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### Appendix A: Chemical and Trade Names of Insecticides Trialed in This Report | 107 |
Broccoli Variety Trial: Fall 2013

Timothy Coolong
Extension Vegetable Specialist, Department of Horticulture, Tifton, GA 31793

Introduction
Broccoli (*Brassica oleracea* var. *italica*) production in Georgia has increased in recent years due to market windows in the fall and early spring. Primarily grown in southwest Georgia, broccoli is marketed as crowns or bunches. Because of wide temperature fluctuations in Georgia during the fall, varieties may be planted when daytime temperatures routinely exceed 90°F and harvested after exposure to freezing temperatures. Therefore, varieties developed under more uniform climate conditions often perform poorly when grown in southwest Georgia. Thus routine variety evaluation is essential for Georgia growers.

Methods
Fourteen varieties of broccoli were seeded into 332-cell trays on 30 July 2013 and grown using standard production techniques. On 5 Sept. 2013 seedlings were transplanted into a bare-ground production system. Double rows were planted with 1.8 m spacing on center with 20 cm in-row spacing. Plots received 700 lb/a pre-plant and two additional applications of 400 lb/a at four and six weeks post-transplant of 10-N, 4.4-P, 8.2-K (10-10-10 Rainbow; Agrium, Tifton, GA).

Plants were overhead irrigated as necessary and sprayed weekly with fungicides and insecticides when needed, according to commercial recommendations for Georgia. Plots contained 30 plants, and the trial was arranged in a randomized complete block design with four replications.

Harvests were initiated on 1 Nov. 2013 and terminated on 9 Dec. 2013. Heads were harvested when they were a diameter of 12 cm and cut to a length of 12.7 cm at per commercial standards. Individual heads were weighed and shoot/crown height determined. Stems were also bisected to determine incidence of hollow stem. Color, bead size, shoots per head, and head tightness were also evaluated (data not shown). Data were analyzed using the GLM procedure with SAS statistical software (Version 9.3, SAS Institute).

Results and Discussion
Air temperatures, recorded at plant height during the trial, were highly variable. Weighted averages were used to determine the harvest dates for the 14 varieties trialed (Table 1). Those varieties, which had the lowest days to harvest, were generally more uniform. A freeze was experienced 83 days after transplanting, which negatively affected the quality and yield of those varieties maturing after that point (Table 2). Harvests continued for 95 days after transplanting, but no heads harvested at 95 days were marketable.

Luna and Gypsy were the highest yielding varieties, but they were not statistically different from the top six yielding varieties. Yield was a function of average head weight and number of marketable heads. Green Magic had the greatest average head weight, but it was not significantly different than Luna or Imperial.

Average crown height and a crown to head ratio were determined as well. The market for Georgia growers demands a compact crown, allowing heads to be used for either bunching or crown cuts. Belstar and Alborada had the most compact crowns, but overall head weights were low. BC 1691 had a compact crown, but still produced yields that were no different from the highest yielding varieties.

Hollow stem was evaluated in all varieties, but was only present in a small number of heads and was not statistically significant among varieties (data not shown).

Emerald Crown is the most widely grown variety in Georgia, as it generally does not exhibit the purpling associated with anthocyanin production in cold weather. However, in this trial maturity tended to be variable, requiring several harvests over a long period of time. Two newer varieties that yielded well and displayed high quality characteristics were Luna and BC 1691. Both had compact, tight heads with small beads. Although most plants were harvested prior to the freeze event at 83 days after planting, those that remained did demonstrate purple coloring. Thus, they would not be recommended for winter production in Georgia.
Table 1. Seed source, average days to harvest post-transplant for broccoli (*Brassica oleracea* var. *italica*) grown in Tifton, GA, during fall 2013.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Seed Source</th>
<th>Average Days to Harvest&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green Magic</td>
<td>Sakata</td>
<td>70</td>
</tr>
<tr>
<td>Luna (HMX 8131)</td>
<td>Harris Moran</td>
<td>72</td>
</tr>
<tr>
<td>Gypsy</td>
<td>Sakata</td>
<td>75</td>
</tr>
<tr>
<td>BC 1691</td>
<td>Seminis</td>
<td>77</td>
</tr>
<tr>
<td>Imperial</td>
<td>Sakata</td>
<td>78</td>
</tr>
<tr>
<td>2863</td>
<td>Bejo</td>
<td>78</td>
</tr>
<tr>
<td>Batavia</td>
<td>Bejo</td>
<td>81</td>
</tr>
<tr>
<td>Constellation</td>
<td>Harris Moran</td>
<td>81</td>
</tr>
<tr>
<td>Emerald Crown</td>
<td>Sakata</td>
<td>81</td>
</tr>
<tr>
<td>Gemini</td>
<td>Harris Moran</td>
<td>84</td>
</tr>
<tr>
<td>Belstar</td>
<td>Bejo</td>
<td>88</td>
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<tr>
<td>2914</td>
<td>Bejo</td>
<td>88</td>
</tr>
<tr>
<td>Alborada</td>
<td>Bejo</td>
<td>90</td>
</tr>
<tr>
<td>Malibu</td>
<td>Bejo</td>
<td>90</td>
</tr>
</tbody>
</table>

<sup>a</sup>Average days to harvest is a weighted average based on number of heads harvested at each harvest date.

<sup>b</sup>Numbers within the same column followed by the same letter are not significantly different at P < 0.05 according to Duncan’s multiple range test.

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Table 2. Marketable yield, average head weight and crown height, and crown to head ratio for 14 varieties of broccoli (*Brassica oleracea* var. *italica*) grown in Tifton, GA, during fall 2013.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Yield&lt;sup&gt;z&lt;/sup&gt; (boxes/a )</th>
<th>Average Head Weight&lt;sup&gt;y&lt;/sup&gt; (oz)</th>
<th>Average Crown Height&lt;sup&gt;x&lt;/sup&gt; (in)</th>
<th>Crown to Head Ratio&lt;sup&gt;z&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Luna (HMX 8131)</td>
<td>710 a&lt;sup&gt;w&lt;/sup&gt;</td>
<td>7.3 ab</td>
<td>2.8 de</td>
<td>0.55 cd</td>
</tr>
<tr>
<td>Gypsy</td>
<td>706 a</td>
<td>7.2 bc</td>
<td>2.8 cd</td>
<td>0.57 c</td>
</tr>
<tr>
<td>Green Magic</td>
<td>664 ab</td>
<td>8.0 a</td>
<td>3.3 a</td>
<td>0.67 a</td>
</tr>
<tr>
<td>Imperial</td>
<td>659 ab</td>
<td>7.3 ab</td>
<td>3.3 a</td>
<td>0.67 a</td>
</tr>
<tr>
<td>BC 1691</td>
<td>592 abc</td>
<td>7.0 bcd</td>
<td>2.5 f</td>
<td>0.50 e</td>
</tr>
<tr>
<td>Constellation</td>
<td>548 abc</td>
<td>6.7 bcd</td>
<td>3.1 b</td>
<td>0.62 b</td>
</tr>
<tr>
<td>2863</td>
<td>477 bcd</td>
<td>6.6 b-e</td>
<td>3.0 bc</td>
<td>0.60 b</td>
</tr>
<tr>
<td>Emerald Crown</td>
<td>460 bcd</td>
<td>6.2 def</td>
<td>3.1 b</td>
<td>0.62 b</td>
</tr>
<tr>
<td>2914</td>
<td>414 cde</td>
<td>6.4 c-f</td>
<td>2.5 f</td>
<td>0.50 e</td>
</tr>
<tr>
<td>Batavia</td>
<td>392 cde</td>
<td>6.4 c-f</td>
<td>3.2 ab</td>
<td>0.62 b</td>
</tr>
<tr>
<td>Gemini</td>
<td>382 cde</td>
<td>6.2 def</td>
<td>2.6 ef</td>
<td>0.52 de</td>
</tr>
<tr>
<td>Belstar</td>
<td>373 cde</td>
<td>6.3 def</td>
<td>2.2 g</td>
<td>0.45 f</td>
</tr>
<tr>
<td>Alborada</td>
<td>321 de</td>
<td>5.8 ef</td>
<td>2.2 g</td>
<td>0.43 f</td>
</tr>
<tr>
<td>Malibu</td>
<td>219 e</td>
<td>5.6 f</td>
<td>2.5 f</td>
<td>0.50 e</td>
</tr>
</tbody>
</table>

<sup>z</sup>Yield based on number of 14 lb boxes per hectare and a plant population of 21,787 plants per acre.

