

Soybean Aphids (SBA) in New York State IPM Field Teaching Module

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Concept	Activity	Handouts
Managing SBA properly is based on correct identification, knowing its lifecycle, <i>and ...</i>	Identify soybean aphid; learn its lifecycle	SBA handout
... monitoring to determine economic threshold, <i>and ...</i>	Scout for soybean aphid and decide if you're at threshold	Should I Spray for Soybean Aphids? SBA Scouting Card
... knowing which options actually work, then choosing and using a timely, effective plan.	Look for biological control agents in the field. Examine chemical options—their uses, caveats and constraints. Decide which combination of tactics to use.	Biological control handout
Resources: Cornell Guide to Integrated Field Crop Management.	Related Modules: Module 2: Introduction to IPM Module 3: Principles of Scientific Sampling Module 4: What is a Threshold? Module 5: Economic Implications of IPM	

Here's what we'll do:

Beforehand: Set up meeting with a soybean producer who might have an infestation of SBA

Today on-site:

- Learn how to correctly identify SBA
- Learn the lifecycle of SBA
- Become skilled at sampling and monitoring for SBA
- Learn the methods for managing SBA in soybeans

ACTIVITY # 1: Identify SBA			
Setting	Time Required	Materials	Handouts
Soybean Field	30 minutes	Clipboards Hand-lens 10x to 20x	SBA handout

Q:	Pose a series of questions:	A:
What are common insect pests found in soybeans in NY?	<i>Quick review:</i> seed corn maggot, Japanese beetle, Mexican bean beetle, bean leaf beetle, grasshoppers—and soybean aphid (SBA). <i>(See “IPM for Soybean Insect Pest Teaching Module” for specifics on other insect pests.)</i>	
What makes SBA special?	It’s a new invasive insect with the potential to build up quickly—and it can affect yield. It both overwinters and migrates in via weather patterns. Can vector virus diseases (such as cucumber mosaic virus (which also attacks snap beans, dry beans, and others). No resistant varieties are commercially available yet.	
When and where were SBA first found in the US?	Wisconsin, 2000. By the end of the growing season, SBA was in IA, MI, IL, KY, IN, MN, MO, OH, and WV. The 2001 it was discovered in NY, NE, PA, and VA. Soybean aphid has continued it’s geographic expansion in 2008 to include Wyoming, Colorado, and Mississippi.	
Where did SBA come from?	SBA is a new invasive species; this exotic pest is native to eastern Asia.	
Does anyone know what SBA looks like?	<ul style="list-style-type: none"> • Tiny, pale yellow-green (“mountain dew green”); less than 1/16 inch • Soft bodied • <i>Only</i> aphid infesting soybeans • Black cornicles, <i>aka</i> “tail pipes” on hind end • Most generations lack wings—exceptions being early field invaders and a population readying for migration or dispersal <p>View picture of aphids or live SBA with a hand lens: http://www.soybeans.umn.edu/images2/insects/2004aphid/biolody_pic8.jpg</p>	

