Slugs in Pennsylvania: Research plans and progress

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A Major Challenge of Mid-Atlantic No till

- **Slugs**
  - ~50% of my extension phone calls in 2009 were on slug problems
  - Research appeared needed, so I naively waded into the slug world

Since 1990 corn yields in Pennsylvania have increased an average of 0.28 Mg ha\(^{-1}\) yr\(^{-1}\) (~200 lbs of stover per acre)
Slug working group: Grower survey  (Winter 2010; ~80 responses)

- 82% think that slugs are the most challenging pest they face
- 92% had experienced “significant slug damage”

Most respondents rotate: corn/soy (25%) or corn/soy/wheat (12%)

- Slugs were most problematic in corn (72%) and soy (21%)
- 66% of growers routinely used cover crops
  - Cereal rye was most common [51%]), mostly before corn (28%)

Cover crops damaged by slugs:

- Cereal rye – 18%
- No damage to cover crops – 23%
How often do you experience trouble with slugs in your crops?

a. Every year 20%
b. About every 2-3 years 48%
c. About every 4-5 years 13 %
d. Greater than every 5 years 13%

In which crops do you experience trouble with slugs?

a. Corn 82%
b. Soybeans 51%
c. Alfalfa 8%
d. Snap bean 8%
e. Small grain 5%
Slug working group: **Grower survey** (Winter 2010; ~80 responses)

Slug damage did not appear to be associated with:

- Soil type
- Fertilizer or manure use
- Pesticide use

Low to moderate confidence in management options:

- Metaldehyde
- Nitrogen sprays
- Row cleaners
- Pop-up fertilizer
- Varieties with early season vigor
Current research on slug management

1. Determine feeding preferences for slugs among crops, cover crops, and common weed species.
   a) Can cover crops or weeds help suppress slug populations and foster natural-enemy populations?

2. Identify natural enemies of slugs in PA soybean fields.
   a) What predatory insect species will eat various slug species?

3. Can minimal tillage help controlling slug populations?
Slug feeding preferences

Slugs: major determinants of grassland community composition

- Prefer to eat seedlings
- Have species preferences
  - Hard to interpret published results – variable methods

In some experiments, gray garden slugs preferred:

- Red and white clover
- Narrowleaf plantain
- Dandelion
- Shepherd’s purse
- Lambsquarters

Can slightly weedy fields or underseeded crops help limit crop damage?
What are the feeding preferences for slugs among crops, various cover crop species, and common weed species?
Gray garden slugs significantly prefer:

<table>
<thead>
<tr>
<th>Soybean</th>
<th>vs</th>
<th>Hairy vetch</th>
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<tbody>
<tr>
<td>Soybean</td>
<td>vs</td>
<td><strong>Red Clover</strong></td>
</tr>
<tr>
<td>Soybean</td>
<td>vs</td>
<td><strong>Cereal rye</strong></td>
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<tr>
<td>Soybean</td>
<td>vs</td>
<td>Triticale</td>
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<tr>
<td>Soybean</td>
<td>vs</td>
<td>Lambsquarters</td>
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<tr>
<td>Soybean</td>
<td>vs</td>
<td><strong>Velvetleaf</strong></td>
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<tr>
<td>Soybean</td>
<td>vs</td>
<td><strong>Italian ryegrass</strong></td>
</tr>
<tr>
<td>Corn</td>
<td>vs</td>
<td><strong>Crimson clover</strong></td>
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<tr>
<td>Corn</td>
<td>vs</td>
<td><strong>Italian ryegrass</strong></td>
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Farmer-driven slug research project
(Lucas Criswell, Union County)

Observation: clean fields provide one food source – the crop
Question 1: Can we provide an alternative food & take pressure off the crop?

1. Drilled a mix of rye and clover

Question 2: What role do insecticides play in slug control?

1. Sprayed Warrior
Farmer-driven slug research project
(Lucas Criswell, Union County)

Observation: clean fields provide one food source – the crop

**Question 1:** Can we provide an alternative food & take pressure off the crop?

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<table>
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<tr>
<th></th>
<th>No underseed</th>
<th>Underseed</th>
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<tbody>
<tr>
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<td>None</td>
<td>Underseed No insecticide</td>
</tr>
<tr>
<td>Insecticide</td>
<td>Insecticide No underseed</td>
<td>Underseed Insecticide</td>
</tr>
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</table>
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Farmer-driven slug research project

- Increasing diversity by underseeding corn with rye/clover
- Could kill underseeded crop in June

Corn with no rye
lots of slug damage

Corn with rye-little slug damage
Farmer-driven slug research project

- Rye/clover planting took pressure off of corn
- Insecticide / natural enemy data still coming

![Graph showing slug damage (0-4 scale)]
Can we improve upon this effort? Put underseeded crop between rows?

