

# Current and Developing Soybean Aphid Scouting Protocols

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Date: 7-18-17 Field: 2017-3-11 Variety: \_\_\_\_\_  
 Collection: 2017 GPS Coordinates: \_\_\_\_\_

Node*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Time*	0:00	0:00	0:00	0:00	0:00	0:00	0:00	0:00	0:00	0:00	0:00	0:00	0:00	0:00	0:00	0:00	0:00	0:00	0:00	0:00
Latents*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Matings	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Matings	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

\* If aphids are absent, place a star/asterisk (\*) in the cell. However, will count aphids on remaining nodes (components) and place total number next to star.  
 \* From bottom of plant and work your way up to the "new growth" node (see Figure 1). Designate "new growth" as N1 and write it next to the aphid total.  
 \* Record total time (min sec, 00:00) to sample all nodes (no lateral or broad counts).  
 \* Turn the total number of latents for that plant, write it in the Latents column, and circle it. Next to that number, write the total number of aphids found on all latents.

Soybean aphid economic threshold provides treatment decision support

Field scouting is the step required to reach that decision (treat or no-treat)

How do current scouting protocols compare?

- Whole plant count
- Speed-scouting

What's new in sampling research?

- Node-based sample unit

# *Journal of Economic Entomology* 100:1258-1267.

FIELD AND FORAGE CROPS

## Economic Threshold for Soybean Aphid (Hemiptera: Aphididae)

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E. W. HODGSON, M. E. O'NEAL,<sup>4</sup> K. D. JOHNSON,<sup>4</sup> R. J. O'NEIL,<sup>5</sup> C. D. DIFONZO,<sup>6</sup>  
T. E. HUNT,<sup>7</sup> P. A. GLOGOZA,<sup>8</sup> AND E. M. CULLEN<sup>9</sup>

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Common University research protocol in  
**6 North Central states**, pooled data from  
**19 yield-loss experiments** over 3 years.

