Refining Insect Pest Management in Snap Beans: New Seed Treatment Technologies

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**Relative Importance of the Snap Bean Crop; Great Lakes Region**

<table>
<thead>
<tr>
<th>State</th>
<th>Acreage</th>
<th>Value (million $)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wisconsin</td>
<td>73,500</td>
<td>36.6</td>
</tr>
<tr>
<td>New York</td>
<td>22,200</td>
<td>15.1</td>
</tr>
<tr>
<td>Ontario, Canada</td>
<td>20,000</td>
<td>N/A</td>
</tr>
<tr>
<td>Michigan</td>
<td>19,000</td>
<td>9.8</td>
</tr>
<tr>
<td>Illinois</td>
<td>15,800</td>
<td>6.8</td>
</tr>
<tr>
<td>Pennsylvania</td>
<td>10,900</td>
<td>6.7</td>
</tr>
<tr>
<td><strong>Total (U.S.)</strong></td>
<td>169,200</td>
<td>97.3</td>
</tr>
</tbody>
</table>

NASS (2007)
Insecticides for Managing Snap Bean Pests

Recently Labeled in Wisconsin:

- **Radiant SC** (spinetoram)

In the Pipeline:

- **Entrust** (spinosad) OMRI approved seed treatment
- **Coragen and Dermacor X** (chlorantraniliprole)
- **Durivo, Voliam Flexi, Voliam Xpress** (chlorantraniliprole + thiamethoxam or chlorantraniliprole + lambda-cyhalothrin)
- **HGW86** (cyantraniliprole)
- **Belt 480SC** (flubendiamide)
Anthranilic Diamide Insecticides

- **Active ingredients**: rynaxypyr (aka chlorantraniliprole) and cyazypyr (aka cyantraniliprole) and flubendiamide (Belt 480SC)

- **Class**: anthranilic diamide (IRAC MoA Class 28)

- **Mode of action**: ryanodine receptor modulator
  - Systemic activity
  - Most effective through ingestion
  - Insects stop feeding, become paralyzed and die within 1 to 3 days
  - Applied to soil at planting, drip chemigation and foliar spray
    *(no data on seed treatment application)*
  - Exceptionally long residual control – xylem mobile
  - Active against Lepidopterans, Coleoptera, and other pests?
Major Snap Bean Pests in Midwest

Seedcorn Maggot (SCM)

Potato Leafhopper (PLH)

European corn borer (ECB)
Processing Snap Bean: Pest Phenology in Wisconsin

- European corn borer
- Potato leafhopper
- Seed corn maggot

Date

- Planting: 5/5, 5/19, 6/2, 6/16, 6/30, 7/14, 7/28, 8/11, 8/25, 9/8, 9/22, 10/6
- Harvesting: 7/14, 7/28, 8/11, 8/25, 9/8, 9/22, 10/6

Potato leafhopper

Seed corn maggot

European corn borer

Harvesting

Planting
Objective

• To evaluate the efficacy of chlorantraniliprole and cyantraniliprole when applied as a seed treatment, in furrow spray and foliar spray for managing seedcorn maggot, potato leafhopper and European corn borer.
# Products Evaluated for Managing Insect Pests of Snap Bean in WI, NY and VA in 2009