<sup>y</sup>Crown height is determined by the length of the base of the lowest shoot to the top of the crown.

<sup>x</sup>Crown to head ratio is based on crown height divided by 5 in per head.

<sup>w</sup>Numbers within the same column followed by the same letter are not significantly different at P < 0.05 according to Duncan’s multiple range test.
Cabbage Variety Trial: Fall 2013

Matt Roberts¹,³ and Timothy Coolong²

¹Agriculture and Natural Resources Agent, Colquitt County, GA; ²Extension Vegetable Specialist, Department of Horticulture, Tifton, GA 31793; ³Agronomist for CH Robinson/Robinson Fresh Inc.

Introduction

More than 8,000 acres of cabbage (Brassica oleracea var. capitata) are grown in Georgia annually, much of it for the fresh market, though some is processed. Cabbage is grown in both fall and spring. Routine cabbage evaluations have not been conducted in Georgia in recent years, despite the introduction of several new and promising varieties. This trial was conducted to determine the suitability of several of these varieties for fresh market production in the fall in southwest Georgia.

Materials and Methods

Fifteen varieties (13 green and two red) were seeded into 332-cell trays on 15 Aug. 2013 and grown using standard production methods. On 15 Sept. 2013 seedlings were transplanted into a bare-ground production system. Single rows were planted with 3 ft spacing on center and 8-inch in-row spacing. Plants were grown according to standard commercial practices for Georgia and were sprayed weekly with fungicides or insecticides. Plants were irrigated as needed, using center-pivot irrigation. Plots contained 60 plants, and the trial was arranged as a randomized complete block design with four replications.

Harvests were initiated on 2 Dec. 2013 and continued until 15 Jan. 2014. Plots were rated for disease on 20 Dec. 2013. At harvest, heads were counted and weighed and sub-samples of five heads were used to determine core length and head diameter. Data were analyzed using the GLM procedure of SAS statistical software (Version 9.3, SAS Institute).

Results and Discussion

The fall and early winter of 2013 was slightly cooler than typical, and plants were slow to mature. A weighted average was used to determine days to harvest. Checkmate was the earliest variety harvested, while Garnet was the latest to mature (Table 1). Varieties were also evaluated for disease.

Checkmate had the highest incidence of disease, with Stonehead and Primo Vantage also having significant levels of disease (Table 1). Disease symptoms appeared primarily the outer leaves of the heads, making them unmarketable. Isolates were identified as Pseudomonas syringae.

Yields ranged from 22,730 lb/a to 78,276 lb/a. The variety SCB6334R had the highest marketable yield, but it was not significantly different than seven additional varieties (Table 2). SCB6334R is a flattened variety that also had the largest average head weight at harvest. Excalibur and Expat were both part of the highest yielding group and tended to have very tightly packed leaves. The two lowest yielding green varieties, Stonehead and Checkmate, displayed significant disease symptoms, resulting in large numbers of unmarketable heads.

The two red varieties trialed had smaller average head weights, leading to lower yields as well. Garnet, the latest maturing variety, had the smallest head diameter. Capture, a widely grown variety, had a relatively large head diameter (7.4 inches) but a low average head weight, suggesting that this variety formed a looser head than others. Viceroy, with an average head diameter of 6.7 inches had one of the highest average head weights, suggesting a denser head.

Core to head ratios were also determined. Growers prefer varieties with a relatively small core compared to the size of the overall head. Primo Vantage had the smallest core to head ratio, while Capture and Bravo had the highest.
**Table 1.** Seed source, average days to harvest, and disease ratings for cabbage (*Brassica oleracea* var. *capitata*) grown in Ellenton, GA, during fall 2013.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Seed Source</th>
<th>Average Days to Harvest</th>
<th>Disease Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Checkmate</td>
<td>Bejo</td>
<td>96</td>
<td>a’</td>
</tr>
<tr>
<td>Supreme Vantage</td>
<td>Sakata</td>
<td>103</td>
<td>ab</td>
</tr>
<tr>
<td>Capture</td>
<td>Bejo</td>
<td>105</td>
<td>bc</td>
</tr>
<tr>
<td>Bravo</td>
<td>Harris Moran</td>
<td>106</td>
<td>bc</td>
</tr>
<tr>
<td>SCB6334R</td>
<td>Sakata</td>
<td>107</td>
<td>bc</td>
</tr>
<tr>
<td>Primo Vantage</td>
<td>Sakata</td>
<td>107</td>
<td>bc</td>
</tr>
<tr>
<td>Stonehead</td>
<td>Sakata</td>
<td>108</td>
<td>bc</td>
</tr>
<tr>
<td>Expat</td>
<td>Bejo</td>
<td>108</td>
<td>bc</td>
</tr>
<tr>
<td>Excalibur</td>
<td>Bejo</td>
<td>108</td>
<td>bc</td>
</tr>
<tr>
<td>Ramada</td>
<td>Bejo</td>
<td>110</td>
<td>bcd</td>
</tr>
<tr>
<td>HMX2257</td>
<td>Harris Moran</td>
<td>111</td>
<td>bcd</td>
</tr>
<tr>
<td>Bronco</td>
<td>Bejo</td>
<td>111</td>
<td>bcd</td>
</tr>
<tr>
<td>Bruno</td>
<td>Bejo</td>
<td>112</td>
<td>cd</td>
</tr>
<tr>
<td>Red Jewel (red)</td>
<td>Sakata</td>
<td>113</td>
<td>cd</td>
</tr>
<tr>
<td>Garnet (red)</td>
<td>Harris Moran</td>
<td>117</td>
<td>d</td>
</tr>
</tbody>
</table>

**Notes:**
- Average days to harvest was determined from transplant and a weighted average based on number of heads harvested at each harvest date.
- Disease rating conducted on 20 Dec. 2013. The following scale was used: 1 = 0 disease incidence, 2 = 1-10% of heads affected, 3 = 11-30% affected, 4 = 31-60% affected, and 5 = 61-100% of heads affected.
- Numbers within the same column followed by the same letter are not significantly different at P < 0.05 according to Duncan’s multiple range test.