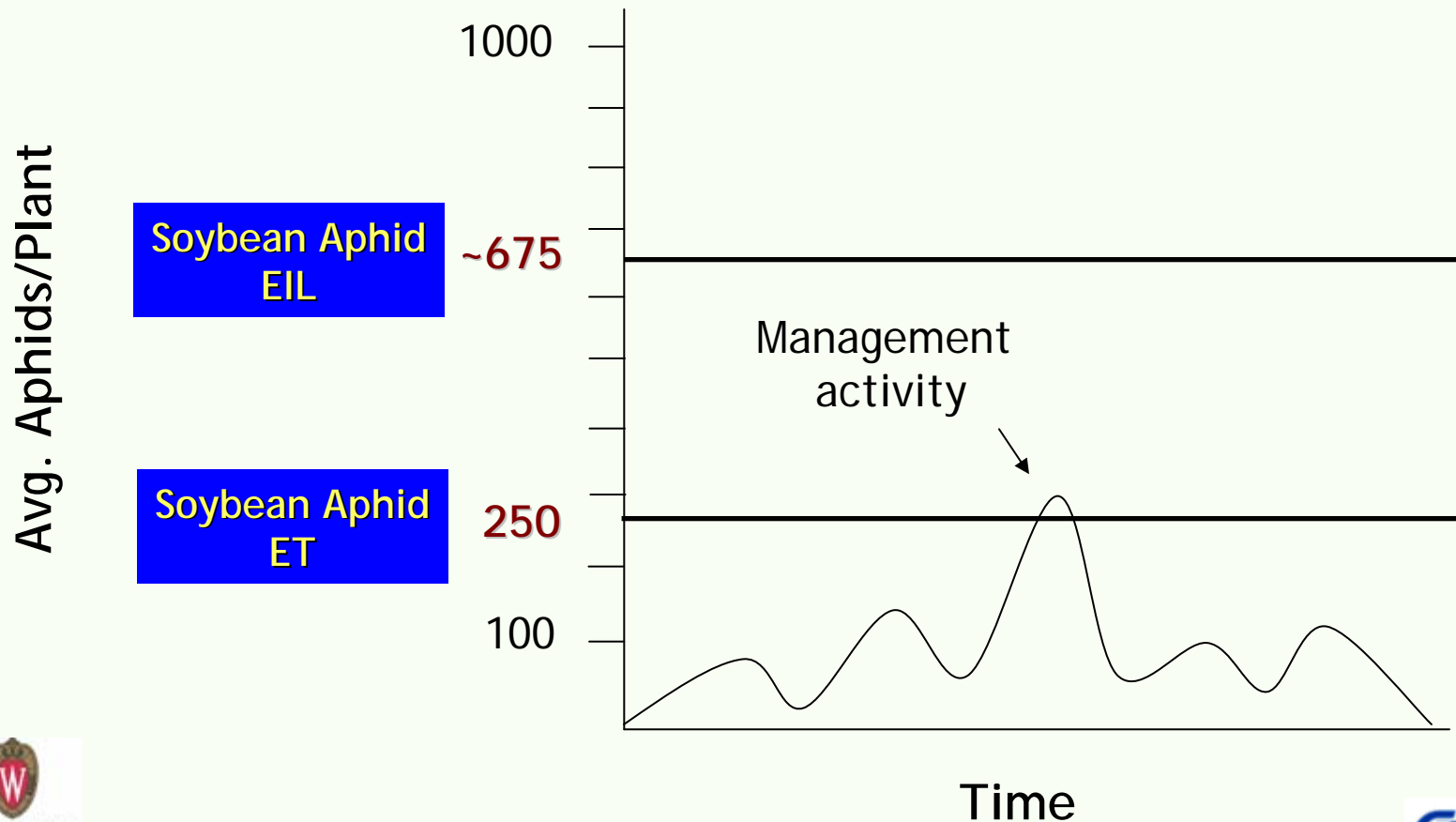


Results validated soybean aphid economic  
threshold to treat within 5 - 7 days when aphid  
density exceeds **250 aphids/plant**.

# Economic Injury Level (EIL)

Pest density which causes losses equal to the costs of control

**Economic Threshold (ET)** Pest density at which control action is taken to PREVENT pest population from reaching or exceeding the EIL





- Doubling time for field populations of SBA averaged  $6.8(\pm 0.8)$  days.
- Natural enemies, host plant quality and weather combined can constrain population growth.
- Treating below the ET (too early) or above the EIL (too late) each have negative consequences in an IPM system.

# SBA Scouting Ground Rules

## Current Methods:

1. Whole plant count
2. Speed-scouting

## Developing Methods:

1. Node-based unit



Begin scouting late vegetative/ early flowering (R1), Continue through full pod (R5).



Repeated field visits (weekly ideal).



All sampling methods are based on the ET of 250 aphids/plant.



# Whole Plant Count – “gold” standard

- Count the number of aphids on 20 to 30 plants randomly sampled from throughout the field for a representative sample.
- Examine entire plant for aphids, especially upper leaves and stems.
- Whole plant counts up to 250 are critical. For heavily infested plants you may find it easier to estimate (500-1000; 1000+) *rather than trying to count “3,262” aphids on one plant!*
- Calculate average aphids/plant based on total number of plants sampled.



# Soybean Aphid Scouting Guides

Available from UW Madison NPM at:

<http://ipcm.wisc.edu/>

**SHOULD I SPRAY FOR SOYBEAN APHIDS?**


Treat when field average is **250 APHIDS/PLANT** and populations are **ACTIVELY INCREASING**

A **MINIMUM OF TWO FIELD VISITS** are required to determine if aphid populations are increasing. To calculate a field average, count the number of aphids on **20-30 PLANTS/FIELD**.

Begin field scouting in late June, making one or two visits/field/week. Continue scouting until aphid populations decline, usually mid to late August.

