At-Plant Uses of Coragen™ and Verimark™ in Green Beans

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Insecticides for Managing Snap Bean Pests

Recently Labeled in Wisconsin:

- **Radiant SC** (spinetoram)
- **Coragen 1.67 SC** (chlorantraniliprole) – foliar
- **Entrust** (spinosad) – seed treatment
- **Voliam Xpress** (chlorantraniliprole + lambda-cyhalothrin)

In the Pipeline:

- **Dermacor X** (chlorantraniliprole) - not supported
- **Durivo, Voliam Flexi** (chlorantraniliprole + thiamethoxam)
- **Benevia, Verimark** (cyantraniliprole)
- **Belt 480SC** (flubendiamide)
**Anthranillic Diamide Insecticides**

- **Active ingredients**: rynaxypyr (aka chlorantraniliprole) and cyazypyr (aka cyantraniliprole).

- **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 (*seed treatment*)
  - Exceptionally long residual control – xylem mobile
  - Active against Lepidopterans, Coleoptera, and Hemiptera
Processing Snap Bean: Pest Phenology in Wisconsin

- **European corn borer**
- **Potato leafhopper**
- **Seed corn maggot**

**Planting**
- 5/5
- 5/19
- 6/2
- 6/16
- 6/30
- 7/14
- 7/28

**Harvesting**
- 8/11
- 8/25
- 9/8
- 9/22
- 10/6
Processing Snap Bean: ECB Pest Phenology

- Early
- Middle
- Late

- Flowering
- Insecticide app

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

ECB Phenology
Major Snap Bean Pests in Midwest

Seedcorn Maggot (SCM)

Potato Leafhopper (PLH)

European corn borer (ECB)
Objective

• To evaluate the efficacy of chlorantraniliprole and cyantraniliprole when applied as in furrow and fertilizer pre-mix applications 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 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>
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<tr>
<td>Dermacor X</td>
<td>rynaxypyr</td>
<td>ST</td>
<td>3.84 fl oz/cwt of seed</td>
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<tr>
<td>Dermacor X DPX YX860</td>
<td>rynaxypyr</td>
<td>ST</td>
<td>1.28 fl oz/cwt of seed</td>
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<tr>
<td></td>
<td>experimental</td>
<td></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>
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<tr>
<td>Coragen 1.67SC</td>
<td>rynaxypyr</td>
<td>IF</td>
<td>7 fl oz/acre</td>
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<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
# Products Evaluated for Managing Insect Pests of Snap Bean in WI, 2011

<table>
<thead>
<tr>
<th>Product</th>
<th>Active Ingredient</th>
<th>Type*</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. UTC</td>
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<td></td>
</tr>
<tr>
<td>2. Coragen</td>
<td>rynaxypyr</td>
<td>IF</td>
<td>3.5 fl oz/acre</td>
</tr>
<tr>
<td>3. Coragen</td>
<td>rynaxypyr</td>
<td>IF</td>
<td>5.0 fl oz/acre</td>
</tr>
<tr>
<td>4. Coragen</td>
<td>rynaxypyr</td>
<td>IF</td>
<td>7.0 fl oz/acre</td>
</tr>
<tr>
<td>5. Verimark</td>
<td>cyazypyr</td>
<td>IF</td>
<td>10.2 fl oz/acre</td>
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<td>6. Coragen</td>
<td>rynaxypyr</td>
<td>LF</td>
<td>3.5 fl oz/acre</td>
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<tr>
<td>7. Coragen</td>
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<td>LF</td>
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<tr>
<td>8. Coragen</td>
<td>rynaxypyr</td>
<td>LF</td>
<td>7.0 fl oz/acre</td>
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<tr>
<td>9. Verimark</td>
<td>cyazypyr</td>
<td>LF</td>
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<tr>
<td>10. Coragen</td>
<td>rynaxypyr</td>
<td>DF</td>
<td>5.0 fl oz/acre</td>
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<tr>
<td>11. Coragen</td>
<td>rynaxypyr</td>
<td>DF</td>
<td>7.0 fl oz/acre</td>
</tr>
<tr>
<td>12. Verimark</td>
<td>cyazypyr</td>
<td>DF</td>
<td>10.2 fl oz/acre</td>
</tr>
<tr>
<td>13. Coragen</td>
<td>rynaxypyr</td>
<td>LF</td>
<td>3.5 fl oz/acre**</td>
</tr>
<tr>
<td>14. Coragen</td>
<td>rynaxypyr</td>
<td>LF</td>
<td>5.0 fl oz/acre**</td>
</tr>
<tr>
<td>15. Coragen</td>
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<td>LF</td>
<td>7.0 fl oz/acre**</td>
</tr>
<tr>
<td>16. Verimark</td>
<td>cyazypyr</td>
<td>LF</td>
<td>10.2 fl oz/acre**</td>
</tr>
</tbody>
</table>

*IF = in furrow application; LF = liquid fertilizer; DF = dry fertilizer

**Trts 13-16 pre-mixed 10:1 with H₂O before mixing with fertilizer
Seedcorn Maggot (SCM)
Percent Snap Bean Seedlings Damaged by Seedcorn Maggot  
Arlington, WI 2010

Mean % damaged seedlings (20 ft rows)

Seed treatments

In-furrow  Foliar

Treatments

- Untreated
- Dermacor (low)
- Dermacor (med)
- Dermacor (high)
- Dermacor (low) + Exp
- Verimark (low)
- Verimark (high)
- Cruiser
- Coragen (5.0)
- Coragen (7.0)
- Benevia 10SE (10.1)
- Coragen (3.5)