<table>
<thead>
<tr>
<th>Product</th>
<th>Active Ingredient</th>
<th>Type*</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cruiser 5FS</td>
<td>thiamethoxam</td>
<td>ST</td>
<td>1.28 fl oz/cwt of seed</td>
</tr>
<tr>
<td>Dermacor X</td>
<td>rynaxypyr</td>
<td>ST</td>
<td>1.28 fl oz/cwt of seed</td>
</tr>
<tr>
<td>Dermacor X</td>
<td>rynaxypyr</td>
<td>ST</td>
<td>3.84 fl oz/cwt of seed</td>
</tr>
<tr>
<td>HGW86 60FS</td>
<td>cyazypyr</td>
<td>ST</td>
<td>1.28 fl oz/cwt of seed</td>
</tr>
<tr>
<td>HGW86 60FS</td>
<td>cyazypyr</td>
<td>ST</td>
<td>3.84 fl oz/cwt of seed</td>
</tr>
<tr>
<td>Coragen</td>
<td>rynaxypyr</td>
<td>IF</td>
<td>5 fl oz/acre</td>
</tr>
<tr>
<td>Coragen</td>
<td>rynaxypyr</td>
<td>IF</td>
<td>7 fl oz/acre</td>
</tr>
<tr>
<td>HGW86 60FS</td>
<td>cyazypyr</td>
<td>IF</td>
<td>6.75 fl oz/acre</td>
</tr>
<tr>
<td>HGW86 60FS</td>
<td>cyazypyr</td>
<td>IF</td>
<td>13.5 fl oz/acre</td>
</tr>
<tr>
<td>Durivo</td>
<td>chlorantraniliprole + thiamethoxan</td>
<td>IF</td>
<td>13 fl oz/acre</td>
</tr>
<tr>
<td>Coragen</td>
<td>rynaxypyr</td>
<td>F</td>
<td>5 fl oz/acre</td>
</tr>
<tr>
<td>HGW86 60FS</td>
<td>cyazypyr</td>
<td>F</td>
<td>13.5 fl oz/acre</td>
</tr>
<tr>
<td>Hero 1.24 EC</td>
<td>Z-cypermethrin + bifenthrin</td>
<td>F</td>
<td>4 fl oz/acre</td>
</tr>
</tbody>
</table>

*ST = seed treatment; IF = in furrow application; F = foliar
# Products Evaluated for Managing Insect Pests of Snap Bean in WI, NY and VA in 2010

<table>
<thead>
<tr>
<th>Product</th>
<th>Active Ingredient</th>
<th>Type*</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Untreated</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Dermacor X</td>
<td>rynaxypyr</td>
<td>ST</td>
<td>1.28 fl oz/cwt of seed</td>
</tr>
<tr>
<td>Dermacor X</td>
<td>rynaxypyr</td>
<td>ST</td>
<td>2.56 fl oz/cwt of seed</td>
</tr>
<tr>
<td>Dermacor X</td>
<td>rynaxypyr</td>
<td>ST</td>
<td>3.84 fl oz/cwt of seed</td>
</tr>
<tr>
<td>Dermacor X DPX YX860</td>
<td>rynaxypyr experimental</td>
<td>ST</td>
<td>1.28 fl oz/cwt of seed</td>
</tr>
<tr>
<td>HGW86 60FS</td>
<td>cyazypyr</td>
<td>ST</td>
<td>1.28 fl oz/cwt of seed</td>
</tr>
<tr>
<td>HGW86 60FS</td>
<td>cyazypyr</td>
<td>ST</td>
<td>3.84 fl oz/cwt of seed</td>
</tr>
<tr>
<td>Cruiser</td>
<td>thiamethoxam</td>
<td>ST</td>
<td>1.28 fl oz/cwt of seed</td>
</tr>
<tr>
<td>Coragen 1.67SC</td>
<td>rynaxypyr</td>
<td>IF</td>
<td>5 fl oz/acre</td>
</tr>
<tr>
<td>Coragen 1.67SC</td>
<td>rynaxypyr</td>
<td>IF</td>
<td>7 fl oz/acre</td>
</tr>
<tr>
<td>HGW86 10SE + MSO</td>
<td>cyazypyr</td>
<td>F</td>
<td>10.1 fl oz/acre</td>
</tr>
<tr>
<td>Coragen 1.67SC + MSO</td>
<td>rynaxypyr</td>
<td>F</td>
<td>3.5 fl oz/acre</td>
</tr>
</tbody>
</table>

*ST = seed treatment; IF = in furrow application; F = foliar
Seedcorn Maggot (SCM)
Bone and meat meal to lure SCM flies and concentrate eggs

