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2016 INSECTICIDE AND ACARICIDE RESEARCH ON VEGETABLES IN VA



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INSECTICIDE AND ACARICIDE RESEARCH ON VEGETABLES IN VIRGINIA – 2016

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Foreword

This booklet contains arthropod pest management research conducted on vegetable crops in eastern Virginia in 2016. Research was conducted at several locations in Virginia including: 1) the Virginia Tech Eastern Shore Agricultural Research and Extension Center (AREC) near Painter, VA; 2) the Hampton Roads AREC in Virginia Beach, VA; 3) the Virginia Tech Kentland Research Farm near Blacksburg, VA; and 4) the Southwest Virginia 4-H Educational Center in Abingdon, VA. All plots were maintained according to standard commercial practices. Soil type at the ESAREC is a Bojac Sandy Loam. Soil type at the HRAREC is Tetotum loam (average pH: 5.7). Soil type at the Kentland Research Farm is Shottower loam. Most of the research involves field evaluations of insecticides. Some of the information presented herein will be published in a similar format in the journal *Arthropod Management Tests*: 2017, vol. 42 (Entomological Society of America). We hope that this information will be of value to those interested in insect pest management on vegetable crops, and we wish to make the information accessible.

However, please note that all information is for informational purposes only. Because most of the data from the studies are based on a single season's environmental conditions, it is requested that the data not be published, reproduced, or otherwise taken out of context without the permission of the authors. The authors neither endorse any of the products in these reports nor discriminate against others. Additionally, some of the products evaluated are not commercially available and/or not labeled for use on the crop(s) in which they were used.

2016 Weather Data for research farm locations

2016 ESAREC Weather data can be found at:

http://arec.vaes.vt.edu/arec/eastern-shore/Weather_Data.html

2016 Kentland Farm Weather data can be found at:

<http://vaes.vt.edu/college-farm/weather/weather2016.html>

If you have questions concerning the data or interpretation of the results, please feel free to contact me, Tom Kuhar at 540-231-6129; e-mail: tkuhar@vt.edu

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COLE CROPS

CONTROL OF GREEN PEACH APHIDS IN CABBAGE

Location: ESAREC, Painter, VA
Variety: 'Late Flat Dutch'
Transplant Date: 25 Aug 2016
Experimental Design: 7 treatments arranged in a RCB design with 4 reps – 1 row x 20 ft. (3-ft row centers)
Treatment Method: All foliar treatments were applied with a 3-nozzle boom equipped with 8003VS spray tips spaced 20" apart and powered by a CO GPA.
Foliar Treatment Dates: 4 Oct 2016

| Treatment | Rate / acre | Mean no. green peach aphids / 5 plants | Mean no. ladybugs / 5 plants | Mean no. harlequin bugs / 5 plants |
|----------------------------|-----------------------|--|------------------------------|------------------------------------|
| Untreated check | | 288.0 a | 1.3 | 0.8 |
| Experimental + Li-700 | n/a | 3.0 ab | 0.3 | 0.0 |
| Experimental + Li-700 | n/a | 121.0 ab | 1.0 | 0.3 |
| Experimental + Li-700 | n/a | 30.5 ab | 0.5 | 0.5 |
| Experimental + Li-700 | n/a | 9.8 ab | 0.0 | 0.8 |
| Movento + Li-700 | 5 fl. oz + 0.25% v/v | 57.8 a | 1.3 | 0.5 |
| Sivanto + Li-700 | 10 fl. oz + 0.25% v/v | 0.3 b | 1.3 | 0.0 |
| <i>P-value from Anonva</i> | | 0.0050 | ns | ns |

All data were analyzed using analysis of variance procedures. Means were separated using Tukey's HSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different ($P > 0.05$).

CONTROL OF HARLEQUIN BUGS IN COLLARDS

Location: HRAREC, Virginia Beach, VA
Variety: 'Champion'
Transplant Date: 19 May 2016
Experimental Design: 9 treatments arranged in a RCB design with 4 reps – 1 row x 20 ft. (3-ft row centers)
Treatment Method: All foliar treatments were applied with a 3-nozzle boom equipped with 8003VS spray tips spaced 20" apart and powered by a CO GPA.
Foliar Treatment Dates: 28 Jul

| Treatment | Rate / acre | Mean no. harlequin bugs / 5 plants | | | |
|-----------------------------------|-------------------------|------------------------------------|-----------------|---------------|-----------------|
| | | Nymphs | | Adults | |
| | | 3-Aug (6 DAT) | 10 Aug (13 DAT) | 3-Aug (6 DAT) | 10 Aug (13 DAT) |
| Untreated check | | 266.3 a | 90.8 a | 5.5 | 3.0 |
| Certador* (dinotefuran) + Scanner | 6.5 fl. oz + 0.25% v/v | 0.3 b | 7.5 b | 0.0 | 0.3 |
| Certador* + Scanner | 19.5 fl. oz + 0.25% v/v | 1.3 b | 0.3 b | 0.0 | 0.5 |
| Certador* + Scanner | 26 fl. oz + 0.25% v/v | 3.3 b | 2.0 b | 0.5 | 0.5 |

| | | | | | |
|----------------------------|-------------------------|--------|--------|-----|-----|
| Actara 25WG + Scanner | 5.5 oz + 0.25% v/v | 0.8 b | 1.5 b | 1.3 | 1.0 |
| Brigade 2EC + Scanner | 5.20 fl. oz + 0.25% v/v | 1.8 b | 9.3 b | 0.3 | 3.0 |
| Harvanta 50SL + Scanner | 11 fl. oz + 0.25% v/v | 6.8 b | 12.3 b | 4.0 | 2.3 |
| Harvanta 50SL + Scanner | 16.4 fl. oz + 0.25% v/v | 8.3 b | 1.8 b | 3.8 | 2.3 |
| Sivanto + Scanner | 10 fl. oz + 0.25% v/v | 3.8 b | 18.0 b | 0.8 | 1.5 |
| <i>P</i> -value from Anova | | 0.0002 | 0.0013 | ns | ns |

All data were analyzed using analysis of variance procedures. Means were separated using Tukey's HSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different ($P>0.05$).

*Not currently labeled for collards

CONTROL OF LEPIDOPTERAN LARVAE IN COLLARDS

| | |
|------------------------|---|
| Location: | HRAREC, Virginia Beach, VA |
| Variety: | 'Champion' |
| Transplant Date: | 19 May 2016 |
| Treatment Method: | All foliar treatments were applied with a 3-nozzle boom equipped with 8003VS spray tips spaced 20" apart and powered by a CO GPA. |
| Experimental Design: | 11 treatments arranged in a RCB design with 4 reps – 1 row x 20 ft. (3-ft row centers) |
| Foliar Treatment Date: | 3 Jun, 9 Jun (CX1212 and CX1201 only) and 15 Jun |

| Treatment | Rate / acre | Mean no. total lepidopteran larvae* / 5 plants | | | | % unmarketable leaves |
|----------------------------|------------------------|--|---------|--------|--------|-----------------------|
| | | 9-Jun | 15-Jun | 22-Jun | 29-Jun | |
| Untreated check | | 9.3 a | 8.8 a | 1.8 a | 9.8 a | 67.5 a |
| Experimental + Scanner | 12 fl. oz + 0.25% v/v | 0.3 b | 1.5 b | 0.0 b | 2.5 b | 40.0 abc |
| Experimental + Scanner | 24 fl. oz + 0.25% v/v | 0.3 b | 0.3 b | 0.8 ab | 2.3 b | 40.0 abc |
| Experimental + Scanner | 8 oz + 0.25% v/v | 0.0 b | 0.8 b | 0.0 b | 3.0 ab | 22.5 abc |
| Experimental + Scanner | 16 oz + 0.25% v/v | 0.5 b | 0.0 b | 0.3 b | 1.0 b | 25.0 abc |
| Endigo ZC + Scanner | 4 fl. oz + 0.25% v/v | 0.0 b | 0.0 b | 0.3 b | 2.5 b | 25.0 abc |
| Intrepid Edge + Scanner | 8 fl. oz + 0.25% v/v | 0.0 b | 0.0 b | 0.3 b | 2.5 b | 17.5 abc |
| Radiant + Scanner | 5.8 fl. oz + 0.25% v/v | 0.0 b | 0.5 b | 0.0 b | 1.8 b | 7.5 c |
| Coragen + Scanner | 4.8 fl. oz + 0.25% v/v | 0.3 b | 0.3 b | 0.0 b | 0.3 b | 12.5 bc |
| Avaunt + Scanner | 7 oz + 0.25% v/v | 0.3 b | 0.8 b | 0.0 b | 3.3 ab | 50.0 ab |
| Belt + Scanner | 1.5 fl. oz + 0.25% v/v | 1.5 b | 3.5 | 0.0 b | 1.5 b | 17.5 abc |
| <i>P</i> -value from Anova | | <0.0001 | <0.0001 | 0.0056 | 0.0074 | 0.0032 |

All data were analyzed using analysis of variance procedures. Means were separated using Tukey's HSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different ($P>0.05$).

CUCURBIT CROPS

CONTROL OF FOLIAR INSECTS IN SUMMER SQUASH

| | |
|------------------|---------------------|
| Location: | ESAREC, Painter, VA |
| Variety: | 'Gold Star' |
| Transplant Date: | 15 Jul 2016 |

Treatment Method: All foliar treatments were applied with a 3-nozzle boom equipped with 8003VS spray tips and powered by a CO₂ backpack sprayer at 40psi delivering 30 GPA.

Experimental Design: 12 treatments arranged in a RCB design with 4 reps – 1 row x 20 ft (6 ft. row centers).

