Update on insect pest management and Cucumber mosaic virus in snap bean

Processing Snap Bean Advisory Meeting

December 4, 2018

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Geneva, NY
Topics

I. Seedcorn maggot/seed treatments

II. Potato leafhopper/OMRI products

III. Aphid activity and CMV incidence
Seedcorn maggot (SCM) (*Delia platura*)

**Adult**

Nikita Vikrhev

**Larva**

Joe Ogrodnik

Photo: J. Ogrodnick

**Damaged seedlings**

Photo: Univ. Minnesota
Risk period for SCM in snaps
Standard SCM management since 2004

planting

[Crusier® 5FS seed treatment]

Days after planting

flower

pin to pod

harvest

bean crop

Cornell AgriTech
New York State Agricultural Experiment Station
SCM management using a seed treatment

Cruiser® 5FS

No insecticide

Photo: B. Nault
SCM management using a seed treatment

➢ If neonicotinoid insecticides (e.g., Cruiser 5FS) and chlorpyrifos (e.g., Lorsban) become unavailable, what alternatives exist for SCM?

➢ Organic options?
SCM management using a seed treatment

➢ If neonicotinoid insecticides (e.g., Cruiser 5FS) and chlorpyrifos (e.g., Lorsban) become unavailable, what alternatives exist for SCM?

Answer: chlorantraniliprole and spinosad, but neither are commercially available

➢ Organic options?

Answer: spinosad…but are there others already labeled?
SPE-120 Soil and Seed Enhancer

• Manufactured by JABB of the Carolinas

• Active ingredient: *Beauvaria bassiana*

• “Natural symbiotic fungus that grows with your plants and defends them against pests and pathogens that attack roots, stems and leaves”

• For **organic** crop production

• Can be applied to seeds, applied in the soil trench and foliar sprayed to enhance plant, leaf, and stem health
OBJECTIVE

• To evaluate a *Beauvaria bassiana*-based-product (SPE-120) delivered as a seed treatment for managing seedcorn maggot (SCM) damage in snap bean
## METHODS

Treatments evaluated – 2018

<table>
<thead>
<tr>
<th>Product</th>
<th>Active Ingredient</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>No insecticide</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Cruiser 5FS</td>
<td>thiamethoxam</td>
<td>0.84 g/800 g of seed</td>
</tr>
<tr>
<td>SPE-120 (low)</td>
<td><em>Beauvaria bassiana</em></td>
<td>70,000 CFU/seed</td>
</tr>
<tr>
<td>SPE-120 (high)</td>
<td><em>Beauvaria bassiana</em></td>
<td>700,000 CFU/seed</td>
</tr>
</tbody>
</table>

Note: No fungicide used on seeds; Seeds treated in Alan Taylor’s lab
METHODS

- Planting date: May 25, 2018
- Plots: 2 rows x 20 ft; treatments replicated 6 times
- At planting: bone, fish & meat meal banded over rows
METHODS

- On 7 June 2018 (13 dap), 25 plants systematically sampled to assess number damaged/infested by SCM
RESULTS

Efficacy of seed treatments for SCM management

cv. ‘Huntington’ Geneva, NY  2018

$F_{3, 15} = 4.16; P = 0.0248 \quad n = 6$

Infested/ damaged seedlings (%)

Seed Treatment

- Untreated
- Cruiser 5FS
- SPE-120 (low)
- SPE-120 (high)
SUMMARY

- *Beauvaria bassiana* (SPE-120) failed as a seed treatment for managing seed corn maggot in snap bean.
Potato Leafhopper (PLH) *Empoasca fabae*

Nymph

Adult

Stunting, leaf curling and “hopperburn”
Risk Period for PLH in Snaps
Standard PLH Management since 2004

- Use a systemic insecticide seed treatment
- Apply applications of insecticides to foliage ONLY when needed during bloom

Foliar spray – pyrethroid

Days after planting

Crop

Conventional

Bean crop

0 10 20 30 40 50 60

Flower
Pin to pod

Cruiser® 5FS seed treatment

Cornell AgriTech
New York State Agricultural Experiment Station
PLH Management using a Seed Treatment

No insecticide

Photo: B. Nault

Cruiser® 5FS

Cornell AgriTech
New York State Agricultural Experiment Station
PLH Management using a Seed Treatment

- If neonicotinoid insecticides (e.g., Cruiser 5FS) become unavailable, what alternatives exist for PLH?