**Table 2.** Marketable yield, average head weight and crown height, and core to head ratio for 15 varieties of cabbage grown in Colquitt County, GA, during fall 2013.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Yield’ (lb/a)</th>
<th>Average Head Weight (lb)</th>
<th>Average Head Diameter’ (in)</th>
<th>Core to Head Ratio’</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCB6334R</td>
<td>78,276</td>
<td>3.63</td>
<td>a</td>
<td>0.51</td>
</tr>
<tr>
<td>Excalibur</td>
<td>76,451</td>
<td>3.48</td>
<td>ab</td>
<td>0.38</td>
</tr>
<tr>
<td>Bravo</td>
<td>73,478</td>
<td>3.39</td>
<td>ab</td>
<td>0.53</td>
</tr>
<tr>
<td>Expat</td>
<td>73,265</td>
<td>3.39</td>
<td>ab</td>
<td>0.54</td>
</tr>
<tr>
<td>Viceroy (HMX 2257)</td>
<td>72,829</td>
<td>3.39</td>
<td>ab</td>
<td>0.43</td>
</tr>
<tr>
<td>Supreme Vantage</td>
<td>72,366</td>
<td>3.21</td>
<td>abc</td>
<td>0.38</td>
</tr>
<tr>
<td>Bronco</td>
<td>71,565</td>
<td>3.41</td>
<td>ab</td>
<td>0.54</td>
</tr>
<tr>
<td>Primo Vantage</td>
<td>70,595</td>
<td>3.34</td>
<td>abc</td>
<td>0.27</td>
</tr>
<tr>
<td>Capture</td>
<td>67,409</td>
<td>3.08</td>
<td>bc</td>
<td>0.58</td>
</tr>
<tr>
<td>Bruno</td>
<td>66,625</td>
<td>3.21</td>
<td>abc</td>
<td>0.47</td>
</tr>
<tr>
<td>Ramada</td>
<td>65,308</td>
<td>3.21</td>
<td>abc</td>
<td>0.50</td>
</tr>
<tr>
<td>Red Jewel</td>
<td>52,403</td>
<td>2.40</td>
<td>d</td>
<td>0.44</td>
</tr>
<tr>
<td>Garnet</td>
<td>48,452</td>
<td>2.33</td>
<td>d</td>
<td>0.50</td>
</tr>
<tr>
<td>Checkmate</td>
<td>40,006</td>
<td>2.84</td>
<td>c</td>
<td>0.46</td>
</tr>
<tr>
<td>Stonehead</td>
<td>22,731</td>
<td>2.18</td>
<td>d</td>
<td>0.42</td>
</tr>
</tbody>
</table>

**Notes:**
- Yield based on number a plant population of 21,787.
- Head diameter based on the average of five heads.
- Core to head ratio is based on core height divided by head height for five individual heads.
- Numbers within the same column followed by the same letter are not significantly different at P < 0.05 according to Duncan’s multiple range test.
Cabbage Variety Trial: Fall 2014
Amber Arrington and Timothy Coolong
1Agriculture and Natural Resources Agent, Colquitt County, GA; 2Extension Vegetable Specialist, Department of Horticulture, Tifton, GA 31793

Introduction
Georgia is one of the national leaders in cabbage production. With a value of nearly $75 million in 2013, cabbage is ranked sixth within the state in terms of value for vegetables. Cabbage is planted on over 8,700 acres in Georgia, with 80% planted in Colquitt county. Due to the importance of cabbage to the vegetable growers of Colquitt county, a trial was undertaken in the fall of 2014 to evaluate numerous newer varieties of cabbage. The trial was conducted on a farm located in Colquitt County, GA.

Materials and Methods
The trial was planted on 19 Sept. 2014, using 6-week-old transplants that were grown in 332-cell trays. Sixteen varieties were included in the trial (Table 1). There were 15 green and one red varieties. Plants were grown using standard grower practices on bareground plots with overhead (pivot) irrigation. Plants were transplanted into rows that were 36-inches center to center, with 12-inch within-row spacing. Each plot/replicate contained 30 plants, and there were three replicates of each variety planted. Of the 30 plants in a plot, 20 were harvested to obtain average weight and yield data. Three harvests occurred on 5, 15, and 22 Jan. 2015. Five representative heads of each variety were subsequently analyzed for average diameter, height, core length, disease, and general quality observations.

Results and Discussion
Yield and quality data are presented in Table 1. Because very little stand loss was encountered, total per acre yields reflect fairly closely the differences in average head weight. Supreme Vantage was the only variety where there were limited occurrences of disease, which was tentatively identified as *Pseudomonas* spp., resulting in the approximately 15% loss of harvested heads. In addition, the variety Garnett, the only red variety in this trial, was not harvested, as it did not mature in the time frame allotted by the grower. The varieties Cheers and Bravo, which are the two most widely planted varieties in Georgia, yielded similarly and were among the top four yielding varieties. Some of the lowest yielding varieties in this trial were later maturing and generally had lower head weights than the highest yielding varieties. It is suspected that given more time to mature these varieties would have increased in average head weight; however, for a variety to become widely grown it must fit within current growing and marketing windows for fall planted cabbage.

### Table 1. Yield and quality data (no statistical analysis) for cabbage grown in Colquitt County, GA, in Fall 2014.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Avg. Yield (lb/a)</th>
<th>Avg. Weight (lb)</th>
<th>1st Harvest (%)</th>
<th>2nd &amp; 3rd Harvest (%)</th>
<th>Avg. Head Diam. (in)</th>
<th>Avg. Head Height (in)</th>
<th>Avg. Core Length (in)</th>
<th>Core Ratio (core/height)</th>
<th>Core Ratio (core/height)</th>
<th>Disease (0-5)+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primo Vantage</td>
<td>57,697</td>
<td>3.97</td>
<td>87%</td>
<td>13%</td>
<td>6.6</td>
<td>6.7</td>
<td>2.1</td>
<td>0.31</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>FCB3344</td>
<td>55,118</td>
<td>3.80</td>
<td>74%</td>
<td>26%</td>
<td>5.9</td>
<td>6.1</td>
<td>3.2</td>
<td>0.53</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Cheers</td>
<td>53,941</td>
<td>3.71</td>
<td>95%</td>
<td>5%</td>
<td>7.1</td>
<td>6.1</td>
<td>2.9</td>
<td>0.48</td>
<td>0.3</td>
<td></td>
</tr>
<tr>
<td>Bravo</td>
<td>53,540</td>
<td>3.69</td>
<td>95%</td>
<td>5%</td>
<td>7.2</td>
<td>6.1</td>
<td>3.4</td>
<td>0.55</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>Viceroy</td>
<td>53,089</td>
<td>3.66</td>
<td>74%</td>
<td>26%</td>
<td>6.7</td>
<td>6.0</td>
<td>2.8</td>
<td>0.47</td>
<td>0.7</td>
<td></td>
</tr>
<tr>
<td>SCB6334</td>
<td>52,454</td>
<td>3.61</td>
<td>100%</td>
<td>0%</td>
<td>6.9</td>
<td>6.1</td>
<td>3.1</td>
<td>0.51</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>Excalibur</td>
<td>48,803</td>
<td>3.36</td>
<td>77%</td>
<td>23%</td>
<td>6.9</td>
<td>6.3</td>
<td>2.5</td>
<td>0.39</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>Bobcat</td>
<td>47,755</td>
<td>3.29</td>
<td>98%</td>
<td>2%</td>
<td>5.2</td>
<td>5.7</td>
<td>2.8</td>
<td>0.49</td>
<td>2.0</td>
<td></td>
</tr>
<tr>
<td>Supreme Vantage</td>
<td>45,696</td>
<td>3.93</td>
<td>88%</td>
<td>12%</td>
<td>7.0</td>
<td>6.8</td>
<td>3.3</td>
<td>0.48</td>
<td>2.7</td>
<td></td>
</tr>
<tr>
<td>Bruno</td>
<td>44,418</td>
<td>3.06</td>
<td>68%</td>
<td>32%</td>
<td>6.3</td>
<td>6.0</td>
<td>3.0</td>
<td>0.50</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td>Ramada</td>
<td>43,674</td>
<td>3.01</td>
<td>88%</td>
<td>12%</td>
<td>6.5</td>
<td>5.5</td>
<td>3.0</td>
<td>0.54</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>Bronco</td>
<td>41,679</td>
<td>2.87</td>
<td>81%</td>
<td>19%</td>
<td>6.4</td>
<td>5.7</td>
<td>2.6</td>
<td>0.46</td>
<td>0.3</td>
<td></td>
</tr>
<tr>
<td>Capture</td>
<td>37,687</td>
<td>2.60</td>
<td>70%</td>
<td>30%</td>
<td>6.7</td>
<td>5.2</td>
<td>2.5</td>
<td>0.49</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>Blue Vantage</td>
<td>36,829</td>
<td>2.54</td>
<td>64%</td>
<td>36%</td>
<td>6.2</td>
<td>5.9</td>
<td>3.0</td>
<td>0.50</td>
<td>0.7</td>
<td></td>
</tr>
<tr>
<td>Expat</td>
<td>31,086</td>
<td>2.14</td>
<td>40%</td>
<td>60%</td>
<td>6.2</td>
<td>5.1</td>
<td>2.5</td>
<td>0.49</td>
<td>0.0</td>
<td></td>
</tr>
</tbody>
</table>