Foliar Treatment Date: 16 and 23 Aug

Table 1. Summary of efficacy of foliar insecticides for the control of foliar insects in summer squash; Virginia Tech ESAREC, Painter, VA 2016 (Squash bug counts)

| Treatment | Rate / Acre | Mean no. squash bugs / 5 plants | | | | | | |
|----------------------------|----------------------|---------------------------------|----------|--------|--------|----------|--------|--------|
| | | 19-Aug | 23-Aug | | | 30-Aug | | |
| | | Adults | Egg mass | Nymphs | Adults | Egg mass | Nymphs | Adults |
| Untreated check | | 2.0 | 3.8 | 10.8 | 2.3 | 1.3 | 22.0 | 5.0 |
| Movento + Scanner (NIS) | 5 fl. oz + 0.25% v/v | 1.0 | 1.0 | 0.5 | 3.3 | 0.5 | 15.8 | 0.8 |
| Sivanto | 7 fl. oz | 0.3 | 1.0 | 2.5 | 0.8 | 0.0 | 15.0 | 0.0 |
| Sivanto | 10 fl. oz | 0.3 | 1.3 | 0.0 | 1.0 | 1.3 | 1.0 | 0.5 |
| Experimental | 2.28 fl. oz | 0.8 | 0.3 | 0.0 | 1.0 | 1.5 | 3.8 | 2.3 |
| Experimental | 3.43 fl. oz | 1.8 | 2.0 | 4.0 | 3.5 | 0.5 | 1.3 | 3.0 |
| Experimental | 4.57 fl. oz | 0.8 | 1.8 | 4.3 | 2.3 | 1.3 | 0.0 | 1.3 |
| Experimental | 1.37 fl. oz | 0.8 | 2.5 | 5.3 | 1.0 | 0.5 | 11.3 | 2.0 |
| Beleaf 50WDG | 2.8 oz | 0.5 | 2.0 | 15.8 | 1.8 | 0.8 | 5.0 | 2.3 |
| Harvanta 50SL | 11 fl. oz | 2.3 | 0.5 | 0.5 | 1.5 | 0.0 | 6.5 | 0.8 |
| Harvanta 50SL | 16.4 fl. oz | 1.3 | 0.8 | 1.3 | 1.5 | 0.3 | 2.5 | 0.8 |
| Warrior II | 1.92 fl. oz | 0.3 | 1.0 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 |
| <i>P</i> -value from Anova | | ns | ns | ns | ns | ns | ns | ns |

All data were analyzed using analysis of variance procedures. Means were separated using Tukey's HSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different ($P > 0.05$).

Table 2. Summary of efficacy of foliar insecticides for the control of foliar insects in summer squash; Virginia Tech ESAREC, Painter, VA 2016 (aphid counts)

| Treatment | Rate / Acre | Mean no. aphids / 10 leaves | | | | | | | |
|-------------------------|----------------------|-----------------------------|--------------|--------------------|--------------|--------------|--------------------|--------------|--------------|
| | | 23-Aug | 30-Aug | | | 6-Sep | | | 13-Sep |
| | | Melon aphids | Melon aphids | Green peach aphids | Total aphids | Melon aphids | Green peach aphids | Total aphids | Melon aphids |
| Untreated check | | 18.5 ab | 80.5 a | 0.5 | 81.0 a | 78.3 b | 5.0 ab | 83.3 b | 41.3 b |
| Movento + Scanner (NIS) | 5 fl. oz + 0.25% v/v | 2.5 ab | 3.0 b | 3.5 | 6.5 b | 3.0 b | 8.0 ab | 11.0 b | 36.8 b |
| Sivanto | 7 fl. oz | 1.3 b | 0.0 b | 1.5 | 1.5 b | 1.8 b | 0.0 b | 1.8 b | 27.8 b |
| Sivanto | 10 fl. oz | 0.0 b | 0.0 b | 0.5 | 0.5 b | 0.3 b | 0.0 b | 0.3 b | 20.3 b |
| Experimental | 2.28 fl. oz | 0.0 b | 0.0 b | 0.5 | 0.5 b | 0.0 b | 0.8 ab | 0.8 b | 3.8 b |
| Experimental | 3.43 fl. oz | 0.0 b | 0.0 b | 0.0 | 0.0 b | 0.0 b | 0.5 b | 0.5 b | 27.8 b |
| Experimental | 4.57 fl. oz | 0.3 b | 0.5 b | 5.0 | 5.5 b | 0.0 b | 0.0 b | 0.0 b | 6.3 b |
| Experimental | 1.37 fl. oz | 2.8 ab | 2.3 b | 0.8 | 3.0 b | 1.8 b | 4.5 ab | 6.3 b | 29.3 b |
| Beleaf 50WDG | 2.8 oz | 0.0 b | 0.3 b | 0.0 | 0.0 b | 0.0 b | 2.8 ab | 2.8 b | 12.0 b |

| | | | | | | | | | |
|----------------------------|-------------|--------|---------|-----|---------|---------|--------|---------|----------|
| Harvanta 50SL | 11 fl. oz | 9.5 ab | 4.3 b | 5.0 | 9.3 b | 0.5 b | 17.0 a | 17.5 b | 10.3 b |
| Harvanta 50SL | 16.4 fl. oz | 0.5 b | 1.3 b | 1.3 | 2.5 b | 1.0 b | 8.5 ab | 9.5 b | 3.5 b |
| Warrior II | 1.92 fl. oz | 21.8 a | 94.3 a | 0.0 | 94.3 a | 293.0 a | 2.0 ab | 295.0 a | 1149.5 a |
| <i>P</i> -value from Anova | | 0.0021 | <0.0001 | ns | <0.0001 | <0.0001 | 0.0285 | <0.0001 | 0.0022 |

All data were analyzed using analysis of variance procedures. Means were separated using Tukey's HSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different ($P>0.05$).

Table 3. Summary of efficacy of foliar insecticides for the control of foliar insects in summer squash; Virginia Tech ESAREC, Painter, VA 2016 (cucumber beetle counts)

| Treatment | Rate / Acre | Mean no. cucumber beetles | | |
|----------------------------|----------------------|---------------------------|-----------------|-----------------|
| | | Live / 10 blooms | Dead / 5 plants | Dead / 5 plants |
| | | 19-Aug | 19-Aug | 30-Aug |
| Untreated check | | 17.8 ab | 1.8 b | 0.0 b |
| Movento + Scanner (NIS) | 5 fl. oz + 0.25% v/v | 28.5 a | 1.3 b | 0.0 b |
| Sivanto | 7 fl. oz | 1.8 b | 13.8 b | 11.3 ab |
| Sivanto | 10 fl. oz | 0.8 b | 34.5 a | 16.3 a |
| Experimental | 2.28 fl. oz | 9.8 ab | 2.5 b | 0.3 b |
| Experimental | 3.43 fl. oz | 24.0 ab | 1.3 b | 1.8 b |
| Experimental | 4.57 fl. oz | 21.5 ab | 2.0 b | 0.3 b |
| Experimental | 1.37 fl. oz | 20.8 ab | 1.8 b | 1.3 b |
| Beleaf 50WDG | 2.8 oz | 16.8 ab | 0.5 b | 0.0 b |
| Harvanta 50SL | 11 fl. oz | 4.5 ab | 15.5 ab | 6.3 ab |
| Harvanta 50SL | 16.4 fl. oz | 2.5 b | 15.3 ab | 15.5 a |
| Warrior II | 1.92 fl. oz | 0.5 b | 2.0 b | 1.0 b |
| <i>P</i> -value from Anova | | 0.0004 | <0.0001 | <0.0001 |

All data were analyzed using analysis of variance procedures. Means were separated using Tukey's HSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different ($P>0.05$).

Table 4. Summary of efficacy of foliar insecticides for the control of foliar insects in summer squash; Virginia Tech ESAREC, Painter, VA 2016 (yield data)

| Treatment | Rate / Acre | Mean no. fruit / plot | | Mean total number of fruit | Mean weight in lbs 23 Aug | Mean no. fruit / plant 30 Aug ¹ | % diseased fruit / plot 30 Aug ² | Mean no. total fruit / plant ³ |
|-------------------------|----------------------|-----------------------|--------|----------------------------|---------------------------|--|---|---|
| | | 23-Aug | 30-Aug | | | | | |
| Untreated check | | 12.0 | 9.0 | 21.0 | 5.8 | 1.1 | 21.8 | 2.4 |
| Movento + Scanner (NIS) | 5 fl. oz + 0.25% v/v | 8.5 | 12.5 | 21.0 | 2.9 | 1.5 | 19.5 | 2.9 |
| Sivanto | 7 fl. oz | 7.0 | 13.8 | 20.8 | 3.0 | 1.1 | 30.8 | 1.6 |
| Sivanto | 10 fl. oz | 12.5 | 15.5 | 28.0 | 5.0 | 1.2 | 6.5 | 2.3 |
| Experimental | 2.28 fl. oz | 11.5 | 12.0 | 23.5 | 5.4 | 1.1 | 7.0 | 2.2 |

| | | | | | | | | |
|----------------------------|-------------|------|------|------|-----|-----|------|-----|
| Experimental | 3.43 fl. oz | 9.3 | 10.8 | 20.0 | 4.2 | 1.4 | 8.8 | 2.6 |
| Experimental | 4.57 fl. oz | 7.0 | 11.5 | 18.5 | 3.3 | 1.0 | 13.0 | 1.8 |
| Experimental | 1.37 fl. oz | 8.8 | 10.3 | 19.0 | 4.3 | 0.9 | 18.0 | 1.7 |
| Beleaf 50WDG | 2.8 oz | 13.3 | 10.0 | 23.3 | 6.0 | 1.0 | 16.5 | 2.4 |
| Harvanta 50SL | 11 fl. oz | 12.3 | 8.8 | 21.0 | 5.4 | 0.8 | 14.3 | 1.9 |
| Harvanta 50SL | 16.4 fl. oz | 11.3 | 12.5 | 23.8 | 5.1 | 1.1 | 20.5 | 2.2 |
| Warrior II | 1.92 fl. oz | 11.3 | 13.8 | 25.0 | 3.5 | 1.1 | 6.3 | 2.0 |
| <i>P</i> -value from Anova | | ns | ns | ns | ns | ns | ns | ns |

¹: no. fruit per plot / no. of plants per plot

²: (no. diseased fruit / no. healthy + diseased fruit) * 100

³: no. total fruit (2 harvests) / no. of plants per plot

All data were analyzed using analysis of variance procedures. Means were separated using Tukey's HSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different ($P > 0.05$).

CONTROL OF SQUASH BUGS IN SUMMER SQUASH

Location: HRAREC, Virginia Beach, VA

Variety: 'Spineless perfection'

Transplant Date: 9 Jun 2016

Treatment Method: All foliar treatments were applied with a 3-nozzle boom equipped with 8003VS spray tips and powered by a CO delivering 30 GPA.

Experimental Design: 9 treatments arranged in a RCB design with 4 reps – 1 row x 20 ft (6 ft. row centers).

