areas on the plant (new leaves and root tips). Seed treatments may reduce early-season insect damage; however, they lack the residual activity necessary to suppress soybean aphid during July and August. Do not expect seed treatments to kill soybean aphid 50 days after planting.

Treated soybean seed

Examples of insecticides labeled for soybean aphid

Product	Active ingredient	Chemical class	PHI[1]
Cruiser®	thiamethoxam	neonicotinoid	---
Gaucho®	imidacloprid	neonicotinoid	---
NipsIt INSIDE®	clothianidin	neonicotinoid	---
Poncho®	clothianidin	neonicotinoid	---
Leverage® 360[2]	imidacloprid + ß-cyfluthrin	neonicotinoid + pyrethroid	21 days
Lorsban® 4E[2]	chlorpyrifos	organophosphate	28 days
Nufos® 4E[2]	chlorpyrifos	organophosphate	28 days
Cobalt™[2]	chlorpyrifos + γ-cyhalothrin	organophosphate + pyrethroid	30 days
Asana® XL	esfenvalerate	pyrethroid	21 days
Baythroid® XL[2]	ß-cyfluthrin	pyrethroid	45 days
Mustang Max™[2]	ζ-cypermethrin	pyrethroid	21 days
Proaxis™[2]	γ–cyhalothrin	pyrethroid	45 days
Warrior® II[2]	λ-cyhalothrin	pyrethroid	30 days

[1] *Pre-harvest interval – the amount of time that must occur between insecticide application and harvest.*

[2] *Restricted-use insecticide*

Tank mixing insecticides with herbicides

Tank mixing an insecticide with a herbicide may reduce application costs. However, it is impractical because of timing and application issues. The optimum time for application of glyphosate on soybean is when the weeds are less than four inches tall, most likely in June. The optimum time for controlling soybean aphid has been between mid July and mid August. Insecticides applied in June do not have the residual activity needed to significantly suppress soybean aphid. Early-season insecticide applications also can kill beneficial insects, a situation which may allow aphids to produce large colonies more quickly.

Additionally, sprayer specifications such as water volume, pressure and droplet size (nozzle type) must be optimized for each pest situation. While medium to fine droplet sizes are suitable for many insecticide applications, herbicide applications require larger droplet sizes to avoid herbicide drift.

Given these concerns, adding insecticide to an early-season glyphosate application is not recommended unless aphid populations have reached the economic threshold.

Tank mixing insecticides with fungicides

Foliar fungicide use on soybean has increased. The timing and application method of fungicides may overlap with the management of soybean aphid. Like insecticides, fungicides require smaller droplet size and thorough plant coverage. There is no known adverse interaction between fungicides and insecticides labeled for soybean aphid control in Iowa.

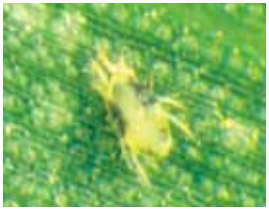
One potential negative side effect of fungicides is that many are toxic to naturally occurring fungi that can attack aphids (see page 49). Foliar fungicides have reduced the aphid-killing fungi by 28 to 100 percent in laboratory experiments. The frequency of fungal infection of aphid populations is not known in Iowa but is probably quite low.

Insecticides and fungicides require smaller droplet size than herbicides and thorough coverage for best results.

Considering Other Pests

Other soybean pests are often present with soybean aphid in Iowa soybean fields. Other phloem-feeding pests include potato leafhopper, stink bugs and spider mites. A mixture of defoliators comprised of bean leaf beetle, Japanese beetle, cutworms, armyworms and green cloverworm also may be present.

Making treatment decisions with multiple insect pests is complicated if both are present but not exceeding threshold guidelines. The cumulative damage and pest density should be taken into consideration to justify a foliar insecticide.



Two-spotted spider mite

Green cloverworm

Green stink bug

Bean leaf beetle

Properly identifying soybean aphid and beneficial insects is critical for implementing effective management strategies.

Natural Enemies

Soybean aphid is an excellent food source for several predatory and parasitic insects and even some fungi. Beneficial insects feed on soybean aphid and other soft-bodied insects, helping keep soybean aphid population densities low early in the season when colonies are small. Once aphids fully infest a field (more than 80 percent of plants with aphids) and populations reach 100 to 200 aphids per plant, the impact of these natural enemies is limited and aphid populations will likely increase. Recognizing the presence of natural enemies in a soybean field may influence the decision to use, delay or not use an insecticide (or fungicide) because these products may suppress populations of beneficial organisms.