- Organic options?
PLH Management using a Seed Treatment

➢ If neonicotinoid insecticides (e.g., Cruiser 5FS) become unavailable, what alternatives exist for PLH?
   Answer: no seed treatments; foliar applications of pyrethroids are available

➢ Organic options?
   Answer: no seed treatments; foliar products available?
OBJECTIVE

• To evaluate foliar applications of [OMRI Listed] products for managing potato leafhopper in snap bean
## METHODS

### Treatments evaluated – 2018

<table>
<thead>
<tr>
<th>Product</th>
<th>Active Ingredient</th>
<th>Rate</th>
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<tbody>
<tr>
<td>Untreated control</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Azera</td>
<td>pyrethrin + azadirachtin</td>
<td>40 fl oz/A</td>
</tr>
<tr>
<td>Pyganic Specialty</td>
<td>pyrethrins</td>
<td>0.4% v:v</td>
</tr>
<tr>
<td>Venerate XC</td>
<td>Heat-killed <em>Burkholderia</em> spp. strain A396</td>
<td>2 qts</td>
</tr>
<tr>
<td>Venerate XC</td>
<td>Heat-killed <em>Burkholderia</em> spp. strain A396</td>
<td>4 qts</td>
</tr>
<tr>
<td>Warrior II w/zeon</td>
<td>lambda-cyhalothrin</td>
<td>1.92 fl oz/A</td>
</tr>
</tbody>
</table>

*Note: No insecticide used on seeds; only fungicide
*Treatments applied only one time to assess residual activity*
RESULTS

Efficacy of one foliar application for PLH management

Sprayed on 3 July

Mean number of nymphs/20 trifoliolate leaves

Date

6-Jul 10-Jul 16-Jul

cv. ‘BA101’

Geneva, NY 2018

- Untreated
- Azera
- Pyganic
- Venerate (low)
- Venerate (high)
- Warrior II w/zeon

Sprayed on 3 July
RESULTS

Efficacy of three foliar applications for PLH management

cv. ‘BA101’ Geneva, NY 2017

Sprayed on 11 July, 16 July and 21 July
SUMMARY

• None of the products were effective when applied only a single time.

• Both Azera and Pyganic applied three times @ 5 day intervals significantly reduced the PLH infestation.
Status of aphid activity and cucumber mosaic virus (CMV) epidemics in snap bean fields

Photo: B. Nault
CMV impact on snap bean yield

Photo: B. Nault

Non-infected

CMV-Infected
Primary vector of CMV – soybean aphid

Aphis glycines
**CMV impact on snap bean industry**

<table>
<thead>
<tr>
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<th>Estimated Loss ($)</th>
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<td>2002</td>
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*CMV caused over $9 million in losses in a decade (source: Vegetable Processing Industry in New York)*
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*CMV caused over $9 million in losses in a decade (source: Vegetable Processing Industry in New York)*
OBJECTIVE

• To monitor activity of winged soybean aphids in snap bean fields

• To assess incidence of CMV in snap bean fields
METHODS

Sampling Aphids
- New York only
- 2017 & 2018
- 3 periods (early, middle and late)
- 4 fields/ period
- 3 traps/ field
- Sampled weekly
- Aphids identified to species

Ceramic tile on bottom + water + soap
Sampling Plants for CMV

- New York & Wisconsin
- NY: n= 46 and 38 fields in 2017 and 2018, respectively; WI: n= 20 fields in 2017 and 2018
- Sampled 500 plants/field (NY); 200 plants/field (WI) at bloom stage
- DAS-ELISA
- (+) was 3x OD reading in negative control
RESULTS
Winged aphid activity

<table>
<thead>
<tr>
<th>Sampling period</th>
<th>No. of winged aphids/ snap bean field/ trap over 4 weeks</th>
</tr>
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<tbody>
<tr>
<td>Mid June – mid July</td>
<td>8 (6-11)</td>
</tr>
<tr>
<td>Mid July – early Aug</td>
<td>17 (3-42)</td>
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<tr>
<td>Early Aug – early Sept</td>
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## RESULTS

Winged aphid activity

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<td>Mid June – mid July</td>
<td>8 (6-11)</td>
<td>12.6</td>
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<td>Mid July – early Aug</td>
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NO soybean aphids!
## RESULTS