*Yield per acre determined using a plant population of 14,520 plants per acre.
*Disease rating based on a 0 to 5 scale with 0=no disease and 5=100% of heads with disease symptoms. Disease symptoms identified as *Pseudomonas* spp.
**Evaluation of Insecticide Treatments in Cabbage: 2014**

David G. Riley  
Department of Entomology, University of Georgia, Tifton, GA 31793

**Materials and Methods**

Cabbage ‘Cheers’ was transplanted into two rows per 6-ft beds on 11 March 2014 and maintained with standard cultural practices at the Lang Farm, Coastal Plain Experiment Station, Tifton, GA. A total of 500 pounds of 10-10-10 was applied to Tift pebbly clay loam field plots initially followed by 150 pounds of 10-10-10 at first side dressing and 150 pounds of ammonia nitrate at second side dressing. Scouting was initiated on 1 April 2014 and continued weekly until a final damage rating was completed on 12 June 2014 at harvest time. Applications of insecticide were made 11 and 24 April, 6, 13, 21, and 28 May, and 3 June. The damage rating and harvest sample size was 10 heads per plot. Ratings were based on a 1 = no damage to 6 = maximum damage scale. Insect counts were analyzed using ANOVA by date and averaged over all sample dates. Harvest was a single harvest and percent marketable was estimated as heads with a 1-2 rating/total.

**Results and Discussion**

Diamondback moth was the most prevalent Lepidopteran pest present in this study. One of the earliest observations on 14 April (Table 1) was that Coragen was not providing the traditionally high level of DBM control as seen in previous years. This tendency in a reduced amount of efficacy compared to the newer products tested carried through to the end of the test (Table 2) and was reflected in overall DBM (Table 3) wrapper leaf and head damage (Table 4) and marketable yield (Table 5). The new DPX-RDS63 was highly efficacious against all Lepidopteran larvae throughout, even at the lowest tested rate. Radiant continues to be a standard for Lepidopteran control in cabbage in Georgia based on the results of this study, but perhaps also due to the acute awareness among Georgia growers as to the potential for spinosyn resistance and the need for rotations with this mode of action. The low rate of KN128 was intermediate in control between Coragen and Avaunt, but the high rate was similar to Avaunt. As a final note, the high rate of Avaunt tends to provide better protection against Lepidopteran larvae than the lower rate but did not separate out statistically.

**DBM: Diamondback moth, ICW: Imported cabbage worm, CL: Cabbage looper, THRIPS: Tobacco thrips**

> NOTE: The chemical in treatments 2-5 and related discussion in this report have been redacted by the author. For more information, contact David Riley at dgr@uga.edu or 229-386-3374.

**Table 1. Efficacy against Lepidoptera larvae early in the season.**

<table>
<thead>
<tr>
<th>Treatment (rate per acre)</th>
<th>DBM 4/14</th>
<th>All Larvae 4/14</th>
<th>DBM 4/28</th>
<th>All Larvae 4/28</th>
<th>DBM 5/7</th>
<th>All Larvae 5/7</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Untreated check</td>
<td>1.25a</td>
<td>1.25a</td>
<td>6.50a</td>
<td>6.5a</td>
<td>1.50ba</td>
<td>1.75ba</td>
</tr>
<tr>
<td>2. DPX-RDS63 + Induce at 0.125% v*</td>
<td>0.00b</td>
<td>0.25b</td>
<td>0.00c</td>
<td>0.00c</td>
<td>0.75bc</td>
<td>0.75bac</td>
</tr>
<tr>
<td>3. DPX-RDS63 + Induce at 0.125% v</td>
<td>0.75ba</td>
<td>0.75ba</td>
<td>0.25c</td>
<td>0.25c</td>
<td>0.00c</td>
<td>0.00c</td>
</tr>
<tr>
<td>4. DPX-RDS63 + Induce at 0.125% v</td>
<td>0.00b</td>
<td>0.00b</td>
<td>0.75cb</td>
<td>0.75cb</td>
<td>1.00bac</td>
<td>1.00bac</td>
</tr>
<tr>
<td>5. DPX-RDS63 + Induce at 0.125% v</td>
<td>0.00b</td>
<td>0.00b</td>
<td>0.50c</td>
<td>0.50c</td>
<td>0.00c</td>
<td>0.25c</td>
</tr>
<tr>
<td>6. Coragen SC 3.5 fl oz/a + Induce at 0.125% v</td>
<td>0.75ba</td>
<td>0.75ba</td>
<td>2.00cb</td>
<td>2.00cb</td>
<td>2.00a</td>
<td>2.00a</td>
</tr>
<tr>
<td>7. Avaunt WDG 3.5 oz/a + Induce at 0.125 % v</td>
<td>0.00b</td>
<td>0.00b</td>
<td>1.75cb</td>
<td>2.00cb</td>
<td>1.75ba</td>
<td>1.75ba</td>
</tr>
<tr>
<td>8. KN128 WG at 3.5 oz/a + MSO at 0.5% v**</td>
<td>0.00b</td>
<td>0.00b</td>
<td>2.75b</td>
<td>2.75b</td>
<td>0.75bc</td>
<td>0.75bac</td>
</tr>
<tr>
<td>9. KN128 WG at 6 oz/a + MSO at 0.5% v</td>
<td>0.25b</td>
<td>0.25b</td>
<td>0.50c</td>
<td>0.50c</td>
<td>0.25c</td>
<td>0.25c</td>
</tr>
<tr>
<td>10. Avaunt WDG at 3.5 oz/a + MSO at 0.5% v</td>
<td>0.00b</td>
<td>0.00b</td>
<td>1.75cb</td>
<td>1.75cb</td>
<td>1.00bac</td>
<td>1.25bac</td>
</tr>
<tr>
<td>11. Avaunt WDG at 6 oz/a + MSO at 0.5% v</td>
<td>0.25b</td>
<td>0.25b</td>
<td>0.25c</td>
<td>0.25c</td>
<td>0.25c</td>
<td>0.50bc</td>
</tr>
<tr>
<td>12. Radiant 5 fl oz/a + Induce at 0.125%</td>
<td>0.25b</td>
<td>0.25b</td>
<td>0.75cb</td>
<td>0.75cb</td>
<td>0.25c</td>
<td>0.25c</td>
</tr>
</tbody>
</table>

*Means within columns followed by the same letter are not significantly different (LSD, P < 0.05).*
Table 2. Efficacy against Lepidoptera larvae late-season.