Multicolored Asian lady beetle eating a winged soybean aphid

Lady beetles are the most common predators of aphids in Iowa soybean fields and are capable of eating up to 70 aphids per day as a larva or adult. Lady beetles also move to buckthorn with aphids and continue to prey on aphids during the fall. This predation may significantly reduce the overwintering soybean aphid population.

Multicolored Asian lady beetle

Description: Adults are $^{1}/_{8}$-inch long and have wing covers that vary from red to yellow and may or may not be spotted. The area behind the head has a distinctive black "M"-shaped mark.

Seven-spotted lady beetle

Description: Adults are $^1/_8$-inch long and have dark red wing covers with seven black spots. The head is black except for a square white mark behind each eye.

Lady beetle larva

Description: Larvae are soft-bodied and resemble miniature alligators. Early larval stages are gray or black. Older larvae are gray or black, with bright yellow or orange markings.

Damsel bug (Nabids)

Description: Adults are 1/2-inch long, slender and smoky gray with wings folded across the back. The head is narrower than the body. Nymphs look similar but have no wings.

Pirate bugs

Description: Adults are 1/16-inch long and black with white markings. They have piercing-sucking mouthparts and can deliver a painful bite to humans.

Green lacewing larva

Description: Larvae are up to 1/3-inch long, small, grayish brown and have pincher-like jaws.

Parasitic wasps

Parasitic wasp

Soybean aphid mummy

Stingless, parasitic wasps lay eggs inside soybean aphid. The wasp larva hatches inside the aphid and eventually kills it. A parasitized aphid looks bloated and black or tan and is often referred to as a "mummy." An adult wasp emerges from the mummy. Currently, parasitic wasps are not a major source of soybean aphid mortality in the United States. However, in their native China, these wasps significantly reduce aphid populations. In 2007, an Asian species of parasitic wasp, *Binodoxys communis*, was released in the Midwest. Parasitic wasps can only be a practical management tool if insecticide use is reduced throughout the region.

Fungal pathogens

Naturally occurring fungal pathogens also have been observed to reduce soybean aphid populations. Outbreaks of these fungi can cause a very quick (less than one week) decline in aphid numbers and are believed to be partly responsible for some reductions in late-season aphid densities. Several fungal species are known to occur in Iowa, but environmental conditions must be right for them to infect aphids. High humidity that follows rain can increase the potential for fungal infection of aphids. Infected aphids look white or pink and fuzzy; eventually, infected aphids die and shrivel.

Soybean aphid colony with cast skins (white) and fungus killed aphids (shown with arrows).

Look-alikes

These insects may be confused with soybean aphids. Only aphids have a pair of cornicles at the end of the abdomen.

Lygus bug nymphs

Description: Yellow-green and can have dark spots on the thorax. As nymphs mature, they darken and form wing pads. Lygus bugs are more active than aphids.

Mealybugs

Description: Oval and white with a "powdered" texture caused by a waxy secretion that covers their bodies.

Pirate bug nymphs

Description: Red-eyed, yellowish or orange and wingless. Often feeds on aphids or soft-bodied insects.

Potato leafhopper

Description: Nymphs are pale green and wingless with big, white eyes on a broad head; they become bright green and form wing pads as they mature. Nymphs move rapidly sideways and backwards. Adults appear similar to nymphs, but are larger and have wings.

Potato leafhopper nymph (left) and adult (right)

Thrips

Description: Larvae are light in color and lack wings; adults are cigar-shaped with wings and can have dark bands on the body. They are much more active than soybean aphid.

Whitefly

Description: Adults are $^{1}/_{25}$-inch long with a yellow head and body and white, powdery wings. Whitefly nymphs are pear-shaped like aphids, but lack cornicles, antennae and long legs.

Acknowledgments

Additional information:
Printable blank copies of the Speed Scouting worksheet can be downloaded from: *www.ent.iastate.edu/dept/faculty/hodgson/extension*

For more information on soybean aphid, consult these websites: *www.soybeanaphid.info*; *www.planthealth.info/aphids_basics.htm*

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SOYBEAN APHID FIELD GUIDE

A visual aid for identifying, sampling and managing soybean aphid

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