What's the SBAs lifecycle?	<p>Soybean aphids have a complicated lifecycle.</p> <ol style="list-style-type: none">1. Eggs are laid on common buckthorn shrubs in the fall. Note location near next year's leaf buds. Wingless females hatch in spring. View picture of eggs on buckthorn: http://www.soybeans.umn.edu/images2/insects/2004/aphid/biolody_pic5.jpg2. Females give birth asexually (no males needed) to live female young—clones of themselves—and go through up to 4 generations on buckthorn. At some point they give birth to winged females.3. These winged female aphids fly from the buckthorn in search of soybeans. They then give live birth to wingless female aphids.4. When populations in the field explode, winged females are born. These fly to other soybean fields as summer progresses to begin the cycle there.5. As fall approaches, females give birth to both winged females <i>and</i> males—which fly off in search of buckthorn (common in NY). Once there they mate; females lay eggs.
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<p>Pause ... Does anyone know what common buckthorn is?</p>	<p>Appearance: This understory shrub or tree can reach 25 feet. Most have several trunks at the base.</p> <p>Leaves: Dark green, smooth, glossy. Curved veins. Egg-shaped with pointed tips and finely toothed margins. Cling through late fall without changing color.</p> <p>Branch: Twigs are tipped with a short, sharp thorn.</p> <p>Fruit: Poisonous round, black berries about a ¼ inch diameter in clusters at branch tip. Resemble wild black cherries.</p> <p>Biology and Spread: Trees produce either male or female flowers. Trees with berries are always female. Most fruits fall directly beneath the shrubs, creating a dense understory. Birds and mice eat the plentiful fruit; its strong laxative effect helps distribute seeds, often far from the parent plant. Establishes well at forest and field edges.</p> <p>Buckthorn was imported from Europe in the mid-1800s. <i>It is listed as an invasive plant in several parts of the US.</i></p> <p>Have samples of buckthorn to view.</p> <p>http://www.dcnr.state.pa.us/forestry/invasivetutorial/common_glossy_buckthorn.htm</p> <p>http://www.dcnr.state.pa.us/forestry/invasivetutorial/common_glossy_buckthorn.htm</p>
<p>Do winged and wingless forms look different?</p>	<p>Yes. Winged forms have a black head and thorax (the part right behind the head). Their abdomen is dark green with black cornicles—those “tail pipes” near their rear end.</p>
<p>What are ideal conditions for SBA?</p>	<p>Prefers temperatures between 72^o to 77^oF and relative humidity below 78%. When temperatures reach 81°F, their life cycle takes longer and slows down some.</p>
<p>How fast could SBA (potentially) build to large infestation levels?</p>	<p>Under laboratory conditions, aphid populations can double in 2 to 3 days. In the field they can double in 9 to 13 days. Females can produce upward of 15 generations—occasionally more—per season. Young mature in 3 to 7 days Populations sometimes build up <i>fast</i>.</p>

<p>What is a <i>white dwarf</i> or aphid morph?</p>	<p><i>White dwarfs</i> are a smaller, lighter-colored version of the typical yellow-green soybean aphids. These aren't necessarily SBA "babies"—nor a different species. Nobody truly understands what provokes females to give birth to dwarfs. But it could be a response to stress or change: high temperatures, shorter day length, or lower nutritional quality.</p> <p>These dwarfs live half as long and make 70% fewer nymphs compared to the normal green morph. Do they injure soybeans less? Maybe—but at this point, it's speculation. Include counts White dwarf numbers are still included in overall counts of aphids.</p> <p>White dwarfs are more likely to show during R3 to R4, when host quality declines. They reproduce more slowly and are less likely to exceed economic threshold of 250 aphids per plant. <i>(Later, we'll show you the quick way to guesstimate aphid populations.)</i></p> <p>Check that growers know what the R3 and R4 (etc.) growth stage means.</p> <p>If possible, view live white dwarf specimens through hand lens or microscope. Alternatively, view a photo of white dwarfs.</p> <p>http://extension.entm.purdue.edu/pestcrop/2007/issue19/graphic19/bug2.jpg</p>
<p>Let's review: how do SBAs reproduce?</p>	<p>Asexually. Females give birth to live nymphs without need of a male. They produce male nymphs in late summer. These breed with egg-laying females.</p>
<p>When are soybeans most vulnerable to SBA?</p>	<p>During early growth and reproduction.</p>
<p>What signs or symptoms indicate SBAs are there?</p>	<p>Aphids and cast skins. Stunted leaves and yellowing plants. Ants in the canopy and sooty mold on leaves. Natural enemies (such as, lady beetles).</p>

<p>Can SBA transmit diseases to soybeans?</p>	<p>YES. They can vector these viral diseases:</p> <ul style="list-style-type: none"> • alfalfa mosaic • cucumber mosaic • soybean mosaic • bean yellow mosaic • peanut mottle • peanut strip
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Go and look for soybean aphids

ACTIVITY # 2: Monitoring and Management			
Setting	Time Required	Materials	Handouts
Soybean Field	30 minutes	Clipboards	Should I Spray for Soybean Aphids SBA Scouting Card Biological control handout Pesticide list

Q:	Pose a series of questions:	A:
<p>When should you start scouting for soybean aphid?</p>	<p>At V-1 or V-2 stage. Start scouting about mid-June. Typically aphids come in two waves. The local movement off of buckthorn during June is usually fairly light. Long-range migrants usually appear suddenly after a thunderstorm around July 4th —and often infest fields at a much higher rate.</p> <p>Check that all growers are familiar with V-stages.</p>	
<p>What do you need to scout with?</p>	<ol style="list-style-type: none"> 1. A 10x or 20x hand lens—remember, SBA is tiny. 2. One scouting card for each field. 3. The guide <i>Should I Spray for Soybean Aphid?</i> 	
<p>Let's review: what are the signs and symptoms of SBA?</p>	<p>Aphids on leaves White cast aphid skins Stunted leaves Plants yellowing Ants in the canopy Sooty mold on leaves Natural enemies (lady beetles, for example)</p>	