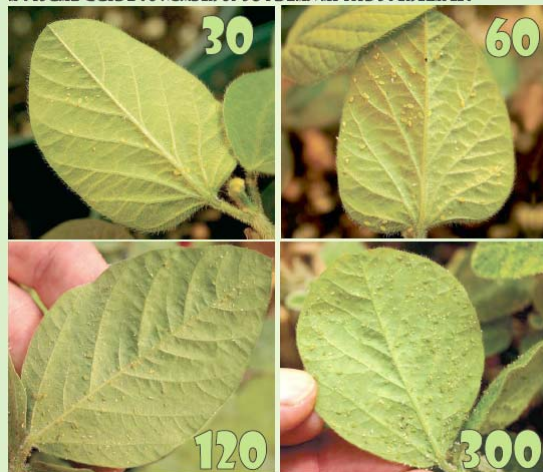
**OPEN FOR A VISUAL GUIDE TO COUNTING APHIDS...**

Soybean aphids in various sizes, colors, and stages of development.



(Do not count the cast skins.)

## A VISUAL GUIDE TO NUMBER OF SOYBEAN APHIDS PER LEAFLET



Soybean aphid count will vary from leaflet to leaflet. Add up the total number of aphids on the entire plant, not on a single leaflet. To calculate a field average, count the number of aphids on **20-30 PLANTS/FIELD**.

## Reproductive Soybean Development Stages and Soybean Aphid Thresholds

X1134

University of Wisconsin - Extension



### R1 Stage soybean plant (beginning bloom)

One open flower at any node on the main stem.

A node is the part of the stem where a leaf is (or has been) attached.

Stage length 0 to 7 days: average 3

Aphid thresholds depend on actively increasing populations. Examine 20-30 plants once or twice weekly to determine population dynamics.

Action Threshold - 250 aphids/plant when population actively increasing.

soybean aphid

Photo © Iowa State University



### R2 Stage soybean plant (full bloom)

Open flower at one of the two uppermost nodes on the main stem with a fully developed leaf.

Stage length 5 to 15 days: average 10

Action Threshold - 250 aphids/plant when population actively increasing. This guideline incorporates an approximate 7-day lead time between scouting and treatment to make spray arrangements.



### R3 Stage soybean plant (beginning pod)

Pod is 3/16 inch long at one of the four uppermost nodes on the main stem with a fully developed leaf.

Stage length 5 to 15 days: average 9

Action Threshold - 250 aphids/plant when population actively increasing. In replicated trials conducted throughout the Midwest in 2003, the 250 aphids/plant action level worked best from late vegetative through R3 stages.



### R4 Stage soybean plant (full pod)

Pod is 1/4 inch long at one of the four uppermost nodes on the main stem with a fully developed leaf.

The most critical time for soybean yield: Stress at this time can not be recovered and results in more yield loss than at any other time.

Stage length 4 to 26 days: average 9

Thresholds not currently determined, but populations exceeding 250/plant and actively increasing need monitoring and treatment at grower discretion.\*



David W. Fischer - Dane County UWEX Crops and Soils Agent  
James Fanta - Dodge County UWEX Crops and Soils Agent

Available at UW  
Soybean Plant Health:

<http://www.plantpath.wisc.edu/soyhealth/pdf/sbrthresholds05.pdf>

## IDENTIFICATION OF **soybean** aphid AND **look-alike** species



Ho Jung Yim, Purdue University

### Identification of Soybean Aphid & Look-alike Species

The soybean aphid, *Aphis glycines* Matsumura, is a small, pear-shaped bright green to yellow aphid with dark tips on the cornicles (two tube-like structures or "tailpipes" on the tip of the abdomen); the cauda or tail end of the abdomen is pale and narrow with four or five pairs of setae, or hair-like structures. This aphid can be found on growing points and young leaves of early vegetative soybean plants. As soybean plants mature from late vegetative through reproductive stages, aphids are found on all plant parts. Although most common on undersides of leaves, they also occur on stems, petioles and upper leaf surfaces. Soybean aphid damages plants by sucking phloem (plant sap) resulting in plant stunting, reduced pod set, and smaller seed size. If populations are large, feeding may cause shiny, sticky leaves coated with aphid exudate ("honey dew") and black "sooty" mold fungal growth on soybean leaves.



