# EFFICACY OF CONCURRENT AND SEQUENTIAL APPLICATIONS OF CORAGEN AND NEONICOTINOID INSECTICIDES APPLIED AS DRENCH TREATMENTS FOR MANAGEMENT OF SILVERLEAF IN SQUASH

Alton N. Sparks, Jr., Extension Entomologist
University of Georgia, Tifton Campus
P.O. Box 748
Tifton, GA 31794
asparks@uga.edu

## Introduction

The silverleaf whitefly is a key pest of cucurbit crops grown in the fall in South Georgia. This pest produces severe silverleaf symptoms in squash at relatively low pest densities. The neonicotinoid insecticides have served as the cornerstone of management for this pest for over a decade. Coragen is a new diamide insecticide that has shown promise for management of this problem. With two chemistries available that provide systemic protection of the crop, the question arises whether these chemistries should be used together or sequentially. If used sequentially, the best order of chemistries needs to be identified. These tests were conducted to address these questions for direct seeded squash production in South Georgia.

## Materials and Methods

Two similar small plot trials were conducted at the University of Georgia Horticulture Farm in Tifton, Georgia. Squash (var. Destiny III) was direct seeded for both test, with the first test planted on 14 August and the second on 22 September, 2008. Experimental plots were established as one row (36 inch beds) by 25 feet, with four replications in a randomized complete block design. Treatments evaluated were the same for both tests. Treatments involved an application of insecticide shortly after planting, followed by either no insecticide or an additional application of insecticide 19 days after the first application. Application dates were 15 Aug. and 3 Sept. in the first test, and 24 Sept. and 13 Oct. in the second test. Treatments evaluated were:

Coragen at 5 oz/ac - single application after planting
Platinum at 11 oz/ac - single application after planting
Admire Pro at 7 oz/ac - single application after planting
Venom at 5 oz/ac - single application after planting
Coragen + Platinum - single application after planting
Coragen + Admire Pro - single application after planting
Coragen + Venom - single application after planting
Coragen fb Platinum - first product applied after planting, 2$^{nd}$ product 19 days later
Coragen fb Admire Pro - first product applied after planting, 2$^{nd}$ product 19 days later

Coragen fb Venom - first product applied after planting, 2nd product 19 days later
Platinum fb Coragen - first product applied after planting, 2nd product 19 days later
Admire Pro fb Coragen - first product applied after planting, 2nd product 19 days later
Venom fb Coragen - first product applied after planting, 2nd product 19 days later
Venom fb Venom - first product applied after planting, 2nd product 19 days later
Coragen fb Coragen - first product applied after planting, 2nd product 19 days later
Non-treated Check

Insecticide rates were calculated based on a three foot row spacing, with product per acre applied in an over-the-row drench. The product was applied in three liters of water per plot on a roughly four inch band. After all treatments in a replication were applied, the entire replication was watered over-the-row (roughly 6 inch band) with a transplanter at about 50 gallons per 500 foot or row. The over-the-row watering was applied within 10 to 15 minutes of the drench application.

Efficacy of insecticides was determined by monitoring plots for silverleaf symptoms. Each plot was examined visually and rated on a 0 to 6 scale as follows:

0 = No silverleaf symptoms in plot
1 = silverleaf light and spotty
2 = silverleaf light and evenly distributed
3 = moderate spots within the plot
4 = silverleaf moderate and evenly distributed
5 = heavy spots of silverleaf
6 = silverleaf heavy and evenly distributed

All data were analyzed with the PROC ANOVA procedure of PC-SAS. Where significant differences were detected ($P<0.05$), means were separated with LSD ($P=0.05$).

## Results and Discussion

For ease of discussion, onset of moderate symptoms (rating of 3 or greater) will be used as an indicator of treatment efficacy decline.

*Neonicotinoid insecticides and Coragen alone.*

All of these products delayed onset of silverleaf symptoms in the first test (2 Sept.); however, Admire Pro and Platinum (applied alone or as the first application in a sequential treatment) were not significantly different from the Check when silverleaf first appeared at moderate to heavy levels in the second test (17 Oct.). Venom did slightly delay onset of moderate symptoms as compared to the other neonicotinoids. Coragen provided longer residual control than any of the neonicotinoid insecticides.