<p>What's the economic threshold for SBA?</p>	<p>Midwestern guidelines recommend action when</p> <ul style="list-style-type: none"> • Aphids average 250 aphids per plant • Populations are increasing • Crop is prior to early pod fill (R4) <p>If you see substantial numbers of natural enemies as you scout, take that into account if you're near or just above threshold.</p>
<p><u>Play the “How Many SBAs are on the Leaflet” guessing game.</u></p> <ol style="list-style-type: none"> 1. Have growers look at a leaflet with aphids and estimate how many aphids they see. 2. Have them compare with <i>Should I Spray for Soybean Aphids</i> handout. 	
<p>How do you scout?</p>	<p>Scout each field weekly from mid-June through August.</p> <ol style="list-style-type: none"> 1. Examine an average of 20 plants per field. 2. Examine plants in several locations throughout the field. Avoid sampling field margins. Scout 5 locations per 20 acres. 3. Use <i>Should I Spray for Soybean Aphid</i> to estimate how many aphids you've got per plant. <p>The 250 aphid per plant threshold allows about 7 days for treatment action.</p>
<p>Now scout for soybean aphids</p>	
<p>What management action should you take if aphids are over threshold?</p>	<ol style="list-style-type: none"> 1. If you see several predators on each plant, consider holding off on a control for a few days to see if populations fall below threshold. But if populations far exceed threshold, a control is necessary. 2. Select an appropriately labeled insecticide (See CU Guide for more details—pyrethroid vs organophosphate, spider mites, etc.) 3. No resistant cultivars are available. BUT...
<p>Are any cultivars resistant to SBA?</p>	<p>Not yet. But researchers at the University of Illinois found a resistant gene in varieties “Dowling” and “Jackson.” Single-gene resistance is good, since it can be backcrossed into other cultivars quickly. Eventually we'll be seeing new, resistant cultivars.</p> <p>Other researchers are looking into genetically modified, resistant cultivars.</p>

<p>What should you consider before using an insecticide?</p>	<p>It might not be economical to use insecticides when</p> <ol style="list-style-type: none"> 1. Pods are starting to set 2. Infestation is patchy 3. You see winged nymphs 4. Lots of natural enemies are in the field 5. Most nymphs are diseased <p>If possible, leave an untreated strip to check the effectiveness of your insecticide and yield loss potential.</p>
<p>What natural enemies attack soybean aphids?</p>	<p>Lady beetles Ground beetles Minute pirate bug Parasitic wasp Lacewing larvae Syrphid fly larvae Fungal diseases</p> <p>View live specimens in the field or handout on natural enemies</p>
<p>Can natural enemies really have an affect on a SBA population?</p>	<p>Yes. Natural enemies can keep a population of SBAs under the economic threshold. Sometimes they bring over-threshold populations back under this level.</p> <p><i>(For more information on natural enemies, check the "IPM for Soybean Insect Pest Teaching Module")</i></p>
<p>Quick review: when would insecticides be warranted for soybean aphid control?</p>	<ol style="list-style-type: none"> 1. You find an average of 250 soybean aphids per plant 2. Populations are going up 3. Prior to early pod fill (R4). <p>Spraying after R6 is unlikely to increase yield—especially if crops have grown well through the vegetative stages.</p>

