Multi-state Soybean Aphid RAMP Project
Soybean Aphid IPM on a Landscape Scale (SAILS)
-- Project Update --

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The introduction of soybean aphid impacts more than just soybean

Soybean aphid outbreaks were reported in 2005 across the region, and many fields in the Midwest were over threshold. Table 1 compares % soybean acres treated in 1999 (before SBA was found in the U.S.) to estimated % acres treated in 2005. The introduction of SBA into North America fundamentally changed insect management and insecticide use patterns in soybean in the Midwest.

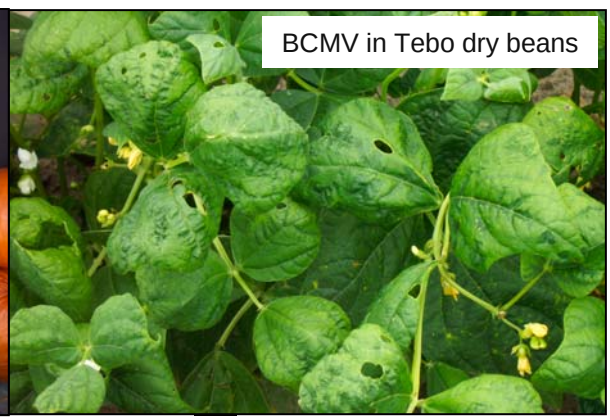
Table 1: Soybean acres treated with insecticides. 1999 acres come from NASS, the National Ag Statistics Service; 2005 acres were estimated by university extension contacts

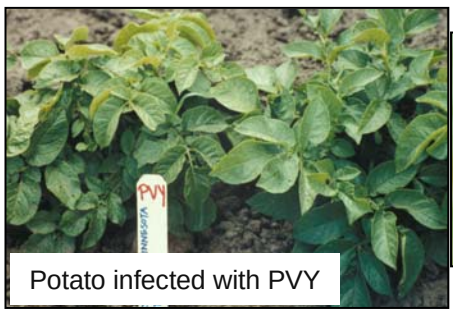
Year	IA	IN	MI	MN	WI
1999	0%	0%	0%	0%	0%
2005	20%	40%	80%	50%	10%

However, soybean growers may not realize that SBA probably impacts more than just the soybean crop itself. In fact, since its discovery and subsequent range expansion across the Midwest, SBA outbreaks are correlated with dramatic increases in virus incidence in vegetable crops.

In the laboratory, we now know that SBA can transmit the following viruses:
- Potato Virus Y (PVY) to potato (U of MN)
- Cucumber Mosaic (CMV) to snap beans (Cornell) and zucchini (Michigan State)
- Bean Common Mosaic (BCMV) to dry beans (Michigan State)


Pumpkins with virus symptoms at a grocery store, East Lansing, MI '05


BCMV in Tebo dry beans



Potato infected with PVY


CMV-infected snap beans

Why are soybean aphids so good at transmitting plant viruses?

There's a lot of them

All SBA in soybean fields are female; there are no males needed for reproduction. Female aphids give live birth to daughters without mating. And the daughters are born pregnant, with babies already forming inside their bodies. This means aphids can reproduce quickly, to high numbers. In 2005, the record number of SBA on a single plant was over 30,000 in Saginaw, MI.

Some aphids are programmed to disperse across the landscape

Many adult aphids are wingless; they churn out babies to infest soybeans. But other adults are winged. Winged adults leave heavily infested plants to found new colonies on new plants or fields. In the process they come in contact with many plant viruses.

Aphids find host plants by 'sap sampling'

In other words, an aphid must taste a plant to determine if is a host. In the process of tasting, it accidentally picks up and moves plant viruses. Virus particles contaminate the mouthpart as the aphid probes, then the particles are introduced into the next plant that it tastes. This process is similar human diseases spread by infected blood in used hypodermic needles – so think of an aphid as a dirty hypodermic syringe!

And there's a lot of soybean – nearly 70 million acres in the U.S., much of this acreage in the Midwest. Until recently, there was no aphid living on soybean in the U.S.. That changed in 2000. Soybean is now contributing billions of additional winged aphids – think dirty hypodermic needles – to the landscape, increasing the chance of virus movement and transmission in other crops.

How many winged aphids are produced in an acre of soybean?

Here is an estimate based on actual counts (between July 28-August 11, 2005) in plots in Saginaw County, MI:

160,000 soybean plants per acre
x
average of ***17,000*** SBA per plant
x
90% [0.9] of population had wing pads
=
2,448,000,000 winged aphids potentially generated per acre.

SAILS, SBA and Snap beans

As part of the multi-state RAMP Project, researchers at the University of Wisconsin are better defining the impact of SBA on virus incidence in snap beans. Over the last few years, snap beans were hit hard by a complex of viruses, including CMV, BCMV, alfalfa mosaic, and clover yellow vein. Emily Mueller, a graduate assistant with Drs. Claudio Gratton and Craig Grau, is addressing three questions to attack this problem:

- Do forage legumes (such as alfalfa, white clover, or lupine - right) serve as reservoirs for snap bean viruses?
- Do soybean aphids colonize legume hosts and acquire virus?
- If forage legumes are nearby, does virus incidence in snap beans increase?

This summer, Emily will be testing legumes and snap beans for virus infection, trapping aphids in snap bean fields, and even testing individual aphids for virus particles. If you grow or scout snap beans and would like to help Emily with her work, contact her at – eem@entomology.wisc.edu.