*Neonicotinoid-Coragen Combination treatments.*

The combination treatments appeared to provide little benefit over the Coragen alone treatment. Addition of Venom did delay onset of moderate symptoms by 4 days as compared to Coragen alone.

*Neonicotinoid treatments followed by Coragen.*

The second drench with Coragen following the neonicotinoid insecticides appeared to have suppressive effects, but not to the degree of the early Coragen applications. These treatments appeared to slow the development of silverleaf symptoms as compared to the neonicotinoids alone, but did not provide adequate suppression.

*Coragen treatments followed by neonicotinoids.*

These treatments appeared to provide the most likely scenario for commercial use. The Coragen appeared to provide good initial suppression, with the neonicotinoid extending suppression. The efficacy of these combinations tended to following that of the individual neonicotinoid, with Venom following Coragen providing the best suppression of silverleaf.

*Coragen-Coragen and Venom-Venom treatments.*

The Venom followed by Venom treatment performed extremely well in the first test, but not as well in the second. The Coragen followed by Coragen treatment appeared only moderately better than the Coragen alone. The second application appeared to have less suppressive activity, similar to results with the neonicotinoid followed by Coragen treatments.

These data support the previous indications of neonicotinoid resistance in silverleaf whitefly in South Georgia. These data and others indicate excellent activity of Coragen against silverleaf whitefly when used in a preventative manner. Results are much less dramatic in a rescue situation. Coragen applied at the first signs of silverleaf is too late for maximum benefit.

Sequential applications of Coragen followed by the neonicotinoid insecticides appears to be the best approach under conditions of this test (direct seeded, etc.). Coragen can be applied early (prior to any symptoms) and the neonicotinoids applied as symptoms first appear (the neonicotinoids activity is rapid enough to allow for a >reactive= application). Additional work is needed to evaluate these treatments for squash grown from transplants.

Table 1. Coragen - Neonicotinoid Drench Test I, Horticulture Farm, Tifton, Georgia, 2008.

| Treatment | Silverleaf Rating (0 to 6) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 2 Sept | 5 Sept | 8 Sept | 11 Sept | 15 Sept. | 19 Sept. | 22 Sept. | 25 Sept. |
| | 18 DAT-1 | 21 DAT-1 | 24 DAT-1 | 27 DAT-1 | 31 DAT-1 | 35 DAT-1 | 38 DAT-1 | 41 DAT-1 |
| | 18 DAT-1 | 2 DAT-2 | 5 DAT-2 | 8 DAT-2 | 12 DAT-2 | 16 DAT-2 | 19 DAT-2 | 22 DAT-2 |
| Check | 5.00 a | 6.00 a | 6.00 a | 6.00 a | 6.00 a | 6.00 a | 6.00a | 6.00 a |
| Admire | 2.00 b | 3.63 bc | 5.75 a | 5.88 a | 6.00 a | 6.00 a | 6.00 a | 6.00 a |
| Platinum | 1.63 bc | 3.25 bcd | 5.50 a | 5.75 ab | 6.00 a | 6.00 a | 6.00 a | 6.00 a |
| Venom | 1.25 bc | 2.63 de | 4.25 b | 4.88 bc | 5.75 a | 5.75 ab | 5.88 ab | 6.00 a |
| Coragen | 0.00 e | 0.00 f | 1.50 d | 2.75 d | 3.63 c | 5.13 abc | 5.25 abc | 6.00 a |
| Coragen+Admire | 0.00 e | 0.00 f | 0.88 de | 2.00 de | 3.25 c | 4.88 bcd | 5.63 ab | 6.00 a |
| Coragen+Platinum | 0.00 e | 0.00 f | 0.50 ef | 1.38 ef | 3.25 c | 4.63 cd | 4.50 cd | 6.00 a |
| Coragen+Venom | 0.00 e | 0.00 f | 0.13 ef | 0.75 fgh | 2.25 de | 3.38 ef | 3.88 d | 4.75 cd |
| Admire fb Coragen | 1.88 b | 3.75 b | 5.38 a | 5.38 ab | 4.63 b | 5.25 abc | 5.50 ab | 5.75 ab |
| Platinum fb Coragen | 1.38 bc | 2.75 cde | 4.00 b | 4.00 c | 3.00 cd | 4.125 de | 5.00 bc | 5.50 abc |
| Venom fb Coragen | 1.00 cd | 2.38 de | 2.50 c | 2.63 d | 2.13 e | 3.13 f | 3.75 d | 4.50 d |
| Coragen fb Admire | 0.00 e | 0.00 f | 0.38 ef | 1.50 ef | 3.13 c | 4.63 cd | 5.25 abc | 5.88 a |
| Coragen fb Platinum | 0.25 de | 0.00 f | 0.00 f | 0.13 gh | 1.13 f | 2.00 g | 2.50 e | 3.00 e |
| Coragen fbVenom | 0.00 e | 0.00 f | 0.00 f | 0.00 h | 0.13 g | 0.13 h | 0.25 f | 0.38 f |
| Venom fb Venom | 1.00 cd | 1.88 e | 2.88 c | 2.50 d | 1.00 f | 0.13 h | 0.13 f | 0.25 f |
| Coragen fb Coragen | 0.00 e | 0.25 f | 0.50 ef | 1.00 fg | 2.00 e | 3.13 f | 4.00 d | 5.00 bcd |