Prediction of Seed corn maggot oviposition

- 200 DD
- 600 DD
- 1,000 DD
Percent Snap bean Seedlings Damaged by Seedcorn Maggot

Arlington, WI  2009

Mean % damaged seedlings (20 ft rows)

Seed treatments

- Untreated
- Cruiser 5FS
- Dermacor (low)
- HGW86 (low)
- Coragen (low)
- HGW86 20SC (low)

In-furrow spray

- Dermacor (high)
- HGW86 (high)
- Coragen (high)
- HGW86 20SC (high)
- Durivo

Treatments

Groves & Chapman

N=4
Percent Snap Bean Seedlings Damaged by Seedcorn Maggot

Arlington, WI 2010

N=4

Mean % damaged seedlings (20 ft rows)

Seed treatments

In-furrow

Foliar

Treatments

Untreated
Dermacor (low)
Dermacor (med)
Dermacor (high)
Dermacor (low) +
HGW86 (low)
HGW86 (high)
Cruiser
Coragen (5.0)
Coragen (7.0)
Coragen (3.5)
HGW86 10SE (10.1)
Groves & Chapman
Percent Snap Bean Seedlings Damaged by Seedcorn Maggot

Plover, WI 2010

Mean % damaged seedlings (20 ft rows)

<table>
<thead>
<tr>
<th>Treatments</th>
<th>N=4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Untreated</td>
<td></td>
</tr>
<tr>
<td>Dermacor (low)</td>
<td></td>
</tr>
<tr>
<td>Dermacor (med)</td>
<td></td>
</tr>
<tr>
<td>Dermacor (high)</td>
<td></td>
</tr>
<tr>
<td>Dermacor (low) + .</td>
<td></td>
</tr>
<tr>
<td>HGW86 (low)</td>
<td></td>
</tr>
<tr>
<td>HGW86 (high)</td>
<td></td>
</tr>
<tr>
<td>Cruiser</td>
<td></td>
</tr>
<tr>
<td>Coragen (5.0)</td>
<td></td>
</tr>
<tr>
<td>Coragen (7.0)</td>
<td></td>
</tr>
<tr>
<td>HGW86 10SE (10.1)</td>
<td></td>
</tr>
<tr>
<td>Coragen (3.5)</td>
<td></td>
</tr>
</tbody>
</table>

Seed treatments

In-furrow

Foliar

Treatments

Flood & Caine

Del Monte Foods
Potato Leafhopper (PLH)

Treated with insecticides

Untreated
Number of Adult Potato Leafhoppers per 25 sweeps (avg. for 4, 11 and 19 June)  Arlington, WI  2009

Treatments

Mean number of PLH per 25 sweeps

N=4

Seed treatments

In-furrow spray

Untreated
Cruiser 5FS
Dermacor (low)
Dermacor (high)
HGW86 (low)
HGW86 (high)
Coragen (low)
Coragen (high)
HGW86 20SC (low)
HGW86 20SC (high)
Durivo

Groves & Chapman
Number of Adult Potato Leafhoppers per 25 sweeps (avg. for 18 and 25 June)  

Arlington, WI  2010

Mean number of PLH per 25 sweeps

- Seed treatments
  - Dermacor (low)
  - Dermacor (med)
  - Dermacor (high)
  - HGW86 (low)
  - HGW86 (high)

- In-furrow
  - Cruiser

- Foliar
  - Coragen (5.0)
  - Coragen (7.0)
  - HGW86 10SE (10.1)
  - Coragen (3.5)

Treatments

Groves & Chapman

N=4
European Corn Borer (ECB)
European corn borer

- Predict ECB flights with heat units: 600, 1700 HU
- Monitor egg masses on plants
- Monitor adults with black light

Foliar Applications

- Treat only when insects and pods / flowers are present
Infested 5 plant row with ~ 350 ECB larvae
Percent Snap Bean Pods Damaged by European Corn Borer