<table>
<thead>
<tr>
<th>Treatment (rate per acre)</th>
<th>DBM 5/14</th>
<th>ICW 5/14</th>
<th>DBM 5/22</th>
<th>ICW 5/22</th>
<th>DBM 5/29</th>
<th>ICW 5/29</th>
<th>ICW 6/4</th>
<th>All Larvae 6/4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Untreated check</td>
<td>3.50a</td>
<td>1.25a</td>
<td>4.50a</td>
<td>1.00a</td>
<td>5.00a</td>
<td>1.50a</td>
<td>1.25a</td>
<td>2.25a</td>
</tr>
<tr>
<td>2. DPX-RDS63 SC 050 gai/ha + Induce at 0.125% v*</td>
<td>0.25b</td>
<td>0.00b</td>
<td>0.00b</td>
<td>0.00b</td>
<td>0.00b</td>
<td>0.00b</td>
<td>0.00b</td>
<td>0.00b</td>
</tr>
<tr>
<td>3. DPX-RDS63 SC 100 gai/ha + Induce at 0.125% v</td>
<td>0.00b</td>
<td>0.00b</td>
<td>0.00b</td>
<td>0.00b</td>
<td>0.25b</td>
<td>0.00b</td>
<td>0.00b</td>
<td>0.00b</td>
</tr>
<tr>
<td>4. DPX-RDS63 SC 150 gai/ha + Induce at 0.125% v</td>
<td>0.00b</td>
<td>0.00b</td>
<td>0.00b</td>
<td>0.00b</td>
<td>0.00b</td>
<td>0.00b</td>
<td>0.00b</td>
<td>0.00b</td>
</tr>
<tr>
<td>5. DPX-RDS63 SC 200 gai/ha + Induce at 0.125% v</td>
<td>0.00b</td>
<td>0.00b</td>
<td>0.00b</td>
<td>0.00b</td>
<td>0.25b</td>
<td>0.00b</td>
<td>0.00b</td>
<td>0.00b</td>
</tr>
<tr>
<td>6. Coragen SC 3.5 fl oz/a + Induce at 0.125% v</td>
<td>1.25b</td>
<td>0.00b</td>
<td>0.50b</td>
<td>0.00b</td>
<td>1.25b</td>
<td>0.25b</td>
<td>0.00b</td>
<td>0.50bc</td>
</tr>
<tr>
<td>7. Avaunt WDG 3.5 oz/a + Induce at 0.125% v</td>
<td>1.50b</td>
<td>0.00b</td>
<td>0.75b</td>
<td>0.00b</td>
<td>1.25b</td>
<td>0.25b</td>
<td>0.00b</td>
<td>0.00b</td>
</tr>
</tbody>
</table>

*Means within columns followed by the same letter are not significantly different (LSD, P < 0.05).

Table 3. Efficacy against Lepidoptera larvae overall.

<table>
<thead>
<tr>
<th>Treatment (rate per acre)</th>
<th>DBM</th>
<th>DBM Sm. Larvae</th>
<th>DBM Lg. Larvae</th>
<th>DBM Pupae</th>
<th>ICW</th>
<th>THRIPS</th>
<th>Predators</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Untreated check</td>
<td>2.91a</td>
<td>0.53a</td>
<td>1.75a</td>
<td>0.63a</td>
<td>0.62a</td>
<td>0.56a</td>
<td>0.56a</td>
</tr>
<tr>
<td>2. DPX-RDS63 SC 050 gai/ha + Induce at 0.125% v*</td>
<td>0.13e</td>
<td>0.00b</td>
<td>0.00c</td>
<td>0.12dec</td>
<td>0.00b</td>
<td>1.12a</td>
<td>0.34a</td>
</tr>
<tr>
<td>3. DPX-RDS63 SC 100 gai/ha + Induce at 0.125% v</td>
<td>0.19ed</td>
<td>0.06b</td>
<td>0.06cb</td>
<td>0.06de</td>
<td>0.00b</td>
<td>1.03a</td>
<td>0.34a</td>
</tr>
<tr>
<td>4. DPX-RDS63 SC 150 gai/ha + Induce at 0.125% v</td>
<td>0.34ced</td>
<td>0.16b</td>
<td>0.03cb</td>
<td>0.16bdec</td>
<td>0.00b</td>
<td>0.53a</td>
<td>0.50a</td>
</tr>
<tr>
<td>5. DPX-RDS63 SC 200 gai/ha + Induce at 0.125% v</td>
<td>0.13e</td>
<td>0.03b</td>
<td>0.06cb</td>
<td>0.03e</td>
<td>0.00b</td>
<td>0.91a</td>
<td>0.43a</td>
</tr>
<tr>
<td>6. Coragen SC 3.5 fl oz/a + Induce at 0.125% v</td>
<td>1.63b</td>
<td>0.19b</td>
<td>0.28cb</td>
<td>0.34bac</td>
<td>0.00b</td>
<td>0.31a</td>
<td>0.37a</td>
</tr>
<tr>
<td>7. Avaunt WDG 3.5 oz/a + Induce at 0.125% v</td>
<td>0.91cb</td>
<td>0.13b</td>
<td>0.41b</td>
<td>0.38bac</td>
<td>0.00b</td>
<td>0.056a</td>
<td>0.056a</td>
</tr>
<tr>
<td>8. KN128 WG at 3.5 oz/a + MSO at 0.5% v**</td>
<td>0.75cbd</td>
<td>0.22b</td>
<td>0.16cb</td>
<td>0.09dec</td>
<td>0.00b</td>
<td>0.44a</td>
<td>0.25a</td>
</tr>
<tr>
<td>9. KN128 WG at 6 oz/a + MSO at 0.5% v</td>
<td>0.31ced</td>
<td>0.06b</td>
<td>0.16cb</td>
<td>0.09dec</td>
<td>0.00b</td>
<td>0.44a</td>
<td>0.31a</td>
</tr>
<tr>
<td>10. Avaunt WDG at 3.5 oz/a + MSO at 0.5% v</td>
<td>0.69cebd</td>
<td>0.09b</td>
<td>0.16cb</td>
<td>0.44ba</td>
<td>0.00b</td>
<td>0.109a</td>
<td>0.25a</td>
</tr>
<tr>
<td>11. Avaunt WDG at 6 oz/a + MSO at 0.5% v</td>
<td>0.47cebd</td>
<td>0.16b</td>
<td>0.19cb</td>
<td>0.13dec</td>
<td>0.00b</td>
<td>0.41a</td>
<td>0.40a</td>
</tr>
<tr>
<td>12. Radiant 5 fl oz/a + Induce at 0.125%</td>
<td>0.25ed</td>
<td>0.13b</td>
<td>0.03cb</td>
<td>0.09dec</td>
<td>0.00b</td>
<td>1.09a</td>
<td>0.25a</td>
</tr>
</tbody>
</table>

*Means within columns followed by the same letter are not significantly different (LSD, P < 0.05).

Table 4. Lepidoptera damage to wrapper leaves and heads in May before harvest on 10 plants per plot.

<table>
<thead>
<tr>
<th>Treatment (rate per acre)</th>
<th>Avg. Wrapper Damage 6/6 (10 plants)</th>
<th>Avg. Head Damage 5/6 (10 plants)</th>
<th>Wrap Damage Overall</th>
<th>Head Damage Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Untreated check</td>
<td>5.90a</td>
<td>5.57a</td>
<td>5.9a</td>
<td>5.57a</td>
</tr>
<tr>
<td>2. DPX-RDS63 SC 050 gai/ha + Induce at 0.125% v*</td>
<td>2.10gf</td>
<td>1.40f</td>
<td>2.1gf</td>
<td>1.40f</td>
</tr>
<tr>
<td>3. DPX-RDS63 SC 100 gai/ha + Induce at 0.125% v</td>
<td>1.87g</td>
<td>1.32f</td>
<td>1.87g</td>
<td>1.33f</td>
</tr>
<tr>
<td>4. DPX-RDS63 SC 150 gai/ha + Induce at 0.125% v</td>
<td>1.67g</td>
<td>1.05f</td>
<td>1.67g</td>
<td>1.05f</td>
</tr>
<tr>
<td>5. DPX-RDS63 SC 200 gai/ha + Induce at 0.125% v</td>
<td>1.85g</td>
<td>1.15f</td>
<td>1.85g</td>
<td>1.15f</td>
</tr>
<tr>
<td>6. Coragen SC 3.5 fl oz/a + Induce at 0.125% v</td>
<td>4.22c</td>
<td>3.27c</td>
<td>4.22c</td>
<td>3.27c</td>
</tr>
<tr>
<td>7. Avaunt WDG 3.5 oz/a + Induce at 0.125% v</td>
<td>4.52cb</td>
<td>3.55cb</td>
<td>4.52cb</td>
<td>3.55cb</td>
</tr>
<tr>
<td>8. KN128 WG at 3.5 oz/a + MSO at 0.5% v**</td>
<td>4.85b</td>
<td>4.00b</td>
<td>4.85b</td>
<td>4.00b</td>
</tr>
<tr>
<td>9. KN128 WG at 6 oz/a + MSO at 0.5% v</td>
<td>3.05ed</td>
<td>2.10d</td>
<td>3.05ed</td>
<td>2.10d</td>
</tr>
<tr>
<td>10. Avaunt WDG at 3.5 oz/a + MSO at 0.5% v</td>
<td>3.30d</td>
<td>2.42d</td>
<td>3.30d</td>
<td>2.42d</td>
</tr>
<tr>
<td>11. Avaunt WDG at 6 oz/a + MSO at 0.5% v</td>
<td>2.82ed</td>
<td>1.97ed</td>
<td>2.82ed</td>
<td>1.97ed</td>
</tr>
<tr>
<td>12. Radiant 5 fl oz/a + Induce at 0.125%</td>
<td>2.55ef</td>
<td>1.47ef</td>
<td>2.55ef</td>
<td>1.47ef</td>
</tr>
</tbody>
</table>