Incidence of CMV in snap bean fields

<table>
<thead>
<tr>
<th>Year</th>
<th>State</th>
<th>Number of fields in which CMV was detected</th>
<th>Estimated mean incidence of CMV per field</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>New York</td>
<td>1/46</td>
<td>0.004%</td>
</tr>
<tr>
<td></td>
<td>Wisconsin</td>
<td>1/20</td>
<td>0.025%</td>
</tr>
</tbody>
</table>
Snap bean fields infected with CMV in 2017

- 0% infected with CMV
- 1-19% infected with CMV
- 20-100% infected with CMV
## CMV impact on snap bean industry

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*CMV caused over $9 million in losses in a decade*  
(source: Vegetable Processing Industry in New York)

Why? CMV virtually absent, probably because no soybean aphids

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Cornell AgriTech  
New York State Agricultural Experiment Station
## RESULTS

**Winged aphid activity**

<table>
<thead>
<tr>
<th>Sampling period</th>
<th>2002-2006</th>
<th>2017*</th>
<th>2018**</th>
</tr>
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<tbody>
<tr>
<td>Mid June – mid July</td>
<td>8 (6-11)</td>
<td>12.6</td>
<td>128.5</td>
</tr>
<tr>
<td>Mid July – early Aug</td>
<td>17 (3-42)</td>
<td>1.4</td>
<td>24</td>
</tr>
<tr>
<td>Early Aug – early Sept</td>
<td>17 (4-25)</td>
<td>13.9</td>
<td>69</td>
</tr>
</tbody>
</table>

* No soybean aphids in any samples  
** Aphids now being identified to species
# RESULTS

Incidence of CMV in snap bean fields

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<td>0.025%</td>
</tr>
<tr>
<td>2018</td>
<td>New York</td>
<td>22/38</td>
<td>18.7%</td>
</tr>
<tr>
<td></td>
<td>Wisconsin</td>
<td>19/20</td>
<td>47.4%</td>
</tr>
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</table>
Snap bean fields infected with CMV in 2018

- 0% infected with CMV
- 1-19% infected with CMV
- 20-100% infected with CMV
SUMMARY

• In 2017, no soybean aphids in NY samples, few in WI samples; CMV virtually absent from snap bean fields in NY and WI

• In 2018, many more aphids in NY and WI (species being identified); CMV was back at high levels in many fields in NY and WI
Future Research

- Continue to monitor aphids and CMV in snap bean fields in NY and WI
- Continue to evaluate novel active ingredients (OMRI-listed) for seedcorn maggot and potato leafhopper control
Acknowledgements

Funding
- New York Vegetable Research Council/Association
- Federal Capacity Funds

Riley Harding & Nault Lab (Cornell - Entomology)

Alan Taylor (Cornell - Horticulture Section)

Masoume Amirkhani (Cornell - Horticulture Section)

Russell Groves (Univ. of Wisconsin)
Soybean aphid dispersal

Spring emigrants search for soybean: May
Summer migrants leave sometime: July - Sept.
Summer migrants land sometime July – Sept.
Summer migrants land sometime July – Sept.

alfalfa

CMV (+)

soybean

Soybean aphid dispersal

Buckthorn

Weeds (+)

snap bean

Buckthorn
Fall migrants search for buckthorn: Sept.
Spring emigrants search for soybean: May
RESULTS – 2018 (NY only)

- 42% (16/38) of snap bean fields had no CMV
- 21% (8/38) of snap bean fields had ~1% plants infected with CMV
- 37% (14/38) of snap bean fields had ~49% plants infected with CMV (range: 4-86%)
# RESULTS

Incidence of CMV in snap bean fields

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of fields sampled</th>
<th>Estimated plants infected with CMV (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>12</td>
<td>40.7</td>
</tr>
<tr>
<td>2003</td>
<td>12</td>
<td>10.2</td>
</tr>
<tr>
<td>2004</td>
<td>14</td>
<td>4.5</td>
</tr>
<tr>
<td>2005</td>
<td>18&lt;sup&gt;a&lt;/sup&gt;</td>
<td>47.2</td>
</tr>
<tr>
<td>2006</td>
<td>18&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.9</td>
</tr>
<tr>
<td>2007-2016</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2017</td>
<td>66&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.007</td>
</tr>
<tr>
<td>2018</td>
<td>58&lt;sup&gt;b&lt;/sup&gt;</td>
<td>33.1</td>
</tr>
</tbody>
</table>

<sup>a</sup> Includes fields from NY and PA

<sup>b</sup> Includes fields from NY and WI