Martin Speelman

Refer to the picture for distinctive features of a soybean aphid. (A) black tipped cornicles, (B) six legs, and (C) six segmented antennae. Make certain that your pest identification is correct before making any insecticide application.



Robert Venette, USDA Forest Service

This image shows several forms of soybean aphid - the normal green form (A), a darker form (B), shed exoskeletons (C), and "mummies" of parasitized aphids (D) (aphids can be parasitized by small wasps that develop inside the aphid body and exit leaving a hollow outer shell called a mummy).



Martin Speelman

### Whitefly Species

Various whitefly species are known to feed on soybean but have never been known to cause economic damage. Whiteflies are most commonly seen on velvetleaf or button weed, and soybean fields with heavy weed populations may have higher whitefly numbers. First instar (crawlers) (A) are legged and oval shaped, about 0.3 by 0.15 mm. The second, third and fourth instars are also oval, do not have legs, and are slightly larger than the first instar. The late fourth instar (pupa) (B) is about 0.7 by 0.4 mm and appears waxy and is tightly attached to the leaf with marginal filaments (tiny hair-like structures around the entire outer edge). Coloration may vary.



Marlin E. Rice, Iowa State University



Jim Kalisch, University of Nebraska

### Mealybug

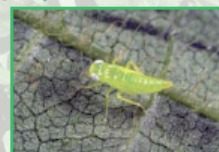
Mealybugs are closely related and look similar to whiteflies. They are oval shaped and are covered with waxy, white, mealy secretions. Like whiteflies, they also have an active crawler stage and an inactive stage. Although not common, they can occur on soybean leaves and stems, but are not known to cause significant damage.



Lyle Buss, University of Florida

### Potato Leafhopper, *Empoasca fabae*

Nymphs are 2-3 mm long, wedge-shaped, pale in color, and wingless. Older nymphs are bright green, with prominent eyes and have wing pads. Unlike aphids, nymphs move sideways rapidly when disturbed.



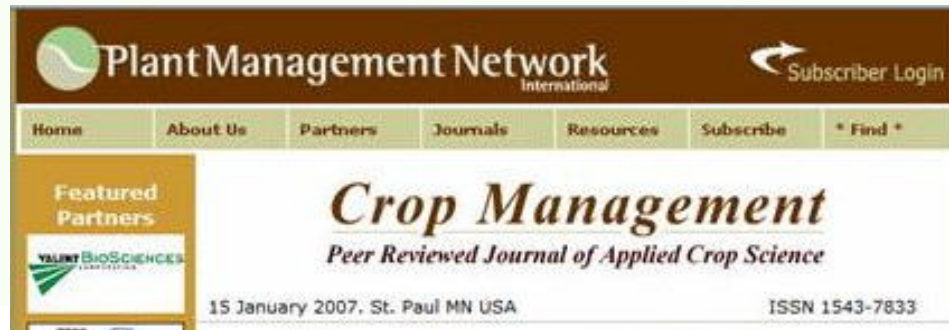
Marlin E. Rice, Iowa State University

Color tri-fold scouting guide to soybean aphid and 8 other "look-alike" species. Portion of six-panel publication shown here.

Available from UW Entomology: <http://entomology.wisc.edu/~cullen/>

# Speed Scouting Method

[www.plantmanagementnetwork.org/](http://www.plantmanagementnetwork.org/)



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## Field Validation of Speed Scouting for Soybean Aphid

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# Rationale



Binomial sequential sampling plan.