Table 2. Coragen - Neonicotinoid Squash Drench Test II, Horticulture Farm, Tifton, Georgia, 2008.

| Treatment | Silverleaf Rating (0 to 6) | | | | | |
|---|---|---|---|---|---|---|
| | 14 Oct. | 17 Oct. | 22 Oct. | 27 Oct. | 31 Oct. | 5 Nov. |
| | 20 DAT-1 | 23 DAT-1 | 28 DAT-1 | 33 DAT-1 | 37 DAT-1 | 42 DAT-1 |
| | 1 DAT-2 | 4 DAT-2 | 9 DAT-2 | 14 DAT-2 | 18 DAT-2 | 23 DAT-2 |
| Check | 0.63 a | 4.75 a | 5.75 a | 6.00 a | 6.00 a | 6.00 a |
| Admire | 0.38 ab | 4.75 a | 5.50 a | 6.00 a | 6.00 a | 6.00 a |
| Platinum | 0.13 bc | 4.50 a | 5.88 a | 6.00 a | 6.00 a | 6.00 a |
| Venom | 0.00 c | 2.88 bc | 5.00 a | 5.75 ab | 5.75 a | 5.88 ab |
| Coragen | 0.00 c | 1.75 cde | 2.75 cdef | 3.63 efg | 4.00 bc | 4.25 def |
| Coragen+Admire | 0.00 c | 1.25 de | 2.25 defg | 3.00 fgh | 3.13 cd | 3.75 efg |
| Coragen+Platinum | 0.00 c | 1.38 de | 3.38 cd | 3.63 efg | 3.88 bc | 4.38 cdef |
| Coragen+Venom | 0.00 c | 0.63 e | 1.25 g | 2.13 h | 3.00 cd | 3.38 g |
| Admire fb Coragen | 0.25 bc | 4.38 a | 4.88 ab | 4.88 bc | 5.00 ab | 5.13 bc |
| Platinum fb Coragen | 0.13 bc | 3.63 ab | 5.00 a | 4.63 cd | 5.00 ab | 4.88 cd |
| Venom fb Coragen | 0.00 c | 2.38 bcd | 3.63 bc | 4.00 cde | 4.13 bc | 4.50 cde |
| Coragen fb Admire | 0.00 c | 0.88 e | 1.63 fg | 2.38 h | 2.63 d | 3.63 fg |
| Coragen fb Platinum | 0.00 c | 1.13 de | 2.00 efg | 3.00 fgh | 3.13 cd | 3.75 efg |
| Coragen fbVenom | 0.00 c | 0.75 e | 1.25 g | 1.13 i | 1.25 e | 2.50 h |
| Venom fb Venom | 0.00 c | 1.75 cde | 3.13 cde | 3.88 def | 4.13 bc | 4.38 cdef |
| Coragen fb Coragen | 0.00 c | 1.75 cde | 2.50 cdefg | 2.75 gh | 2.63 d | 3.38 g |