P< 0.0001  N=4
Percent Snap Bean Seedlings Damaged by Seedcorn Maggot

Plover, WI 2011

Mean % damaged seedlings (20 ft rows)

In-furrow  LF Pre  DF Pre  LF Pre

Treatments

- Untreated
- Coragen 3.5
- Coragen 5.0
- Verimark 7.0
- Coragen 3.5
- Coragen 5.0
- Verimark (10.2)
- Coragen 7.0
- Coragen (10.2)
- Coragen 3.5
- Coragen 5.0
- Verimark 7.0
- Verimark (10.2)

P = 0.0812  N=4
Potato Leafhopper (PLH)

Treated with insecticides  Untreated
Number of Adult Potato Leafhoppers per 25 sweeps (avg. for 18 and 25 June)  Arlington, WI  2010

Mean number of PLH per 25 sweeps

Untreated  Dermacor (low)  Dermacor (med)  Dermacor (high)  Verimark (low) + Exp  Verimark (low)  Verimark (high)  Cruiser  Coragen (5.0)  Coragen (7.0)  Benevia 10SE (10.1)  Coragen (3.5)

Treatments

Seed treatments

In-furrow

Foliar

N=4
European Corn Borer (ECB)
Predicting ECB Flights

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 2010

Seed treatments

In-furrow Foliar

Mean % damaged pods

N=4

Treatments

Untreated
Dermacor (low)
Dermacor (med)
Dermacor (high)
Dermacor (low) + Exp
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

Mean % damaged pods

Seed treatments

1st pinning 13 July 2010  N=4

Treatments

In-furrow Foliar

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

P=0.7629  N=4

Mean % damaged pods

Seed treatments

In-furrow

Foliar

Treatments

Untreated
Dermacor (low)
Dermacor (med)
Dermacor (high)
Dermacor (low) + Exp
HGW86 (low)
HGW86 (high)
Crusier
Coragen (5.0)
Coragen (7.0)
HGW86 10SE (10.1)
Coragen (3.5)
Percent Snap Bean Stems Damaged by European corn borer (Plover, WI 2011)

Mean % damaged stems (25 plants)

In-furrow: LF Pre, DF Pre, LF Pre

Treatments: Untreated, Coragen 3.5, Coragen 5.0, Verimark (10.2), Coragen 3.5, Coragen 5.0, Verimark (10.2), Coragen 5.0, Verimark (10.2), Coragen 3.5, Coragen 5.0, Verimark (10.2)

P < 0.0001  N=4
Mean Percent of Damaged Pods Damaged by European Corn Borer

Plover, WI 2011

Mean % damaged pods (25 ft rows)

P = 0.0232   N=4

Treatments

In-furrow

LF Pre

DF Pre

LF Pre

Untreated
Coragen 3.5
Coragen 5.0
Verimark (10.2)
Coragen 3.5
Coragen 5.0
Verimark (10.2)
Coragen 5.0
Verimark (10.2)
Coragen 3.5
Coragen 5.0
Verimark (10.2)
Percent Snap Bean Pods with Larvae of European corn borer Plover, WI 2011

- In-furrow
- LF Pre
- DF Pre
- LF Pre

Mean % infested pods (25 plants)

Treatments

- Untreated
- Coragen 3.5
- Coragen 5.0
- Coragen 7.0
- Verimark (10.2)
- Coragen 3.5
- Coragen 5.0
- Coragen 7.0
- Verimark (10.2)
- Coragen 3.5
- Coragen 5.0
- Verimark (10.2)

P < 0.0001   N=4
Mean Yield of Snap Bean Pods
Arlington, WI 2010

P = 0.0427  N=4

Seed treatments

In-furrow  Foliar

Treatments

Untreated  Dermacor (low)  Dermacor (med)  Dermacor (high)  Verimark (low)  Verimark (high)  Cruiser  Coragen (5.0)  Coragen (7.0)  Benevia 10SE (10.1)  Coragen (3.5)
Mean Yield of Snap Bean Pods
Plover, WI 2011

Mean yield snap bean pods (tons ac⁻¹)

In-furrow  LF Pre  DF Pre  LF Pre

Treatments

P = 0.9390  N=4

Un treated  Coragen 3.5  Coragen 5.0  Verimark (10.2)  Coragen 3.5  Coragen 5.0  Verimark (10.2)  Coragen 5.0  Verimark (10.2)  Coragen 3.5  Coragen 5.0  Verimark (10.2)
Factors Influencing Insect Pest Management

‘Food Safety’

– Major food retailers are setting acceptable residue levels below those set by government regulatory agencies.

“No detectable residues” will be a competitive advantage for food retailers.

– Older insecticides that do not meet these requirements are not being re-registered, resulting in increased use of novel insecticides (reduced-risk).
Advantages of Novel Application Technologies

• Reduced risk to environment and farm workers
  – Drift to non-target areas is eliminated
  – Farm workers do not come into contact with residues on exterior of plant
  – Beneficial organisms not directly exposed

• Longer residual activity
  – Not subject to loss from rain and UV light
  – Not subject to plant growth dilution effects

• More cost-effective
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 in-furrow and when applied as a liquid fertilizer pre-mix application.
**Summary**

- Damages estimates continue to be more prevalent on stems when compared to damaged pods.

- Larval feeding bioassays (2010) also documented the efficacy of rynaxypyr and cyazypyr against both ECB and CEW.
Future Research

• Repeat experiments in 2011 in larger field-scale plots and generate efficacy data for major pests

• Refine rates of rynaxypyr and cyazypyr, especially for in-furrow treatments – 24c registration data
Acknowledgements

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Don Caine
Stewart Higgins

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Jasmine Navarre
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Marilyn Matusky

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