Foliar Treatment Date: 13 and 20 Jul

Table 1. Summary of efficacy of foliar insecticides for the control of squash bugs in zucchini; Virginia Tech HRAREC, Virginia Beach, VA 2016

| Treatment | Rate / Acre | Mean no. squash bugs / 5 plants | | | | | | Mean no. cucumber beetles / 5 plants |
|----------------------------|-------------|---------------------------------|--------|--------|-----------------|--------|--------|--------------------------------------|
| | | 20-Jul (7 DAT) | | | 27-Jul (7 DAT2) | | | |
| | | egg masses | nymphs | adults | egg masses | nymphs | adults | |
| Untreated check | | 3.5 | 2.5 | 3.3 a | 7.5 | 15.8 a | 3.0 | 1.0 |
| Certador (dinotefuran) | 6.5 fl. oz | 0.3 | 0.0 | 0.5 b | 0.5 | 0.3 b | 0.3 | 1.5 |
| Certador | 19.5 fl. oz | 0.3 | 0.0 | 0.0 b | 0.5 | 0.0 b | 0.0 | 1.3 |
| Certador | 26 fl. oz | 0.0 | 0.3 | 1.3 ab | 0.8 | 0.0 b | 0.0 | 2.0 |
| Actara 25WG | 5.5 oz | 1.3 | 0.0 | 0.3 b | 1.5 | 0.5 b | 0.3 | 0.3 |
| Brigade 2EC | 5.2 fl. oz | 0.8 | 0.3 | 0.0 b | 0.0 | 0.0 b | 0.3 | 0.8 |
| Harvanta 50SL | 11 fl. oz | 0.3 | 3.3 | 0.0 b | 1.8 | 0.0 b | 0.3 | 2.3 |
| Harvanta 50SL | 16.4 fl. oz | 0.5 | 1.5 | 0.0 b | 0.0 | 0.0 b | 0.5 | 1.8 |
| Sivanto | 10 fl. oz | 1.0 | 0.5 | 0.5 b | 0.5 | 0.0 b | 0.3 | 1.5 |
| <i>P</i> -Value from Anova | | ns | ns | 0.0062 | ns | 0.0003 | ns | ns |

All data were analyzed using analysis of variance procedures. Means were separated using Tukey's HSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different ($P > 0.05$).

FRUITING VEGETABLE CROPS

CONTROL OF COLORADO POTATO BEETLES IN EGGPLANTS

Location: ESAREC, Painter, VA
Variety: 'Superior'
Transplant Date: 10 Jun 2016
Treatment Method: All foliar treatments were applied with a 3-nozzle boom equipped with D3 spray tips and powered by a CO 30 GPA.
Experimental Design: 4 treatments arranged in a RCB design with 4 reps – 1 row x 20 ft (6 ft. row centers).
Foliar Treatment Date: 10, 16 and 21 Jun
Laboratory Assay: On 21 Jun, following foliar application, 2 eggplant leaves were removed from field plants and placed in a 20-cm Petri dish with 5 adults and 5 large larvae (2 sets of Petri dishes). Mortality and % feeding were recorded at 1, 3 and 6 DAT.

Table 1. Control of Colorado potato beetles in eggplants; ESAREC, Painter, VA 2016

| Treatment | Rate / acre | Mean no. Colorado potato beetles | | | |
|----------------------------|-------------|----------------------------------|--------|--------|--------------|
| | | Small larvae | | | Large larvae |
| | | 13-Jun | 16-Jun | 20-Jun | 16-Jun |
| Untreated check | | 1.0 | 3.8 | 3.8 | 1.3 |
| Trident | 3 qts | 0.5 | 3.0 | 1.5 | 0.0 |
| Trident | 6 qts | 0.3 | 2.5 | 1.3 | 0.0 |
| Blackhawk | 3.3 oz | 0.5 | 0.0 | 0.0 | 0.0 |
| <i>P</i> -value from Anova | | ns | ns | ns | ns |

All data were analyzed using analysis of variance procedures. Means were separated using Tukey's HSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different ($P>0.05$).

Table 2. Laboratory Assay for the control of Colorado potato beetles fed field treated and excised eggplant leaves; ESAREC, Painter, VA 2016 (CPB mortality)

| Treatment | Rate / acre | % dead Colorado potato beetles | | | | | |
|----------------------------|-------------|--------------------------------|--------------|---------|--------------|--------|--------------|
| | | Adult | Large Larvae | Adult | Large Larvae | Adult | Large Larvae |
| | | 22-Jun | 22-Jun | 24-Jun | 24-Jun | 27-Jun | 27-Jun |
| Untreated check | | 0.0 b | 0.0 | 0.0 c | 0.0 b | 15.0 | 55.0 |
| Trident | 3 qts | 10.0 ab | 10.0 | 20.0 bc | 35.0 ab | 55.0 | 75.0 |
| Trident | 6 qts | 15.0 ab | 5.0 | 30.0 ab | 25.0 ab | 50.0 | 95.0 |
| Blackhawk | 3.3 oz | 45.0 a | 15.0 | 60.0 a | 55.0 a | 95.0 | 100.0 |
| <i>P</i> -value from Anova | | 0.0420 | ns | 0.0026 | 0.0032 | ns | ns |

All data were analyzed using analysis of variance procedures. Means were separated using Tukey's HSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different ($P>0.05$).

Table 3. Laboratory Assay for the control of Colorado potato beetles fed field treated and excised eggplant leaves; ESAREC, Painter, VA 2016 (Feeding data)

| Treatment | Rate / acre | % leaf feeding | | | | | |
|----------------------------|-------------|-----------------|------------------|-----------------|------------------|-----------------|------------------|
| | | Adult 22-Jun | Larvae 22-Jun | Adult 24-Jun | Larvae 24-Jun | Adult 27-Jun | Larvae 27-Jun |
| Untreated check | | 83.8 a | 76.3 a | 91.3 a | 75.0 a | 100.0 a | 82.5 a |
| Trident | 3 qts | 15.0 b | 25.0 b | 13.8 b | 23.8 b | 28.8 b | 35.0 b |
| Trident | 6 qts | 12.5 b | 13.8 b | 7.5 b | 15.0 b | 12.5 b | 33.8 b |
| Blackhawk | 3.3 oz | 13.8 b | 8.8 b | 16.3 b | 6.3 b | 21.3 b | 20.0 b |
| <i>P</i> -value from Anova | | 0.0002 | 0.0005 | 0.0001 | 0.0027 | <0.0001 | 0.0019 |

All data were analyzed using analysis of variance procedures. Means were separated using Tukey's HSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different ($P>0.05$).

CONTROL OF COLORADO POTATO BEETLES IN EGGPLANTS

| | |
|------------------------|--|
| Location: | Kentland Research Farm, Whitethorn, VA |
| Variety: | 'Classic' |
| Transplant Date: | 26 May 2016 |
| Treatment Method: | Plants were sprayed until all leaves were dripping, using 2-liter spray bottles. |
| Experimental Design: | 4 treatments arranged in a RCB design with 4 reps – 1 row x 25 ft (3 ft. row centers). |
| Foliar Treatment Date: | 30 Jun |

| Treatment | Rate / acre | 5 DAT | 9 DAT | Yield of marketable eggplant per 5 plants* (lbs) |
|----------------------------|--------------|--------|-------|--|
| Untreated Control | n/a | 5.5 a | 2.0 | 1.70 b |
| Trident | 96.0 fl. oz | 1.25 b | 2.0 | 3.13 ab |
| Trident | 192.0 fl. oz | 0.5 b | 1.5 | 3.38 ab |
| Blackhawk | 3.3 dry oz | 1.75 b | 0.5 | 3.88 a |
| <i>P</i> -value from ANOVA | | 0.034 | ns | 0.016 |

*Eggplant yields were impacted by heavy flea beetle pressure early in the season. Plots were not sprayed because we were trying to buildup CPB pressure
 All data were analyzed using analysis of variance procedures. Means were separated using Student's t test at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different ($P>0.05$).

CONTROL OF BROWN MARMORATED STINK BUGS IN TOMATOES

| | |
|------------------------|---|
| Location: | Kentland Research Farm, Blacksburg, VA |
| Variety: | 'Plum Regal' |
| Transplant Date: | 2 Jun 2016 |
| Treatment Method: | All foliar treatments were applied with a 3-nozzle boom equipped with D3 spray tips and powered by a CO 30 GPA. |
| Experimental Design: | 8 treatments arranged in a RCB design with 4 reps – 1 row x 20 ft (6 ft. row centers). |
| Foliar Treatment Date: | 11, 21, 26 Jul and 4, 15 and 22 Aug |

| Treatment | Rate / acre | % brown marmorated stink bug fruit damage | | | | |
|----------------------------|-------------|---|-------|--------|---------|-------------------------|
| | | 1-Aug | 8-Aug | 18-Aug | 25-Aug | Total Cumulative Damage |
| Untreated check | | 1.2 | 20.1 | 10.0 | 2.5 abc | 9.0 a |
| Certador (dinotefuran) | 6.5 fl. oz | 0.0 | 9.5 | 2.5 | 0.0 c | 3.3 bc |
| Certador | 19.5 fl. oz | 1.2 | 4.2 | 5.8 | 0.0 c | 3.0 bc |
| Certador | 26 fl. oz | 0.0 | 4.2 | 3.3 | 0.8 bc | 2.2 c |
| Actara 25WG | 5.5 oz | 1.2 | 6.0 | 0.0 | 1.2 abc | 2.4 c |
| Brigade 2EC | 5.2 fl. oz | 0.0 | 5.9 | 0.8 | 0.0 c | 1.9 c |
| Harvanta 50SL | 11 fl. oz | 1.2 | 7.0 | 4.2 | 2.5 ab | 4.1 abc |
| Harvanta 50SL | 15.4 fl. oz | 0.0 | 14.3 | 7.5 | 5.0 a | 6.9 ab |
| <i>P</i> -value from Anova | | ns | ns | ns | 0.0390 | 0.0107 |

All data were analyzed using analysis of variance procedures. Means were separated using Student's LSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different ($P > 0.05$).

CONTROL OF LEPIDOPTERAN LARVAE IN FALL TOMATOES

Location: ESAREC, Painter, VA

Variety: 'BHN 602'

Transplant Date: 27 Jul 2016

Treatment Method: All foliar treatments were applied with a 3-nozzle boom equipped with D3 spray tips and powered by a CO 30 GPA.

Experimental Design: 7 treatments arranged in a RCB design with 4 reps – 1 row x 20 ft (6 ft. row centers).