*Means within columns followed by the same letter are not significantly different (LSD, P < 0.05).
Table 5. Lepidoptera damage (rating scale of 1 [none] to 6 [severe]) to wrapper leaves and heads, marketable weight of cabbage, and percent marketable from 10 plants per plot.

<table>
<thead>
<tr>
<th>Treatment (rate per acre)</th>
<th>Overall Leaf Damage</th>
<th>Overall Head Damage</th>
<th>Marketable Leaf Damage</th>
<th>Marketable Head Damage</th>
<th>Percent Marketable</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Untreated check</td>
<td>4.92a</td>
<td>4.07a</td>
<td>4.00a</td>
<td>2.00a</td>
<td>0.26c</td>
</tr>
<tr>
<td>2. DPX-RDS63 SC 050 gai/ha + Induce at 0.125% v*</td>
<td>1.67ed</td>
<td>1.17cbd</td>
<td>1.65fde</td>
<td>1.12cd</td>
<td>0.95ba</td>
</tr>
<tr>
<td>3. DPX-RDS63 SC 100 gai/ha + Induce at 0.125% v</td>
<td>1.65ed</td>
<td>1.2cbd</td>
<td>1.65fde</td>
<td>1.2cd</td>
<td>1.00a</td>
</tr>
<tr>
<td>4. DPX-RDS63 SC 150 gai/ha + Induce at 0.125% v</td>
<td>1.63ed</td>
<td>1.02d</td>
<td>1.62fe</td>
<td>1.02d</td>
<td>1.00a</td>
</tr>
<tr>
<td>5. DPX-RDS63 SC 200 gai/ha + Induce at 0.125% v</td>
<td>1.38e</td>
<td>1.10cd</td>
<td>1.37f</td>
<td>1.10cd</td>
<td>1.00a</td>
</tr>
<tr>
<td>6. Coragen SC 3.5 fl oz/a + Induce at 0.125% v</td>
<td>2.88b</td>
<td>1.85b</td>
<td>2.78b</td>
<td>1.63b</td>
<td>0.81b</td>
</tr>
<tr>
<td>7. Avaunt WDG 3.5 oz/a + Induce at 0.125 % v</td>
<td>2.42cb</td>
<td>1.72cbd</td>
<td>2.28cb</td>
<td>1.56b</td>
<td>0.94ba</td>
</tr>
<tr>
<td>8. KN128 WG at 3.5 oz/a + MSO at 0.5% v**</td>
<td>2.55cb</td>
<td>1.80cb</td>
<td>2.55cb</td>
<td>1.63b</td>
<td>0.84ba</td>
</tr>
<tr>
<td>9. KN128 WG at 6 oz/a + MSO at 0.5% v</td>
<td>2.55cb</td>
<td>1.7cbd</td>
<td>2.52cb</td>
<td>1.63b</td>
<td>0.94ba</td>
</tr>
<tr>
<td>10. Avaunt WDG at 3.5 oz/a + MSO at 0.5% v</td>
<td>2.27cbd</td>
<td>1.50cbd</td>
<td>2.21cd</td>
<td>1.31cbd</td>
<td>0.90ba</td>
</tr>
<tr>
<td>11. Avaunt WDG at 6 oz/a + MSO at 0.5% v</td>
<td>2.10cd</td>
<td>1.45cbd</td>
<td>2.05cde</td>
<td>1.37cb</td>
<td>0.96ba</td>
</tr>
<tr>
<td>12. Radiant 5 fl oz/a + Induce at 0.125%</td>
<td>1.42e</td>
<td>1.17cbd</td>
<td>1.42f</td>
<td>1.17cd</td>
<td>1.00a</td>
</tr>
</tbody>
</table>

*Means within columns followed by the same letter are not significantly different (LSD, P < 0.05).
Efficacy of Biorational and Diamide (Group 28) Insecticides Against Caterpillar Pests of Cole Crops
Alton N. Sparks, Jr.
Department of Entomology, University of Georgia, Tifton, GA 31793

Materials and Methods

Crop: Collards

Targeted pests: Diamondback moth, imported cabbageworm

Location: The University of Georgia, Tifton Vegetable Park, Tifton Campus, Tifton, GA.

Experimental design: RCBD with four replications

Establishment: Transplanted

Plot size: One row (on 6-foot bed treated as 36-inch) by 13 plants (1.5-foot in-row spacing).

Treatments:
- VBC-60397 (2 pt/a) once per week and twice per week [experimental Bt formulation]
- Dipel DF (1 lb/a) + Dyne-Amic at 0.25% once per week and twice per week
- Xentari (1 lb/a) + Dyne-Amic at 0.25% once per week and twice per week
- Belt at 2.0 and 2.4 oz/a once per week
- Coragen at 3.5 oz/a once per week
- Non-treated control

Application dates:
- All treatments: 31 Mar; 8, 16, 21, and 28 April; and 2 and 11 May 2014
- Twice weekly additional applications: 3, 11, and 24 April; 7 May 2014

Application methods: CO₂ pressurized backpack sprayer (60 psi) at 40 gal/a with three hollow-cone nozzles per row (one over the top; two on drops)

Data collection:

Caterpillar counts. Five randomly selected plants were visually searched in each plot on each sample date. All caterpillars of adequate size for field identification were identified and counted. Those too small to be identified were counted and recorded as “small” and are not included in this report (these typically would not have been in the field long enough for adequate exposure to some treatments, and therefore, were not included in analyses).

Plant damage ratings. All plants in each plot were visually observed for damage by caterpillars. Plants were categorized as light (obvious but probably acceptable damage), moderate (unacceptable level of damage), and severe (most of plant damaged) and counted.

Statistical analyses: PROC ANOVA in SAS Enterprise Guide (P < 0.05); LSD (P = 0.05).

Results and Discussion

Caterpillar counts. The majority of caterpillars in this test were diamondback moth (DBM) until the last sample date. Data are shown in the tables for DBM alone and DBM plus imported cabbageworm (ICW).

Where statistical differences were detected, all insecticide treatments provided similar control. This was also true of numerical trends even when differences were not detected (the control had higher densities than all the insecticide treatments, which were similar to each other). There was an occasional trend for the twice per week applications of the Bt insecticides to appear numerically better than the once per week applications.

Of potential concern, the Belt and Coragen treatments applied weekly did not “zero-out” the populations. This result may have been partially a result of periodic rainfall throughout the test, but it is of potential concern as growers have relied heavily on these chemistries for several years.