<p>What things should you consider when spraying an insecticide?</p>	<ol style="list-style-type: none"> 1. Do you need to? Spray only if your field is over threshold and natural enemies aren't keeping SBAs in check. 2. Timing: The most benefit of the use of an insecticide of SBA is during the early reproductive develop of the plant. Research shows that if aphids are over threshold at this stage, you save yields better that at other growth stages. 3. Equipment considerations: You will need to get optimal coverage (98%) to control SBA. Increase the application pressure, increase the carrier (water) per acre, and keep droplet size small. 4. Can you tank mix with herbicides? No. Here's why: <ul style="list-style-type: none"> • Timing spraying for weeds and aphids rarely coincides. • Insecticides mistimed for aphids kill many natural enemies like lady beetles, etc. • The type of spray nozzles and application pressure is different for herbicides then for insecticides. You could get incomplete coverage of aphids. • Some pyrethroids, if mistimed for aphids, can make spider mites flare up. <p>NOTE: Aphids can rebound after that first treatment—meaning the need to treat again. Keep scouting!</p>
<p>Are insecticidal <i>seed treatments</i> available to control SBA early in the season?</p>	<p>Yes. They help control early infestations of soybean aphids. Research shows you may get up to 45 days of protection with seed treatments.</p> <p>But keep in mind: SBA probably won't be a problem every year. Using a treated seed every year is not IPM—and increases the risk SBA will become pesticide-resistant. IPM promotes scouting and economic thresholds to determine infestation levels—which reduces insecticide use.</p> <p>Plus—the long-range migrants could come after that 45-day protection window, infesting at greater rates ... and could migrate from treated fields in other parts of the country, again increasing the potential for resistance.</p> <p>Research suggests that yields don't differ much whether you use treated or nontreated seed.</p>

References

2010 Cornell Guide for Integrated Field Crop Management

Cornell University

<http://ipmguidelines.org/FieldCrops/default.asp>

Buckthorn

Minnesota Department of Natural Resources

<http://www.dnr.state.mn.us/invasives/terrestrialplants/woody/buckthorn/index.html>

Common Buckthorn Identification: H402B

University of Minnesota Extension, Yard and Garden

<http://www.extension.umn.edu/yardandgarden/ygbriefs/h402buckthorn-common.html>

Managing Soybean Aphid

University of Minnesota, Department of Entomology

http://www.soybeans.umn.edu/crop/insects/aphid/aphid_publication_managingsba.htm

Should I Spray for Soybean Aphids?

University of Wisconsin, Extension, Nutrient and Pest Management Program

http://www.plantpath.wisc.edu/soyhealth/pdf/sba_scout.pdf

Soybean Aphids

Iowa State University, Soybean Research and Extension Program

<http://www.ent.iastate.edu/soybeanaphid/>

Soybean Aphid Resistant Gene

University of Illinois, Office of Technology Management at Urbana-Champaign

<http://www.otm.illinois.edu/node/274>

The Soybean Aphid-MF2482

Kansas State University, Agricultural Experiment Station and Cooperative Extension Service

<http://www.oznet.ksu.edu/library/entml2/mf2582.pdf>

The Soybean Aphid

Purdue University, Weed Ecology Lab

http://www.planthealth.info/pdf_docs/aphid_SP247_IA.pdf

Soybean Aphid

<http://www.ncpndn.org/Library/ViewDocument.pdf?filetype=pdf&DocumentId=894>

Soybean Aphids in Iowa – 2007

(<http://extension.agron.iastate.edu/soybean/documents/SP247Aphids07.pdf>)

Soybean aphid: Life Cycle and Biology

http://www.soybeans.umn.edu/crop/insects/aphid/aphid_biology.htm

For more information on exotic buckthorns, please contact:

Delaware River Invasive Plant Partnership, Invasive Plant Fact Sheets,
<http://www.paflora.org/DRIPP.html>.

Illinois Nature Preserves Commission, Vegetation Management Guidelines,
<http://www.inhs.uiuc.edu/chf/outreach/VMG/VMG.html>

Invasive Plant Atlas of New England, <http://invasives.eeb.uconn.edu/ipane/>

Mid-Atlantic Exotic Pest Plant Council, Inc., <http://www.ma-eppc.org>

National Invasive Species Information Center, <http://www.invasivespeciesinfo.gov>

Plant Conservation Alliance, Alien Plant Working Group, Weeds Gone Wild,
<http://www.nps.gov/plants/alien/factmain.htm>

The Bugwood Network, MA-EPPC Invasive Plant List, <http://www.invasive.org/maweeds.cfm>

The Nature Conservancy Invasive Species Initiative, <http://tncweeds.ucdavis.edu/esadocs.html>

The Ohio Department of Natural Resources, Division of Natural Areas and Preserves,
<http://www.dnr.state.oh.us/dnap/invasive/2buckthorn.htm>.

USDA Forest Service, Northeastern Area, Invasive Plants-Weeds of the Week,
http://www.na.fs.fed.us/fhp/invasive_plants/weeds/

USDA - NRCS PLANTS Database, <http://plants.usda.gov/>

Wisconsin Department of Natural Resources,
<http://www.dnr.state.wi.us/org/land/er/invasive/nonnative.htm#aquatics>