Foliar Treatment Date: 9, 16 and 27 Sep

| Treatment | Rate / acre | Mean no. lepidopteran larvae / 5 plants | % lepidopteran fruit damage | |
|----------------------------|-------------|---|-----------------------------|---------|
| | | | 23-Sep | 4-Oct |
| Untreated check | | 1.0 a | 62.5 a | 44.2 a |
| Endigo ZC | 4 fl. oz | 2.5 a | 22.5 b | 24.2 ab |
| Intrepid Edge | 8 fl. oz | 0.0 b | 2.5 c | 7.5 c |
| Radiant SC | 5.8 fl. oz | 0.3 b | 5.0 bc | 7.5 c |
| Coragen | 4.8 fl. oz | 0.5 b | 7.5 bc | 4.2 c |
| Avaunt | 7 oz | 0.0 b | 0.0 c | 8.3 bc |
| Harvanta 50SL | 11 fl. oz | 0.0 b | 0.0 c | 10.8 bc |
| <i>P</i> -value from Anova | | 0.0034 | <0.0001 | <0.0001 |

All data were analyzed using analysis of variance procedures. Means were separated using Tukey's HSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different ($P > 0.05$).

CONTROL OF FOLIAR INSECTS IN SPRING TOMATOES

Location: ESAREC, Painter, VA

Variety: 'Florida 47'
 Transplant Date: 13 Jun 2016
 Treatment Method: All foliar treatments were applied with a 3-nozzle boom equipped with D3 spray tips and powered by a CO 30 GPA.
 Experimental Design: 11 treatments arranged in a RCB design with 4 reps – 1 row x 20 ft (6 ft. row centers).
 Foliar Treatment Date: 1, 12, 19 and 26 Jul

Table 1. Summary of efficacy of select insecticides for the control of stink bugs and thrips in spring tomatoes; Virginia Tech ESAREC, Painter, VA 2016 (thrips counts on leaves)

| Treatment | Rate / acre | Mean no. thrips / 10 leaves | | | | | | | |
|---------------------------------|-------------------------|-----------------------------|---------------|---------|----------------|---------------|---------|----------------|---------|
| | | 18-Jul | | | 25-Jul | | | 1-Aug | |
| | | Tobacco thrips | Flower thrips | Lar vae | Tobacco thrips | Flower thrips | Lar vae | Tobacco thrips | Lar vae |
| Untreated check | | 1.5 | 0.5 | 2.5 | 6.5 a | 2.0 a | 1.3 ab | 0.0 | 0.3 |
| Certador (dinotefuran) + Li-700 | 6.5 fl. oz + 0.25% v/v | 3.5 | 0.3 | 1.3 | 0.0 b | 0.3 ab | 0.5 ab | 0.3 | 0.0 |
| Certador + Li-700 | 19.5 fl. oz + 0.25% v/v | 1.5 | 0.3 | 1.0 | 0.0 b | 0.5 ab | 0.0 b | 0.5 | 0.3 |
| Certador + Li-700 | 26 fl. oz + 0.25% v/v | 3.0 | 0.0 | 1.0 | 0.0 b | 0.3 ab | 0.8 ab | 0.0 | 0.3 |
| Actara 25WG + Li-700 | 5.5 oz + 0.25% v/v | 1.3 | 0.0 | 1.3 | 2.0 b | 0.3 ab | 0.0 b | 0.3 | 0.3 |
| Brigade 2EC + Li-700 | 5.2 fl. oz + 0.25% v/v | 2.3 | 0.0 | 3.8 | 1.5 b | 0.3 ab | 0.3 ab | 0.3 | 0.3 |
| Harvanta 50SL | 11 fl. oz | 0.8 | 0.0 | 1.8 | 0.0 b | 0.0 b | 0.3 ab | 0.0 | 0.5 |
| Harvanta 50SL | 16.4 fl. oz | 1.0 | 0.0 | 0.5 | 0.0 b | 0.0 b | 0.8 ab | 0.5 | 0.3 |
| Experimental | 1 lb | 1.0 | 0.0 | 1.0 | 0.3 b | 0.3 ab | 0.0 b | 0.0 | 0.5 |
| Experimental | 1 lb | 1.0 | 0.0 | 1.5 | 0.0 b | 0.5 ab | 0.8 ab | 0.5 | 1.5 |
| Entrust | 2.5 oz | 0.8 | 0.5 | 2.0 | 0.0 b | 0.3 ab | 2.0 a | 0.5 | 0.3 |
| <i>P</i> -value from Anova | | ns | ns | ns | <0.0001 | 0.0467 | 0.0205 | ns | ns |

All data were analyzed using analysis of variance procedures. Means were separated using Tukey's HSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different ($P>0.05$).

Table 2. Summary of efficacy of select insecticides for the control of stink bugs and thrips in spring tomatoes; Virginia Tech ESAREC, Painter, VA 2016 (thrips counts on blossoms and total counts on leaves and blossoms)

| Treatment | Rate / acre | Mean no, thrips / 10 blossoms | | | | | | | Mean total no. thrips (adults/larvae) / 10 leaves and blossoms | | |
|-----------------------------|-------------------------------|-------------------------------|--------------------------|------------|---------------------------|------------|---------------------------|------------|--|---------|-------|
| | | 18-Jul | | 25-Jul | | | 1-Aug | | 18-Jul | 25-Jul | 1-Aug |
| | | Tob acco thrip s | Flow er thrip s | Larv ae | Tob acco thrip s | Larv ae | Tob acco thrip s | Larv ae | | | |
| Untreated check | | 1.8 | 0.3 | 2.3 | 0.3 | 1.3 | 0.8 | 1.0 | 8.8 | 11.3 a | 2.0 |
| Certador + Li-700 | 6.5 fl. oz + 0.25% v/v | 1.3 | 0.0 | 3.3 | 0.0 | 3.0 | 0.0 | 1.3 | 9.5 | 3.8 bc | 1.5 |
| Certador + Li-700 | 19.5 fl. oz + 0.25% v/v | 0.5 | 0.0 | 2.8 | 0.0 | 0.8 | 0.3 | 0.5 | 6.0 | 1.3 c | 1.5 |
| Certador + Li-700 | 26 fl. oz + 0.25% v/v | 1.8 | 0.0 | 1.8 | 0.0 | 1.0 | 0.0 | 0.3 | 7.5 | 2.0 bc | 0.5 |
| Actara 25WG + Li-700 | 5.5 oz + 0.25% v/v | 2.8 | 0.8 | 6.0 | 0.0 | 0.3 | 0.3 | 0.3 | 12.0 | 2.5 bc | 1.0 |
| Brigade 2EC + Li- 700 | 5.2 fl. oz + 0.25% v/v | 1.5 | 0.0 | 5.8 | 0.3 | 1.8 | 0.0 | 0.5 | 13.3 | 4.0 bc | 1.0 |
| Harvanta 50SL | 11 fl. oz | 2.3 | 0.0 | 3.3 | 0.3 | 0.5 | 0.0 | 1.5 | 8.0 | 1.0 c | 2.0 |
| Harvanta 50SL | 16.4 fl. oz | 1.0 | 0.0 | 4.5 | 0.3 | 1.5 | 0.0 | 0.8 | 7.0 | 2.5 bc | 1.5 |
| Experimen tal | 1 lb | 1.5 | 0.0 | 6.0 | 0.0 | 1.8 | 0.5 | 1.0 | 9.5 | 2.3 bc | 2.0 |
| Experimen tal | 1 lb | 0.8 | 0.0 | 3.0 | 0.8 | 5.8 | 0.5 | 1.0 | 6.3 | 7.8 ab | 3.5 |
| Entrust | 2.5 oz | 0.8 | 0.0 | 3.3 | 0.8 | 2.0 | 0.3 | 1.5 | 7.3 | 5.0 abc | 2.5 |
| <i>P</i> -value from Anova | | ns | ns | ns | ns | ns | ns | ns | ns | <0.0001 | ns |

All data were analyzed using analysis of variance procedures. Means were separated using Tukey's HSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different ($P>0.05$).

LEGUME CROPS

CONTROL OF FOLIAR INSECTS IN SNAP BEANS

Location: ESAREC, Painter, VA

Variety: 'Hickok'
 Planting Date: 15 Jul 2016
 Treatment Method: All foliar treatments were applied with a 3-nozzle boom equipped with 8003VS spray tips and powered by a CO delivering 30 GPA.
 Experimental Design: 12 treatments arranged in a RCB design with 4 reps – 2 rows x 20 ft (3 ft. row centers).
 Foliar Treatment Date: 5, 12, 19, 26 Aug, 2 Sep (CX2103 and 2130 only) and 9 Sep

Table 1. Summary of efficacy of foliar insecticides for the control of foliar insects in snap beans; Virginia Tech ESAREC, Painter, VA 2016 (Insect counts)

| Treatment | Rate / acre | Mean no. thrips / 10 compound leaves | | | | | Mean no. thrips / 15 blossoms | | Mean no. potato leafhop nymphs / 10 trifoliates |
|----------------------------|------------------------|--------------------------------------|---------------|-----------------|---------------|---------|-------------------------------|---------|---|
| | | 11-Aug (6 DAT) | | 18-Aug (7 DAT2) | | | 26-Aug (7 DAT3) | | |
| | | Tobacco thrips | Flower thrips | Tobacco thrips | Flower thrips | Larvae | Tobacco thrips | Larvae | |
| Untreated check | | 17.0 a | 6.5 a | 5.8 | 0.3 | 7.3 ab | 1.8 | 7.3 ab | 2.8 |
| Experimental | 1 lb | 12.3 ab | 1.8 b | 4.8 | 0.5 | 20.8 ab | 2.0 | 3.8 ab | 2.0 |
| Experimental | 1 lb | 5.3 bc | 0.3 b | 9.8 | 1.0 | 19.3 ab | 0.8 | 4.0 ab | 1.5 |
| Intrepid Edge | 8 fl. oz | 4.0 c | 0.3 b | 2.8 | 0.0 | 0.5 b | 1.8 | 2.8 ab | 3.5 |
| Radiant SC | 5.8 fl. oz | 1.5 c | 0.3 b | 2.5 | 0.5 | 0.3 b | 2.3 | 4.0 ab | 3.5 |
| Coragen | 4.8 fl. oz | 1.8 c | 1.5 b | 5.8 | 0.0 | 10.0 ab | 2.3 | 5.3 ab | 2.8 |
| Endigo ZC | 4 fl. oz | 0.8 c | 0.0 b | 2.3 | 0.3 | 0.5 b | 0.0 | 2.0 b | 0.3 |
| Certador* + Li-700 | 6 fl. oz + 0.25% v/v | 8.3 bc | 2.5 ab | 3.3 | 0.3 | 2.3 b | 2.5 | 12.3 a | 0.8 |
| Certador* + Li-700 | 19 fl. oz + 0.25% v/v | 2.0 c | 0.3 b | 2.3 | 0.3 | 2.0 b | 0.3 | 5.0 ab | 0.0 |
| Certador* + Li-700 | 26 fl. oz + 0.25% v/v | 4.8 bc | 1.5 b | 1.0 | 0.0 | 0.8 b | 1.0 | 6.3 ab | 0.5 |
| Actara 25WG + LI-700 | 5.5 oz + 0.25% v/v | 5.8 bc | 0.8 b | 2.3 | 0.0 | 0.8 b | 0.0 | 5.3 ab | 0.8 |
| Brigade 2EC + LI-700 | 5.2 fl. oz + 0.25% v/v | 12.0 ab | 6.8 a | 7.3 | 0.0 | 39.8 a | 3.8 | 10.0 ab | 0.0 |
| <i>P</i> -value from Anova | | <0.0001 | <0.0001 | ns | ns | 0.0048 | ns | 0.0278 | ns |

All data were analyzed using analysis of variance procedures. Means were separated using Tukey's HSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different ($P>0.05$).