Mathematical relationship between proportion of infested plants, density of aphids per plant, and an ET of 250 aphids/plant.



The goal is to provide a rapid decision aid for estimating pest populations with an acceptable level of error over a wide range of pest densities.

# Speed Scouting Basics

- Randomly select 11 plants.
- Score as “infested” (= 40+ aphids/plant) or “not infested” (= 0 -39 aphids/plant).
- Three possible outcomes

Do not treat (re-sample in 7-10 days)

Treat (confirm in 3-4 days)

Continue sampling (score 5 more plants)

- Visit  UNIVERSITY OF MINNESOTA

[www.soybeans.umn.edu/crop/insects/aphid/aphid\\_sampling.htm](http://www.soybeans.umn.edu/crop/insects/aphid/aphid_sampling.htm)



for instructions, worksheets, examples.

# Speed Scouting for Soybean Aphid

[developed by E. Hodgson, B. McCormack, & D. Ragsdale  
University of Minnesota Entomology Dept.]

Go to [www.soybeans.umn.edu](http://www.soybeans.umn.edu)  
for FAQs and copies of the form.

For questions in Minnesota contact:  
David Ragsdale, U of M Entomology Dept.  
612-624-6771, [ragsd001@umn.edu](mailto:ragsd001@umn.edu)

## Directions

1. Go to the first plant at random. If less 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' (7-10 plants with a +), sample 5 more plants and use the new total number of plants (16) to make a decision.
6. If no decision is reached, sample additional sets of 5 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 3-4 days.
8. A 'TREAT' decision must be confirmed a 2<sup>nd</sup> time 3-4 days later. If confirmed, apply insecticide in 3-4 days.

Field: \_\_\_\_\_

Date: \_\_\_\_\_

Decision: \_\_\_\_\_

Use these - = Less than 40 aphids/ plant ('non-infested')  
Notations: + = 40 or more aphids/ plant ('infested')

Total # of  
Infested plants:

DO NOT treat.  
Resample in  
7-10 days

CONTINUE  
sampling  
5 more plants

TREAT decision,  
confirm in  
3-4 days

1 2 3 4 5 6 7 8 9 10 11 ➡

12 13 14 15 16 ➡ + \_\_\_\_\_

17 18 19 20 21 ➡ + \_\_\_\_\_

22 23 24 25 26 ➡ + \_\_\_\_\_

27 28 29 30 31 ➡ + \_\_\_\_\_

Remember: When  
you continue sampling,  
add the previous # of  
Infested plant to the  
new count to make  
the next decision.

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
22 or less	23 to 26	27 or more

Plant Stage: \_\_\_\_\_

Notes: \_\_\_\_\_

STOP SAMPLING!  
Resample the same field  
in 3-4 days.

CONFIRM 'TREAT' DECISION  
Resample the same field in 3-4 days  
Apply insecticide in 3-4 days if confirmed

# Speed Scouting Summary

- Cost effective sampling method at low aphid densities and very high densities.
- However, it is conservative. When incorrect (21% of the time) it yields “treat” decision too early, below the ET of 250 aphids/plant.
- To avoid over-application, experience suggests basing treatment decision on two consecutive “treat” sampling outcomes.



# What's New in SBA Sampling Research?

- McCornack et al. (2007). UMN research and North Central state validation trials.

[http://esa.confex.com/esa/2007/techprogram/paper\\_32113.htm](http://esa.confex.com/esa/2007/techprogram/paper_32113.htm)

- Aphids found on upper plant portion until mid-July. Mid-season aphids move to lower and inner canopy locations.
- This within-plant distribution shift has prevented sampling single leaf or node to accurately estimate whole plant density.

# Node-Based Sample Units ?

- Testing ability of selected sample units to reliably estimate whole-plant aphid densities.
- Ideally, a subset of nodes could be sampled rather than whole plant.
- Under development, not yet ready for commercial use. Stay tuned.