Plant damage. Damage counts showed trends similar to the caterpillar counts. The majority of plants in the check were classified as severe damage. All of the insecticide treatments eliminated severe damage. Levels of moderate damage were also similar across all insecticide treatments.

Combining all damage classes, there was a trend within the Bt treatments for less damage with twice per week applications. For Belt and Coragen, damage was not reduced as far as expected for these treatments. Again, this may have resulted from rainfall throughout the experiment but does present potential concerns.
### Caterpillar counts, efficacy test against caterpillars in collards, UGA Tifton Vegetable Park, Tifton, GA, 2014.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>2 April</th>
<th>7 April</th>
<th>10 April</th>
<th>14 April</th>
<th>17 April</th>
<th>23 April</th>
<th>28 April</th>
<th>6 May</th>
<th>9 May</th>
<th>12 May</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check</td>
<td>0.00 a</td>
<td>1.75 a</td>
<td>2.25 a</td>
<td>3.25 a</td>
<td>2.50 a</td>
<td>2.75 a</td>
<td>4.50 a</td>
<td>5.00 a</td>
<td>17.25 a</td>
<td>11.25 a</td>
</tr>
<tr>
<td>VBC</td>
<td>0.00 a</td>
<td>0.50 a</td>
<td>0.00 b</td>
<td>1.00 b</td>
<td>0.50 a</td>
<td>0.25 c</td>
<td>0.50 a</td>
<td>1.25 a</td>
<td>2.25 b</td>
<td>4.50 b</td>
</tr>
<tr>
<td>Dipel</td>
<td>0.00 a</td>
<td>0.25 a</td>
<td>0.00 b</td>
<td>1.25 b</td>
<td>0.25 a</td>
<td>0.25 c</td>
<td>1.25 a</td>
<td>1.00 a</td>
<td>3.25 b</td>
<td>5.00 b</td>
</tr>
<tr>
<td>Xentari</td>
<td>0.00 a</td>
<td>0.00 a</td>
<td>0.25 b</td>
<td>1.25 b</td>
<td>0.25 a</td>
<td>0.00 c</td>
<td>0.50 a</td>
<td>1.25 a</td>
<td>2.00 b</td>
<td>3.50 b</td>
</tr>
<tr>
<td>VBC 2x</td>
<td>0.00 a</td>
<td>0.00 a</td>
<td>0.25 b</td>
<td>0.00 b</td>
<td>0.00 a</td>
<td>0.50 c</td>
<td>0.50 a</td>
<td>0.25 a</td>
<td>1.50 b</td>
<td>2.75 b</td>
</tr>
<tr>
<td>Dipel 2x</td>
<td>0.25 a</td>
<td>0.00 a</td>
<td>0.00 b</td>
<td>0.75 b</td>
<td>0.25 a</td>
<td>2.00 ab</td>
<td>0.25 a</td>
<td>0.75 a</td>
<td>2.25 b</td>
<td>4.00 b</td>
</tr>
<tr>
<td>Xentari 2x</td>
<td>0.00 a</td>
<td>0.00 a</td>
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<td>0.25 a</td>
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<td>0.75 b</td>
<td>3.00 b</td>
</tr>
<tr>
<td>Belt 2 oz</td>
<td>0.25 a</td>
<td>0.00 a</td>
<td>0.00 b</td>
<td>0.75 b</td>
<td>1.25 a</td>
<td>0.75 bc</td>
<td>2.25 a</td>
<td>0.75 a</td>
<td>2.25 b</td>
<td>3.25 b</td>
</tr>
<tr>
<td>Belt 2.4 oz</td>
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<td>0.00 a</td>
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<td>1.25 a</td>
<td>3.25 b</td>
<td>2.50 b</td>
</tr>
<tr>
<td>Coragen</td>
<td>0.25 a</td>
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<td>0.00 b</td>
<td>0.00 b</td>
<td>1.50 a</td>
<td>1.00 bc</td>
<td>2.50 a</td>
<td>1.25 a</td>
<td>2.25 b</td>
<td>3.00 b</td>
</tr>
</tbody>
</table>

Means within the same column followed by different letters are significantly different according to Fisher’s Least Significant Difference Test (P < 0.05).

### Caterpillar counts, efficacy test against caterpillars in collards, UGA Tifton Vegetable Park, Tifton, GA, 2014.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>2 April</th>
<th>7 April</th>
<th>10 April</th>
<th>14 April</th>
<th>17 April</th>
<th>23 April</th>
<th>28 April</th>
<th>6 May</th>
<th>9 May</th>
<th>12 May</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check</td>
<td>0.00 a</td>
<td>1.75 a</td>
<td>2.25 a</td>
<td>3.25 a</td>
<td>2.50 a</td>
<td>2.75 a</td>
<td>4.50 a</td>
<td>5.00 a</td>
<td>17.25 a</td>
<td>11.25 a</td>
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<tr>
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<td>0.50 a</td>
<td>0.25 b</td>
<td>1.00 b</td>
<td>0.50 a</td>
<td>0.25 c</td>
<td>0.50 a</td>
<td>1.50 a</td>
<td>2.25 b</td>
<td>4.50 b</td>
</tr>
<tr>
<td>Dipel</td>
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<td>0.25 a</td>
<td>0.00 b</td>
<td>1.25 b</td>
<td>0.25 a</td>
<td>0.25 c</td>
<td>1.25 a</td>
<td>1.00 a</td>
<td>3.25 b</td>
<td>5.00 b</td>
</tr>
<tr>
<td>Xentari</td>
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<td>0.25 b</td>
<td>1.25 b</td>
<td>0.25 a</td>
<td>0.00 c</td>
<td>0.50 a</td>
<td>1.50 a</td>
<td>2.00 b</td>
<td>3.50 b</td>
</tr>
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<td>VBC 2x</td>
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<td>0.00 b</td>
<td>0.00 a</td>
<td>0.50 c</td>
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<td>0.75 a</td>
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</tr>
<tr>
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<td>0.00 b</td>
<td>0.75 b</td>
<td>1.25 a</td>
<td>0.75 bc</td>
<td>2.25 a</td>
<td>0.75 a</td>
<td>2.25 b</td>
<td>3.25 b</td>
</tr>
<tr>
<td>Belt 2.4 oz</td>
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<td>0.00 a</td>
<td>0.25 b</td>
<td>1.00 b</td>
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<td>1.00 bc</td>
<td>2.50 a</td>
<td>1.25 a</td>
<td>2.25 b</td>
<td>3.00 b</td>
</tr>
</tbody>
</table>

Means within the same column followed by different letters are significantly different according to Fisher’s Least Significant Difference Test (P < 0.05).

### Plant damage data, efficacy test against caterpillars in collards, UGA Tifton Vegetable Park, Tifton, GA, 2014.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Severe</th>
<th>Moderate</th>
<th>Light</th>
<th>Severe+Moderate</th>
<th>Total</th>
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</thead>
<tbody>
<tr>
<td>Check</td>
<td>6.00 a</td>
<td>4.75 a</td>
<td>1.75 a</td>
<td>10.75 a</td>
<td>12.50 a</td>
</tr>
<tr>
<td>VBC</td>
<td>0.00 b</td>
<td>2.00 a</td>
<td>4.50 a</td>
<td>2.00 b</td>
<td>6.50 b</td>
</tr>
<tr>
<td>Dipel</td>
<td>0.00 b</td>
<td>2.00 a</td>
<td>4.50 a</td>
<td>2.00 b</td>
<td>6.50 b</td>
</tr>
<tr>
<td>Xentari</td>
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<td>1.25 a</td>
<td>4.75 a</td>
<td>1.25 b</td>
<td>6.00 bc</td>
</tr>
<tr>
<td>VBC 2x</td>
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<td>1.00 a</td>
<td>3.75 a</td>
<td>1.00 b</td>
<td>4.75 bc</td>
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<td>Dipel 2x</td>
<td>0.00 b</td>
<td>1.00 a</td>
<td>2.75 a</td>
<td>1.00 b</td>
<td>3.75 bc</td>
</tr>
<tr>
<td>Xentari 2x</td>
<td>0.00 b</td>
<td>0.25 a</td>
<td>2.75 a</td>
<td>1.00 b</td>
<td>3.75 bc</td>
</tr>
<tr>
<td>Belt 2 oz</td>
<td>0.00 b</td>
<td>0.75 a</td>
<td>3.00 a</td>
<td>0.75 b</td>
<td>3.00 c</td>
</tr>
<tr>
<td>Belt 2.4 oz</td>
<td>0.00 b</td>
<td>2.25 a</td>
<td>3.50 a</td>
<td>2.25 b</td>
<td>5.75 bc</td>
</tr>
<tr>
<td>Coragen</td>
<td>0.00 b</td>
<td>1.50 a</td>
<td>3.50 a</td>
<td>1.50 b</td>
<td>5.00 bc</td>
</tr>
</tbody>
</table>