*Not currently labeled for snap beans

Table 2. Summary of efficacy of efficacy of foliar insecticides for the control of foliar insects in snap beans; Virginia Tech ESAREC, Painter, VA 2016 (Damage and harvest data)

| Treatment | Rate / acre | % bean leaf beetle damage d leaves | % lepidoptera n larvae damaged pods | % stink bug damage d pods | % bean leaf beetle damage d pods | % thrips damage d pods |
|----------------------------|------------------------|------------------------------------|-------------------------------------|---------------------------|----------------------------------|------------------------|
| Untreated check | | 82.5 ab | 6.7 ab | 1.3 | 20.7 | 3.3 |
| Experimental | 1 lb | 85.0 ab | 2.7 ab | 1.3 | 28.0 | 7.3 |
| Experimental | 1 lb | 82.5 ab | 1.3 ab | 0.0 | 21.8 | 5.3 |
| Intrepid Edge | 8 fl. oz | 55.0 abc | 0.0 b | 0.7 | 16.7 | 13.3 |
| Radiant SC | 5.8 fl. oz | 55.0 abc | 0.0 b | 1.3 | 6.7 | 12.7 |
| Coragen | 4.8 fl. oz | 25.0 cd | 2.0 ab | 0.7 | 9.3 | 3.3 |
| Endigo ZC | 4 fl. oz | 20.0 cd | 9.3 a | 0.0 | 8.7 | 4.7 |
| Certador* + Li-700 | 6 fl. oz + 0.25% v/v | 37.5 bc | 2.0 ab | 0.0 | 14.7 | 2.7 |
| Certador* + Li-700 | 19 fl. oz + 0.25% v/v | 27.5 cd | 4.7 ab | 1.3 | 6.0 | 4.0 |
| Certador* + Li-700 | 26 fl. oz + 0.25% v/v | 25.0 cd | 8.0 a | 2.0 | 4.7 | 2.7 |
| Actara 25WG + LI-700 | 5.5 oz + 0.25% v/v | 45.0 abc | 2.0 ab | 0.0 | 6.7 | 2.0 |
| Brigade 2EC + LI-700 | 5.2 fl. oz + 0.25% v/v | 2.5 d | 1.3 ab | 0.7 | 4.7 | 1.3 |
| <i>P</i> -value from anova | | <0.0001 | 0.0056 | ns | nsn | ns |

All data were analyzed using analysis of variance procedures. Means were separated using Tukey's HSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different ($P>0.05$).

*Not currently labeled for snap beans

POTATO CROP

CONTROL OF COLORADO POTATO BEETLES IN POTATOES

Location: ESAREC, Painter, VA

Variety: 'Superior'

Planting Date: 31 Mar 2016

Treatment Method: All foliar treatments were applied with a 4-nozzle boom equipped with 110003VS spray tips spaced 20" apart spraying 2 rows at a time and powered by a CO₂ backpack sprayer at 40psi delivering 38 GPA.

Experimental Design: 6 treatments arranged in a RCB design with 4 reps – 2 rows x 20 ft (3 ft. row centers).

Foliar Treatment Date: 20 and 31 May

Table 1. Summary of efficacy of Trident for the control of Colorado potato beetles in potatoes; ESAREC, Painter, VA 2016 (Colorado potato beetle counts)

| Mean no. Colorado potato beetles / 10 stems | | |
|---|----------------|----------------|
| 27-May (7 DAT) | 2 Jun (2 DAT2) | 7 Jun (7 DAT2) |
| | | |

| Treatment | Rate / acre | Egg mass | Small larvae | Adults | Egg mass | Small larvae | Large larvae | Adults | Egg mass | Small larvae | Large larvae | Adults |
|----------------------------|-------------|----------|--------------|--------|----------|--------------|--------------|--------|----------|--------------|--------------|--------|
| Untreated check | | 0.8 | 2.5 | 2.3 | 0.0 | 34.0 a | 7.0 | 1.3 | 0.0 | 36.0 | 10.0 a | 2.0 |
| Trident | 3 qts | 0.3 | 0.0 | 3.0 | 0.8 | 0.0 b | 0.0 | 1.5 | 0.3 | 2.3 b | 0.0 b | 1.0 |
| Trident | 6 qts | 0.0 | 0.0 | 0.3 | 0.0 | 4.5 b | 0.0 | 2.0 | 0.0 | 2.5 b | 2.0 b | 2.5 |
| Blackhawk | 3.3 oz | 0.0 | 0.0 | 2.0 | 0.3 | 0.5 b | 0.0 | 1.5 | 0.0 | 2.0 b | 0.0 b | 2.0 |
| Sivanto | 10.5 fl. oz | 0.3 | 0.0 | 1.5 | 0.0 | 1.8 b | 0.0 | 1.3 | 0.0 | 2.3 b | 0.0 b | 1.5 |
| Sivanto | 14 fl. oz | 0.0 | 0.0 | 1.8 | 0.0 | 0.3 b | 0.0 | 0.8 | 0.0 | 0.5 b | 0.3 b | 1.0 |
| <i>P</i> -value from Anova | | ns | ns | ns | ns | 0.0026 | ns | ns | ns | 0.0021 | <0.0001 | ns |

All data were analyzed using analysis of variance procedures. Means were separated using Tukey's HSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different ($P>0.05$).

Table 2. Summary of efficacy of Trident for the control of Colorado potato beetles in potatoes; ESAREC, Painter, VA 2016 (potato leafhopper counts and yields)

| Treatment | Rate / acre | Mean no. potato leafhopper nymphs / 20 compound leaves | Total yield (in lbs) |
|----------------------------|-------------|--|----------------------|
| Untreated check | | 0.0 | 17.9 |
| Trident | 3 qts | 0.3 | 23.7 |
| Trident | 6 qts | 0.5 | 22.3 |
| Blackhawk | 3.3 oz | 0.0 | 28.6 |
| Sivanto | 10.5 fl. oz | 0.0 | 23.3 |
| Sivanto | 14 fl. oz | 0.3 | 24.8 |
| <i>P</i> -value from Anova | | | |

All data were analyzed using analysis of variance procedures. Means were separated using Tukey's HSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different ($P>0.05$).

CONTROL OF COLORADO POTATO BEETLES IN POTATOES

Location: ESAREC, Painter, VA
 Variety: 'Superior'
 Planting Date: 18 Mar 2016
 Treatment Method:

All in-furrow and at drag-off treatments were applied in 900 ml of water at 19.8 GPA using a single nozzle boom equipped with an 8003 even flat spray tip powered by a CO₂ backpack sprayer at 30psi. Furrows were cut using a commercial potato planter without the coulters on.

All foliar treatments were applied with a 4-nozzle boom equipped with 110003VS spray tips spaced 20" apart spraying 2 rows at a time and powered by a CO₂ sprayer at 40psi delivering 38 GPA.

Experimental Design: 8 treatments arranged in a RCB design with 4 reps – 2 rows x 20 ft (3 ft. row centers).
 Treatment Date: 18 Mar (in-furrow); 18 April (drag-off); 10 Jun (foliar)

Table 1. Summary of efficacy of Brigadier, Capture LFR and Gladiator for the control of wireworms in potatoes; ESAREC, Painter, VA 2016 (CPB counts)

| Treatment | Rate / acre | Mean no. Colorado potato beetles / 10 stems | | | | | % defoliation |
|---|--|---|--------------|--------------|--------------|--------------|---------------|
| | | 25-May | 1-Jun | | 8-Jun | | |
| | | Small larvae | Small larvae | Large larvae | Small larvae | Large larvae | |
| Untreated check | | 0.8 | 170.0 a | 62.5 a | 17.0 | 66.5 a | 55.0 a |
| Brigadier (in furrow) | 25.6 fl. oz | 0.8 | 15.5 d | 2.5 c | 9.0 | 24.5 abc | 4.3 cd |
| Brigadier (in furrow) fb Gladiator (foliar) | 25.6 fl. oz fb 19 fl. oz | 2.0 | 34.0 cd | 13.8 c | 9.0 | 33.5 abc | 6.0 cd |
| Capture LFR + Brigadier (in furrow) + fb Gladiator (foliar) | 25.6 fl. oz + 5.22 fl. oz fb 19 fl. oz | 2.8 | 96.0 b | 39.0 b | 15.0 | 60.5 ab | 27.5 abc |
| Brigadier (dragoff) fb Gladiator (foliar) | 25.6 fl. oz fb 19 fl. oz | 1.3 | 83.0 bc | 15.3 c | 6.5 | 46.3 abc | 14.3 bcd |
| Platinum 75SG (in furrow) | 2.67 oz | 0.8 | 20.3 d | 3.8 c | 0.3 | 10.0 c | 0.0 d |
| Admire Pro (in furrow) | 8.7 fl. oz | 2.0 | 42.0 cd | 10.8 c | 11.8 | 21.3 bc | 11.3 cd |
| Admire Pro (dragoff) | 1.3 fl. oz | 1.5 | 121.5 a | 47.8 a | 21.3 | 66.3 a | 47.5 ab |
| <i>P</i> -value from Anova | | ns | <0.0001 | <0.0001 | ns | 0.0025 | <0.0001 |

All data were analyzed using analysis of variance procedures. Means were separated using Tukey's HSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different ($P>0.05$).