An interseeder developed at PSU
- Greg Roth
- Bill Curran

To establish cover crops mid-season (& apply fertilizer and herbicide)
Can we improve upon this effort? Put underseeded crop btwn rows?

Will test in 2012 for improving slug control

An interseeder developed at PSU
• Greg Roth
• Bill Curran

To establish cover crops mid-season (& apply fertilizer and herbicide)
Can we exploit slugs ability to feed on some weedy species

• Particularly seedlings
• Slugs will eat grass seedlings, lambsquarters, among other weed species

• Vary post-emergence glyphosate applications.
  • Applied 2, 3, 4, 5, or 6 wks post emergence.
    • > 4 wks post-emergence yield decrease ~ 0.75 bu/ac/day
• Assess slug damage and yield
• Balance weed control with possible benefits for slug control?
Can cover crops help suppress slug populations and foster natural-enemy populations?

Slugs have feeding preferences

• What cover crops do they dislike?
  • They like rye, wheat and barley
  • Dislike hairy vetch, crimson clover, forage radish, oats?

Can non-preferred crops help suppress slug populations?
Assessed slug damage (0-4 scale) on corn following cover crops:

1) Crimson clover + annual ryegrass
2) Annual ryegrass + triticale
3) Rye + oats
4) Rape + hairy vetch + rye
5) Tillage radish + vetch + rye
6) Radish + rye
7) Rye
Mechanical slug control (Sjoerd Duiker & John Tooker)

16-plot experiment at Rock Springs; established in Fall 2009

• 4 Treatments (shallow disking: 3” deep; similar to turbo till)
  1. No fall or spring disking
  2. Fall disking, no spring disking
  3. No fall disking, spring disking
  4. Fall & spring disking
Mechanical control experiment (Sjoerd Duiker & John Tooker)

Slug damage assessed on a 0-4 scale:
0 = no damage; 1 = 1 - 25%; 2 = 25-50%; 3 = 50-75%; 4 = 75-100%
Mechanical control experiment (Sjoerd Duiker & John Tooker)

Slug damage assessed on a 0-4 scale:

0 = no damage; 1 = 1 - 25%; 2 = 25-50%; 3 = 50-75%; 4 = 75-100%

One light spring disking had sign. effect

2009-2010
Mechanical control experiment (Sjoerd Duiker & John Tooker)

Slug damage assessed on a 0-4 scale:

Treatment management (fall, spring)
1) none, turbotill x 1
2) none, disk
3) none, none
4) disk, disk
5) disk, none
6) none, turbotill x 2
Other slug experiments attempts that need repeating

In collaboration with Jeff Graybill (Extension Educator, Lancaster Co.):

Exp. 1: Testing the influence of
- Row cleaners
- Pop-up fertilizer
- Nitrogen sprays
- Metaldehyde

Exp. 2 – Testing the influence of
- Pop-up fertilizer
- Ammonium sulfate
- Nitrogen sprays
- Lannate LV
Slug web portal and reporting tool

- Could be an extension resource presenting best management practices (Mid-Atlantic)
- Information on biology, images of slugs and damage
- Provide a home for a grower survey on slugs

Doug Miller
Dept. of Geography
Director, Center for Environmental Informatics
PestWatch is a northeastern regional view over space and time of dynamic information useful for managing insects or diseases.

Data providers create the human infrastructure powering this network.

Insect population information includes field-collected measurements of pheromone catches, black-light traps, or modeled estimates based on temperature-accumulations.

Comments/Questions?
The Brown Marmorated Stink Bug

Halyomorpha halys

The brown marmorated stink bug (BMSB), an insect not previously seen on our continent, was apparently accidentally introduced into eastern Pennsylvania. It was first collected in September of 1998 in Allentown, but probably arrived several years earlier. As of September 2010, Halyomorpha halys has been recorded from the following 37 counties, although it is probable that they are in all counties:

![Map of PA counties with recorded presence of brown marmorated stink bug](image)

It is also recorded from many other states such as:
Slug web portal and reporting tool

- Could be an extension resource presenting best management practices (Mid-Atlantic)
- Information on biology, images of slugs and damage
- Provide a home for a grower survey on slugs
- Get growers to report locations of slug problems
- Correlate slug problems with soil features
Slug portal and reporting tool...
Soil mapping slug infested fields

- Could reveal environmental correlates
  - Slopes (exposure to sunlight)
  - Soil types
  - Soil textures
- GIS could add information on residue, temperature, moisture
Slug portal and reporting tool...

Website could:

1. Supply information for growers
2. Gather information via:
   a. Survey
   b. Reports of slug infestations
Questions?

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