Arlington, WI  2009

Mean % damaged pods

Seed treatments

Untreated
Cruiser 5FS
Dermacor (low)
Dermacor (high)
HGW86 (low)
HGW86 (high)
Coragen (low)
Coragen (high)
HGW86 20SC (low)
HGW86 20SC (high)

In-furrow spray

Durivo
Hero 1.24EC

Foliar spray

N=4

Treatments

Groves & Chapman
Percent Snap Bean Pods Damaged by European Corn Borer

Geneva, NY 2009

Mean % damaged pods

Seed treatments

In-furrow spray

Foliar spray

Treatments

N=5

Untreated
Cruiser 5FS
Dermacor (low)
Dermacor (high)
HGW86 (low)
HGW86 (high)
Coragen (low)
Coragen (high)
HGW86 20SC (low)
HGW86 20SC (high)
Durivo
Coragen
HGW86 10 OD
Hero 1.24 EC

Nault and Hessney

Cornell University
Percent Snap Bean Pods Damaged by European corn borer

Arlington, WI 2010

Seed treatments

Mean % damaged pods

N=4

Treatments

In-furrow Foliar

Groves & Chapman

Untreated    Dermacor (low)  Dermacor (med)  Dermacor (high)  HGW86 (low)  HGW86 (high)  Cruiser  Coragen (5.0)  Coragen (7.0)  HGW86 10SE (10.1)  Coragen (3.5)
Percent Snap Bean Pods Damaged by European corn borer Plover, WI 2010

1st pinning 13 July 2010  N=4

Mean % damaged pods

Seed treatments

In-furrow  Foliar

Treatments

Untreated  Dermacor (low)  Dermacor (med)  Dermacor (high)  HGW86 (low)  HGW86 (high)  Cruiser  Coragen (5.0)  Coragen (7.0)  HGW86 10SE (10.1)  Coragen (3.5)
Percent Snap Bean Pods Damaged by European corn borer Plover, WI 2010

2nd pinning 20 July 2010  N=4

Mean % damaged pods

Seed treatments

In-furrow  Foliar

Treatments

Del Monte Foods

Flood & Caine
Mean Yield of Snap Bean Pods
Arlington, WI  2010

Mean yield snap bean pods (tons ac\(^{-1}\))

Seed treatments

In-furrow
Foliar

Treatments

- Untreated
- Dermacor (low)
- Dermacor (med)
- Dermacor (high)
- HGW86 (low)
- HGW86 (high)
- Cruiser
- Coragen (5.0)
- Coragen (7.0)
- HGW86 10SE (10.1)
- Coragen (3.5)

N=4

Groves & Chapman
Mean Yield of Snap Bean Pods
Plover, WI 2010

Mean yield snap bean pods (tons ac\textsuperscript{-1})

Seed treatments
In-furrow
Foliar

Treatments
Untreated
Dermacor (low)
Dermacor (med)
Dermacor (high)
HGW86 (low)
HGW86 (high)
Cruiser
Coragen (5.0)
Coragen (7.0)
HGW86 10SE
Coragen (3.5)

$P = 0.0572$  $N=4$

Groves & Chapman
Summary

• Rynaxypyr and cyazypyr have activity against seedcorn maggot, potato leafhopper and European corn borer.

• Rynaxypyr and cyazypyr were effective against the target pest when applied as a seed treatment, in-furrow spray and foliar spray.
• Rynaxypyr and cyazypyr further demonstrated efficacy against corn earworm

• Damages estimates were more prevalent on stems when compared to damaged pods

• Larval feeding bioassays also documented the efficacy of rynaxypyr and cyazypyr against both ECB and CEW
Future Research

• Repeat experiments in 2010 in TX, NY and VA and generate efficacy data for major pests

• Refine rates of rynaxypyr and cyazypyr, especially for seed treatments
Acknowledgements

Collaborators
Alan Taylor (NY)
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Tom Kuhar (VA)

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Carol Groves

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