Table 2. Summary of efficacy of Brigadier, Capture LFR and Gladiator for the control of wireworms in potatoes; ESAREC, Painter, VA 2016 (Yields and % damage from soil insects)

| Treatment | Rate / acre | Total yield (in lbs) | % wireworm and white grub damage |
|---|--|----------------------|----------------------------------|
| Untreated check | | 74.8 | 10.0 a |
| Brigadier (in furrow) | 25.6 fl. oz | 89.3 | 2.8 b |
| Brigadier (in furrow) fb Gladiator (foliar) | 25.6 fl. oz fb 19 fl. oz | 92.5 | 3.8 b |
| Capture LFR + Brigadier (in furrow) + fb Gladiator (foliar) | 25.6 fl. oz + 5.22 fl. oz fb 19 fl. oz | 85.4 | 2.5 b |
| Brigadier (dragoff) fb Gladiator (foliar) | 25.6 fl. oz fb 19 fl. oz | 86.1 | 2.3 b |
| Platinum 75SG (in furrow) | 2.67 oz | 82.1 | 2.3 b |
| Admire Pro (in furrow) | 8.7 fl. oz | 92.4 | 3.5 b |
| Admire Pro (dragoff) | 1.3 fl. oz | 75.6 | 6.0 ab |
| <i>P</i> -value from Anova | | ns | 0.0005 |

All data were analyzed using analysis of variance procedures. Means were separated using Tukey's HSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different ($P>0.05$).

CONTROL OF COLORADO POTATO BEETLES IN POTATOES

Location: ESAREC, Painter, VA

Variety: 'Superior'
 Planting Date: 18 Mar 2016
 Treatment Method: All in-furrow treatments were applied in 900 ml of water at 19.8 GPA using a single nozzle boom equipped with an 8003 even flat spray tip powered by a CO2 backpack sprayer at 30psi. Furrows were cut using a commercial potato planter without the coulters on.
 Seduce was shaken down over the seed in an 8 in. band in furrow at planting.
 All foliar treatments were applied with a 4-nozzle boom equipped with 110003VS spray tips spaced 20" apart spraying 2 rows at a time and powered by a CO₂ sprayer at 40psi delivering 38 GPA.
 Experimental Design: 5 treatments arranged in a RCB design with 4 reps – 2 rows x 20 ft (3 ft. row centers).
 Foliar Treatment Date: 18 March (in-furrow); 20 May and 2 Jun (Movento); 20 May (Blackhawk to control Colorado potato beetles)

| Treatment | Rate / Acre | % wireworm damaged tubers | % grub damaged tubers | % total soil insect damaged tubers | Total weight (in lbs) |
|---------------------------------------|---------------------|---------------------------|-----------------------|------------------------------------|-----------------------|
| Untreated check | | 7.5 a | 6.0 | 13.5 | 57.9 |
| Seduce (over seed in-furrow) | 20 lbs | 8.5 a | 4.3 | 12.8 | 59.6 |
| Admire Pro (in-furrow) | 8.7 fl. oz | 2.8 ab | 1.3 | 4.0 | 78.4 |
| Movento + NIS (at flowering - foliar) | 5 fl. oz + 0.5% v/v | 3.8 ab | 4.0 | 7.8 | 71.3 |
| Platinum 75SG (in-furrow) | 2.67 oz | 1.0 b | 2.8 | 3.8 | 84.8 |
| <i>P</i> -value from Anova | | 0.0183 | ns | ns | ns |

All data were analyzed using analysis of variance procedures. Means were separated using Tukey's HSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different ($P > 0.05$).

CONTROL OF COLORADO POTATO BEETLES IN POTATOES

Location: ESAREC, Painter, VA
 Variety: 'Superior'
 Planting Date: 31 Mar 2016
 Treatment Method: All foliar treatments were applied with a 4-nozzle boom equipped with 110003VS spray tips spaced 20" apart spraying 2 rows at a time and powered by a CO₂ backpack sprayer at 40psi delivering 38 GPA.
 Experimental Design: 9 treatments arranged in a RCB design with 4 reps – 2 rows x 20 ft (3 ft. row centers).
 Foliar Treatment Date: 20 and 31 May

Table 1. Summary of efficacy of Minecto Pro for the control of foliar insects in potatoes; ESAREC, Painter, VA 2016

| Mean no. Colorado potato beetles / 10 stems | | | | Mean no. potato leafhopp |
|---|--------|-------|-------|--------------------------|
| 23-May | 27-May | 2-Jun | 7-Jun | |
| | | | | |

| Treatment | Rate / acre | Small larvae | Small larvae | Large larvae | Small larvae | Large larvae | Small larvae | Large larvae | er nymphs / 10 compound leaves |
|---------------------------|------------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------------------------|
| Untreated check | | 0.0 | 9.5 | 0.0 | 37.5 a | 8.5 | 29.3 a | 8.5 | 0.5 |
| Exirel 0.83SE + NIS | 10.8 fl. oz + 0.1% v/v | 0.0 | 0.0 | 0.0 | 1.0 b | 0.0 | 0.5 b | 0.0 | 0.8 |
| AgriMek + NIS | 2.72 fl. oz + 0.1% v/v | 0.3 | 0.0 | 0.0 | 0.0 b | 0.0 | 0.0 b | 0.0 | 1.0 |
| A21390 + NIS | 5.5 fl. oz + 0.1% v/v | 0.0 | 0.0 | 0.0 | 0.0 b | 0.0 | 0.0 b | 0.0 | 0.0 |
| A21390 + NIS | 8 fl. oz + 0.1% v/v | 0.0 | 9.0 | 0.0 | 0.0 b | 0.0 | 0.0 b | 0.0 | 0.0 |
| A21390 + NIS | 10 fl. oz + 0.1% v/v | 0.0 | 0.0 | 0.0 | 0.0 b | 0.0 | 0.0 b | 0.0 | 0.3 |
| Besiege 1.25ZC + NIS | 9 fl. oz + 0.1% v/v | 0.3 | 0.8 | 0.0 | 0.0 b | 0.0 | 0.0 b | 0.0 | 0.0 |
| Blackhawk + NIS | 3.3 oz + 0.1% v/v | 0.0 | 0.0 | 0.0 | 0.5 b | 0.0 | 0.0 b | 0.0 | 0.0 |
| Coragen + NIS | 5 fl. oz + 0.1% v/v | 0.0 | 0.0 | 0.0 | 0.5 b | 0.0 | 0.0 b | 0.0 | 0.5 |
| <i>P-Value from Anova</i> | | ns | ns | ns | <0.0001 | ns | <0.0001 | ns | ns |

All data were analyzed using analysis of variance procedures. Means were separated using Tukey's HSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different ($P>0.05$).

Table 2. Summary of efficacy of Minecto Pro for the control of foliar insects in potatoes; ESAREC, Painter, VA 2016 (Yields)

| Treatment | Rate / acre | Total Yield (in lbs) |
|---------------------------|------------------------|----------------------|
| Untreated check | | 22.3 |
| Exirel 0.83SE + NIS | 10.8 fl. oz + 0.1% v/v | 33.2 |
| AgriMek + NIS | 2.72 fl. oz + 0.1% v/v | 26.5 |
| Minecto Pro + NIS | 5.5 fl. oz + 0.1% v/v | 29.1 |
| Minecto Pro + NIS | 8 fl. oz + 0.1% v/v | 31.8 |
| Minecto Pro + NIS | 10 fl. oz + 0.1% v/v | 34.6 |
| Besiege 1.25ZC + NIS | 9 fl. oz + 0.1% v/v | 29.2 |
| Blackhawk + NIS | 3.3 oz + 0.1% v/v | 30.9 |
| Coragen + NIS | 5 fl. oz + 0.1% v/v | 26.8 |
| <i>P-Value from Anova</i> | | ns |

All data were analyzed using analysis of variance procedures. Means were separated using Tukey's HSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different ($P>0.05$).

ROW CROPS

CONTROL OF SEEDCORN MAGGOT IN FIELD CORN

Location: Kentland Research Farm, Whitethorn, VA
Variety: Seed treated and provided by Dupont
Planting Date: 10 May 2016
Planting Rate: 50 seeds per row
Treatment Method: Blood and bone meal was applied at a rate of 1 gallon pitcher of dry material per 20 ft row to encourage seedcorn maggot flies.
Experimental Design: 8 treatments arranged in a RCB design with 4 reps – 1 row x 25 ft (3 ft. row centers).
Treatment Date: 10 May 2016

Table 1. Summary of Efficacy of LUMIVIA 625FS Corn Seed Treatment for the control of seedcorn maggot; Virginia Tech Kentland Research Farm, Blacksburg, VA 2016

| Treatment | Stand Count | | | % runt seedlings | | | | | Vigor ratings | | | | |
|---------------------------------|---------------|---------------|---------------|------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| | 13 DA P | 21 DA P | 27 DA P | 13 DA P | 21 DA P | 27 DA P | 34 DA P | 48 DA P | 13 DA P | 22 DA P | 27 DA P | 34 DA P | 48 DA P |
| IST 250 | 43.5 | 43.5 | 44.0 | 4.1 | 1.6 | 4.0 bc | 3.60 | 3.60 | 5.0 | 7.0 | 7.3 | 7.00 | 6.5 ab |
| IST 250 + Lumivia 250 | 46.3 | 46.0 | 47.3 | 1.1 | 1.8 | 4.9 abc | 2.70 | 2.10 | 5.3 | 8.3 | 7.5 | 7.00 | 7.5 a |
| Lumivia 250 | 44.3 | 43.0 | 44.5 | 3.9 | 5.4 | 8.9 ab | 7.20 | 5.00 | 5.5 | 7.0 | 6.0 | 5.25 | 5.75 ab |
| Lumivia 500 | 45.8 | 43.8 | 46.5 | 5.5 | 4.0 | 9.7 ab | 7.90 | 5.80 | 5.0 | 6.3 | 5.8 | 5.00 | 5.0 b |
| Lumivia 750 | 43.5 | 44.3 | 45.0 | 3.6 | 6.3 | 4.2 abc | 3.20 | 2.20 | 4.5 | 6.5 | 6.3 | 6.00 | 6.0 ab |
| Poncho Votivo 1250 | 45.3 | 45.3 | 46.3 | 2.8 | 0.0 | 1.7 c | 3.50 | 3.50 | 4.8 | 7.0 | 7.0 | 6.50 | 6.0 ab |
| Untreated Check, Fungicide only | 45.3 | 45.0 | 45.8 | 2.7 | 5.0 | 9.8 a | 10.0 0 | 8.20 | 5.8 | 6.0 | 6.0 | 4.25 | 5.0 b |
| Untreated Check, Fungicide only | 43.8 | 44.5 | 44.8 | 3.9 | 6.3 | 9.6 ab | 7.70 | 7.10 | 5.0 | 5.0 | 5.0 | 5.00 | 5.0 b |
| <i>P</i> -value from Anova | ns | ns | ns | ns | ns | 0.03 15 | ns | ns | ns | ns | ns | ns | 0.00 9 |

All data were analyzed using analysis of variance procedures. Means were separated using Tukey's HSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different ($P > 0.05$).

Table 2. Summary of Efficacy of LUMIVIA 625FS Corn Seed Treatment for the control of seedcorn maggot; Virginia Tech Kentland Research Farm, Blacksburg, VA 2016 (Yields)

| Treatment | Grain yield | Grain yield (bu/ac) |
|-----------|-------------|---------------------|
|-----------|-------------|---------------------|

| | (lbs/25 ft row) 13 Sept | |
|---------------------------------|----------------------------|-------|
| IST 250 | 23.8 | 275.9 |
| IST 250 + Lumivia 250 | 23.3 | 270.1 |
| Lumivia 250 | 24.8 | 287.5 |
| Lumivia 500 | 23.8 | 275.9 |
| Lumivia 750 | 26.8 | 310.7 |
| Poncho Votivo 1250 | 21.0 | 243.9 |
| Untreated Check, Fungicide only | 23.5 | 273.0 |
| Untreated Check, Fungicide only | 26.8 | 310.7 |
| <i>P</i> -value from Anova | ns | ns |

All data were analyzed using analysis of variance procedures. Means were separated using Tukey's HSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different ($P>0.05$).

CONTROL OF WIREWORMS IN FIELD CORN

Location: Conventional grower's field near Horntown, VA
 Variety: Seed provided and treated by Dupont
 Planting Date: 26 Apr 2016
 Planting Rate: 30 seeds per row
 Experimental Design: 10 treatments arranged in a RCB design with 4 reps – 1 row x 20 ft

| Treatment | Mean stand count | | | % runt seedlings | | % billbug damage | Vigor 31 May |
|------------------------------|------------------|--------|--------|------------------|--------|------------------|--------------|
| | 14 DAP | 28 DAP | 55 DAP | 28 DAP | 55 DAP | | |
| IST 250 | 27.3 | 27.8 | 27.0 | 5.0 | 6.3 | 0.0 | 5.5 |
| IST 250 + lumivia 250 + I323 | 25.5 | 27.8 | 27.3 | 2.0 | 5.4 | 1.0 | 5.5 |
| Lumivia 500 | 22.5 | 22.0 | 22.3 | 3.0 | 8.2 | 1.0 | 5.0 |
| Lumivia 750 | 24.0 | 24.3 | 23.3 | 5.0 | 2.4 | 1.0 | 5.5 |
| Poncho votivo 1250 | 21.8 | 24.0 | 24.3 | 2.0 | 8.4 | 2.0 | 5.3 |
| Check / fungicide only | 24.5 | 25.3 | 25.0 | 8.0 | 5.9 | 2.0 | 5.0 |
| Check no fungicide | 24.3 | 23.8 | 24.3 | 11.0 | 10.9 | 0.0 | 5.0 |
| <i>P</i> -value from Anova | ns | ns | ns | ns | ns | ns | ns |

All data were analyzed using analysis of variance procedures. Means were separated using Tukey's HSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different ($P>0.05$).

CONTROL OF WIREWORMS IN FIELD CORN

Location: HRAREC, Virginia Beach, VA
 Variety: Seed provided and treated by Dupont
 Planting Date: 31 Mar 2016
 Planting Rate: 50 seeds per row
 Experimental Design: 6 treatments arranged in a RCB design with 4 reps – 1 row x 20 ft

| Treatment | Mean stand count | | | % runt seedlings | | % billbug damage | Vigor 31 May |
|-----------|------------------|--------|--------|------------------|--------|------------------|--------------|
| | 14 DAP | 28 DAP | 55 DAP | 28 DAP | 55 DAP | | |
| IST 250 | 27.3 | 27.8 | 27.0 | 5.0 ab | 6.3 | 0.0 | 5.5 |

| | | | | | | | |
|------------------------------|------|------|------|--------|------|-----|-----|
| IST 250 + lumivia 250 + I323 | 25.5 | 27.8 | 27.3 | 2.0 ab | 5.4 | 1.0 | 5.5 |
| Lumivia 500 | 22.5 | 22.0 | 22.3 | 3.0 ab | 8.2 | 1.0 | 5.0 |
| Lumivia 750 | 24.0 | 24.3 | 23.3 | 5.0 ab | 2.4 | 1.0 | 5.5 |
| Experimental | 24.3 | 24.3 | 24.5 | 5.0 ab | 4.9 | 3.0 | 5.3 |
| Experimental | 21.8 | 24.5 | 25.3 | 0.0 b | 6.0 | 3.0 | 5.3 |
| Experimental | 20.8 | 24.8 | 25.0 | 1.0 ab | 7.3 | 1.0 | 5.8 |
| Poncho votivo 1250 | 21.8 | 24.0 | 24.3 | 2.0 ab | 8.4 | 2.0 | 5.3 |
| Check / fungicide only | 24.5 | 25.3 | 25.0 | 8.0 ab | 5.9 | 2.0 | 5.0 |
| Check no fungicide | 24.3 | 23.8 | 24.3 | 11.0 a | 10.9 | 0.0 | 5.0 |
| P-value from Anova | ns | ns | ns | 0.0433 | ns | ns | ns |

All data were analyzed using analysis of variance procedures. Means were separated using Tukey's HSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different ($P>0.05$).

BIOASSAYS

EFFICACY OF INSECTICIDES APPLIED AS DRENCHES FOR THE CONTROL OF CUCUMBER BEETLES IN EXCISED LEAF BIOASSAYS

PROCEDURES:

- 'Tigress' zucchini seed were planted in plastic mulch on 23 June 2016.
- On 27 Jun, seedlings were drenched using a ladle containing 8 fl. oz of insecticidal mixture based on per acre rate.
- Leaves were excised from each plot at 3 DAT (30 Jun) and 9 DAT (6 Jul), placed in moistened floral foam in a 1-liter plastic container.
- Field-collected striped cucumber beetles (*Acalymma vittatum*) (varied numbers) were placed into the container to feed on the leaves. Two different populations of beetles were used for the two dates.
- Mortality was assessed at 24h.
- All data were analyzed using analysis of variance procedures. Means were separated using Tukey's HSD at the 0.05 level of significance. Data were sqrt transformed when necessary.

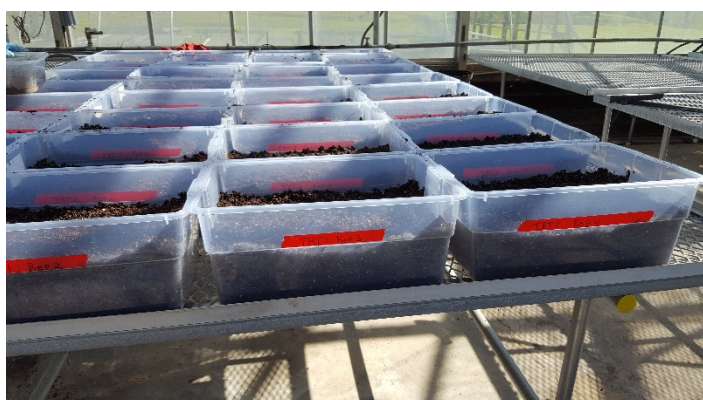
RESULTS

| Treatment (applied as drenches) | Rate / acre | % dead striped cucumber beetle | |
|---------------------------------|-------------|--------------------------------|-------|
| | | 30-Jun | 6-Jul |
| Untreated check | | 0.0 c | 12.5 |
| Verimark 1.67SC | 5 fl. oz | 11.5 b | 16.7 |
| Verimark 1.67SC | 10 fl. oz | 6.4 bc | 16.9 |
| Scorpion | 9 fl. oz | 94.2 a | 17.2 |
| Belay | 9 fl. oz | 89.0 a | 40.3 |
| P-value from Anova | | <0.0001 | ns |

EFFICACY OF FIELD CORN SEED TREATMENTS FOR THE CONTROL OF WIREWORMS IN LABORATORY STUDIES

LABORATORY ASSAY 1 PROCEDURES:

- *Location:* Virginia Tech ESAREC, Painter, VA
- *Plant Date:* 14 Apr 2016
- *Seeding Rate:* 8 seeds / 16 qt plastic container
- *Insect Pressure:* 8 wireworms per container (1 per plant)
- *Target insect:* Wireworm (*Melanotus communis*)



RESULTS

| Treatment | Emergence 19 Apr | Stand count | | | | % runt seedlings | | | Mean plant height (in cm) | |
|------------------------------|---------------------|-------------|--------|--------|--------|------------------|----------|--------|---------------------------|---------|
| | | 7 DAP | 14 DAP | 28 DAP | 35 DAP | 7 DAP | 14 DAP | 35 DAP | 14 DAP | 35 DAP |
| IST 250 | 7.8 a | 8.0 a | 8.0 | 8.0 a | 8.0 a | 2.5 | 5.0 bc | 2.5 | 4.3 abc | 37.5 a |
| IST 250 + Lumivia 250 + I323 | 8.0 a | 8.0 a | 8.0 | 8.0 a | 8.0 a | 2.5 | 12.5 abc | 5.0 | 4.6 ab | 37.6 a |
| Lumivia 500 | 7.5 a | 7.8 a | 7.8 | 7.8 ab | 7.8 ab | 0.0 | 2.5 c | 2.5 | 4.9 a | 39.2 a |
| Experimental | 7.8 a | 7.8 a | 7.8 | 8.0 a | 8.0 a | 7.5 | 12.5 abc | 10.0 | 4.2 abc | 35.6 ab |
| Experimental | 7.0 a | 7.3 ab | 7.8 | 7.5 ab | 7.5 ab | 12.5 | 5.0 bc | 7.5 | 3.8 abc | 38.2 a |
| Experimental | 6.3 ab | 8.0 a | 8.0 | 8.0 a | 8.0 a | 2.5 | 12.5 abc | 10.0 | 3.5 bcd | 35.6 ab |
| Poncho Votivo 1250 | 6.3 ab | 7.0 ab | 7.3 | 7.0 ab | 7.5 ab | 15.0 | 22.5 abc | 10.0 | 3.1 cde | 34.3 ab |

| | | | | | | | | | | |
|----------------------------|---------|--------|-----|--------|--------|------|---------|------|---------|---------|
| UTC + Fungicide | 4.5 bc | 5.8 b | 7.3 | 7.3 ab | 7.3 ab | 20.0 | 40.0 a | 27.5 | 2.3 de | 30.5 b |
| UTC | 3.8 c | 6.3 ab | 6.8 | 6.8 b | 6.8 b | 20.0 | 27.5 ab | 20.0 | 2.1 e | 30.5 b |
| <i>P</i> -value from Anova | <0.0001 | 0.0021 | ns | 0.0059 | 0.0161 | ns | 0.0009 | ns | <0.0001 | <0.0001 |

All data were analyzed using analysis of variance procedures. Means were separated using Tukey's HSD at the 0.05 level of significance. Data were sqrt transformed when necessary.

LABORATORY ASSAY 2 PROCEDURES:

- *Location:* Virginia Tech ESAREC, Painter, VA
- *Plant Date:* 24 May 2016
- *Seeding Rate:* 8 seeds / 16 qt plastic container
- *Insect Pressure:* 8 wireworms per container (1 per plant)
- *Target insect:* Wireworm (*Melanotus communis*)

RESULTS:

| Treatment | Stand Count | | % runt seedlings | | Mean plant height (in cm) | | Vigor | |
|------------------------------|-------------|--------|------------------|--------|---------------------------|----------|--------|--------|
| | 14 DAP | 35 DAP | 14 DAP | 35 DAP | 14 DAP | 35 DAP | 14 DAP | 35 DAP |
| IST 250 | 7.8 | 7.8 | 5.0 ab | 7.5 | 38.3 | 76.6 abc | 6 | 7.8 a |
| IST 250 + Lumivia 250 + I323 | 7.5 | 7.5 | 12.5 ab | 15.0 | 34.5 | 82.1 a | 6 | 8.0 a |
| Lumivia 500 | 7.8 | 8.0 | 22.5 a | 15.0 | 39.6 | 74.2 abc | 6 | 7.8 a |
| Experimental | 7.8 | 7.8 | 0.0 b | 0.0 | 38 | 73.2 abc | 6 | 6.5 b |
| Experimental | 7.8 | 7.8 | 7.5 ab | 7.5 | 39.6 | 83.9 a | 6 | 8.0 a |
| Experimental | 7.8 | 7.8 | 7.5 ab | 7.5 | 37.4 | 80.4 ab | 6 | 8.0 a |
| Poncho Votivo 1250 | 8.0 | 8.0 | 0.0 b | 0.0 | 39.5 | 83.7 a | 6 | 8.0 a |
| UTC + Fungicide | 7.8 | 7.3 | 2.5 b | 15.0 | 39.9 | 68.9 bc | 5 | 5.0 c |
| UTC | 8.0 | 8.0 | 15.0 ab | 10.0 | 35.4 | 66.6 c | 5 | 5.0 c |
| <i>P</i> -value from Anova | ns | ns | 0.0105 | ns | ns | 0.0004 | ns | 0.0001 |

All data were analyzed using analysis of variance procedures. Means were separated using Tukey's HSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different ($P > 0.05$).

| Treatment | % dead wireworm 35 DAP | Mean tissue weight 35 DAP | Mean fresh root weight 35 DAP |
|------------------------------|------------------------|---------------------------|-------------------------------|
| IST 250 | 7.5 | 17.9 | 31.8 a |
| IST 250 + Lumivia 250 + I323 | 7.5 | 17.6 | 31.5 a |
| Lumivia 500 | 17.5 | 18.7 | 26.2 ab |
| Experimental | 2.5 | 15.6 | 20.9 bc |
| Experimental | 12.5 | 17.1 | 30.6 a |
| Experimental | 17.5 | 19.3 | 27.7 ab |
| Poncho Votivo 1250 | 35.0 | 14.4 | 24.6 abc |

| | | | |
|--------------------|-----|------|---------|
| UTC + Fungicide | 0.0 | 14.3 | 20.7 bc |
| UTC | 0.0 | 15.8 | 16.4 c |
| P-value from Anova | ns | ns | <0.0001 |

All data were analyzed using analysis of variance procedures. Means were separated using Tukey's HSD at the 0.05 level of significance. Means followed by the same letter within a column are not significantly different ($P>0.05$).

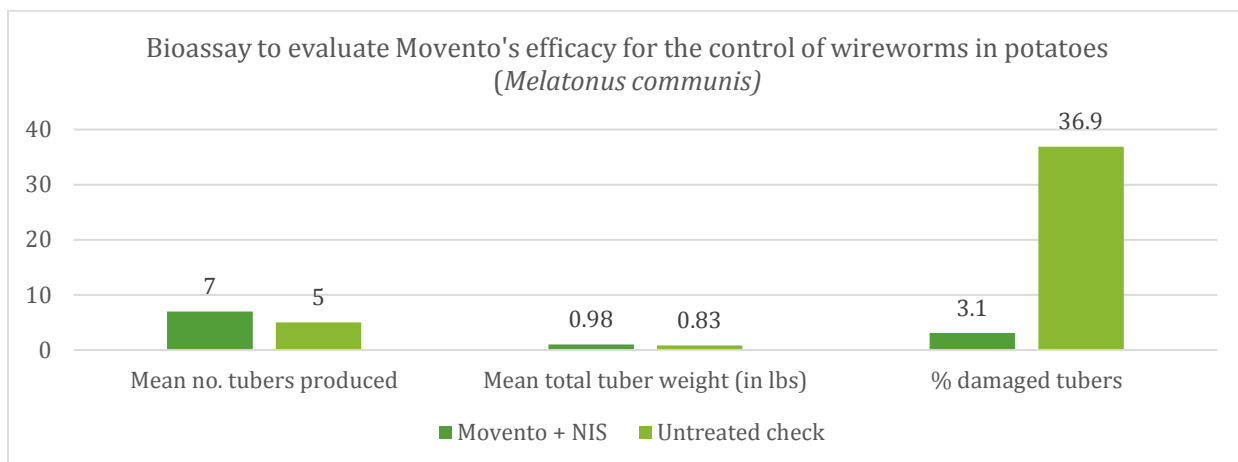
EFFICACY OF MOVENTO FOR THE CONTROL OF WIREWORMS IN POTATO

PROCEDURES:

- Untreated potato plants close to flowering were dug from the field and placed in 5-gallon contractor buckets in a sand/soil mix on 20 May. Treatments were as follows: 1) Movento 5 fl. oz / acre + NIS; 2) Untreated check with 3 plants for each treatment.
- Beginning at flowering, Movento treatments were applied at a 2-week interval with a single nozzle boom powered by a CO2 backpack delivering 40psi. Treatments were applied on 27 May and 10 Jun. Potato plants were placed outdoors and naturally irrigated. Prior to the first Movento treatment, 5 field-collected wireworms (*Melatonus communis*) were placed in each bucket.
- On 14 Jul, the number of tubers for each plant was recorded as well as total tuber weight in lbs. The number of wireworm damaged tubers was also recorded.
- Wireworm mortality was not recorded. Wireworms were difficult to find and results could not be analyzed.

RESULTS

| Treatment | Rate / acre | Mean no. tubers produced | Mean total tuber weight (in lbs) | % damaged tubers |
|-----------------|---------------------|--------------------------|----------------------------------|------------------|
| Movento + NIS | 5 fl. oz + 0.5% v/v | 7 | 0.98 | 3.1 |
| Untreated check | | 5 | 0.83 | 36.9 |



EVALUATION OF WHEAT TREATED SEED FOR WIREWORM CONTROL IN BIOASSAYS

PROCEDURES:

- On 14 Jun, 6 qt Sterilite plastic containers were filled with a 2:1 ratio of soil mix to sand media. 60 winter wheat seed were planted in each container and 8 *Melonus communis* collected from a commercial grower's field in Cheapside, VA were added to each container. There were a total of 3 replicates with 3 treatments each.
- Treatments were as follows:
 - Cruiser treated
 - Gaucho treated
 - Untreated
- Stand counts were recorded at 7, 13, 45 and 56 DAT (21, 27 Jun, 29 Jul and 9 Aug). Mean plant height / 18 tillers was recorded at 7, 45 and 56 DAT (21 Jun, 29 Jul and 9 Aug). At final rating, mean fresh root weight and mean fresh tissue weight was recorded in g. Wireworm mortality was also recorded.

RESULTS

- Stand counts were significant at 13 DAT. Cruiser and gaucho treatments had significantly higher stand count than the untreated control. Stand count data at 7, 45 and 56 DAT had numerically lower stands in the untreated check. Heat possibly accounted for a drastic reduction in stand count at 45 DAT.
- Mean height data were not significant.
- At final evaluation, mean fresh root weight and tissue weight were numerically lower in the untreated check.
- Wireworms were difficult to find and possibly pupated and emerged as adults. Some dead wireworms were observed on top of the soil at 45 DAT and their number was recorded. % dead wireworms represent the number of dead wireworms found at 45 DAT and at 56 DAT. Higher % mortality was observed in cruiser and gaucho treatments although not data were not statistically significant.
- Treating wheat seed with neonicotinoid may prevent some damage from wireworms leading to increased plant health in comparison to untreated wheat.
- This experiment would need to be repeated in early to mid-spring when wireworms are actively feeding but not close to pupating.

| Treatment | Stand count | | | | Mean height / 18 tillers | | | Mean fresh root weight (in g) | Mean fresh tissue weight (in g) | % dead wireworms |
|----------------------------|-------------|--------|--------|--------|--------------------------|--------|--------|-------------------------------|---------------------------------|------------------|
| | 7 DAT | 13 DAT | 45 DAT | 56 DAT | 7 DAT | 45 DAT | 56 DAT | | | |
| Cruiser | 56.3 | 56.7 a | 32.3 a | 33.7 | 11.5 | 7.4 b | 17.8 | 27.3 | 10.7 | 42 |
| Gaucho | 55.0 | 55.7 a | 32.7 a | 35.3 | 10.9 | 9.5 a | 15.1 | 20.0 | 10.3 | 33 |
| Untreated Check | 48.7 | 48.3 b | 25.0 a | 22.0 | 11.2 | 9.6 a | 14.4 | 16.0 | 8.0 | 21 |
| <i>P</i> -value from Anova | ns | 0.0200 | 0.0427 | ns | ns | 0.0065 | ns | ns | ns | ns |