Means within the same column followed by different letters are significantly different according to Fisher’s Least Significant Difference Test (P < 0.05).
Evaluation of Insecticide Treatments in Collards: 2014

David G. Riley
Department of Entomology, University of Georgia, Tifton, GA 31793

Materials and Methods
Collard, hyb. Top Bunch, was transplanted into two rows per 6-ft beds on 19 Sept. 2014 and maintained with standard cultural practices at the Lang Farm, Coastal Plain Experiment Station at Tifton, GA. A total of 500 pounds of 10-10-10 was applied to Tift pebbly clay loam field plots initially followed by 150 pounds of 10-10-10 at first side dressing and 150 pounds of ammonia nitrate at second side dressing. Irrigation was overhead as needed.

Applications of insecticide were made on 3, 9, and 29 Oct. and two applications of fungicides were applied on 23 Sept. and 3 Oct.

Scouting was initiated on 30 Sept. 2014 and continued weekly until a final damage rating was completed on 11 Nov. 2014 at harvest time. The damage rating and harvest sample size was 10 heads per plot. Ratings were based on a 1 = no damage to 6 = maximum damage scale. Insect counts were analyzed using ANOVA by date and averaged over all sample dates. Harvest was based on a single harvest and percent marketable was estimated as heads with a 1-2 rating/total.

Results and Discussion
The results indicated that all of the insecticide treatments and rates significantly control the Lepidoptera larval complex compared to the untreated check (Table 1) and similarly reduced the resulting leaf damage (Table 2). There was significant effect on yield because Lepidoptera pest pressure was too low.

One odd observation that was taken at the end of the test was whitefly nymph counts. For some inexplicable reason, the highest rate of RDS63 experienced enhanced whitefly immature numbers (Table 2). Typically, this is associated with “greener” growth of the plant, which attracts more whiteflies, but this was not seen in the Coragen treatment, which also had good plant growth.

DBM: Diamondback moth, ICW: Imported cabbage worm, CL: Cabbage looper, SW: Sweetpotato whitefly—B-strain.

NOTE: The chemical in treatments 1-5 and related discussion in this report have been redacted by the author. For more information, contact David Riley at dgr@uga.edu or 229-386-3374.

Table 1. Whitefly adults on one date and Lepidoptera larvae observed on selected dates and averaged over all dates at the Lang-Rigdon Farm, Tifton, GA, 2014.

<table>
<thead>
<tr>
<th>Treatment (rate per acre)</th>
<th>WF Adults 10/13</th>
<th>ICW 10/23</th>
<th>Lep. Larvae 10/23</th>
<th>CL 11/6</th>
<th>CL</th>
<th>ICW</th>
<th>Lep. Larvae</th>
<th>WF</th>
<th>Predators</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. RDS 5 ga/ha + Induce at 0.125%</td>
<td>64.92a</td>
<td>0.25b</td>
<td>0.25b</td>
<td>0.00b</td>
<td>0.05b</td>
<td>0.10ba</td>
<td>0.15b</td>
<td>17.43a</td>
<td>0.05a</td>
</tr>
<tr>
<td>2. RDS 7.5 ga/ha + Induce at 0.125%</td>
<td>62.38a</td>
<td>0.00b</td>
<td>0.00b</td>
<td>0.00b</td>
<td>0.05b</td>
<td>0.00b</td>
<td>0.05b</td>
<td>16.85a</td>
<td>0.05a</td>
</tr>
<tr>
<td>3. RDS 10 ga/ha + Induce at 0.125%</td>
<td>59.92a</td>
<td>0.00b</td>
<td>0.00b</td>
<td>0.00b</td>
<td>0.00b</td>
<td>0.00b</td>
<td>0.00b</td>
<td>15.57a</td>
<td>0.25a</td>
</tr>
<tr>
<td>4. RDS 15 ga/ha + Induce at 0.125%</td>
<td>55.75a</td>
<td>0.00b</td>
<td>0.00b</td>
<td>0.00b</td>
<td>0.00b</td>
<td>0.00b</td>
<td>0.00b</td>
<td>15.34a</td>
<td>0.10a</td>
</tr>
<tr>
<td>5. RDS 20 ga/ha + Induce at 0.125%</td>
<td>73.42a</td>
<td>0.00b</td>
<td>0.00b</td>
<td>0.25ba</td>
<td>0.05b</td>
<td>0.00b</td>
<td>0.10b</td>
<td>18.75a</td>
<td>0.15a</td>
</tr>
<tr>
<td>6. Coragen 3.5 fl oz/a + Induce at 0.125%</td>
<td>55.08a</td>
<td>0.25b</td>
<td>0.25b</td>
<td>0.00b</td>
<td>0.05b</td>
<td>0.05ba</td>
<td>0.15b</td>
<td>16.04a</td>
<td>0.25a</td>
</tr>
<tr>
<td>7. Coragen 5 fl oz/a + Induce at 0.125%</td>
<td>53.92a</td>
<td>0.00b</td>
<td>0.00b</td>
<td>0.00b</td>
<td>0.00b</td>
<td>0.00b</td>
<td>0.00b</td>
<td>14.94a</td>
<td>0.10a</td>
</tr>
<tr>
<td>8. Untreated Check</td>
<td>71.88a</td>
<td>0.75a</td>
<td>1.00a</td>
<td>0.50a</td>
<td>0.20a</td>
<td>0.15a</td>
<td>0.35a</td>
<td>18.44a</td>
<td>0.15a</td>
</tr>
</tbody>
</table>

*Means within columns followed by the same letter are not significantly different (LSD, P < 0.05).
Table 2. Whitefly immatures per sq. inch of leaf observed on selected dates, Lepidoptera damage and collard yields based on the average over ten plants per plot at the Lang-Rigdon Farm, Tifton, GA, 2014.

<table>
<thead>
<tr>
<th>Treatment (rate per acre)</th>
<th>WF Eggs 11/12</th>
<th>WF Sm. Nymphs 11/12</th>
<th>WF Lg. Nymphs 11/12</th>
<th>WF Nymphs 11/12</th>
<th>Leaf Damage</th>
<th>“Head” Weight</th>
<th>Percent Marketable</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. DPX-RDS63 SC 050 gai/ha, 20.2 gai/a, 3.4 fl oz/a + Induce at 0.125%</td>
<td>20.85a</td>
<td>14.55a</td>
<td>18.45b</td>
<td>33.00b</td>
<td>1.27b</td>
<td>8.88a</td>
<td>100a</td>
</tr>
<tr>
<td>2. DPX-RDS63 SC 75 gai/ha, 30.4 gai/a, 5.1 fl oz/a + Induce at 0.125%</td>
<td>19.75a</td>
<td>9.25a</td>
<td>10.90b</td>
<td>20.15b</td>
<td>1.40b</td>
<td>9.35a</td>
<td>100a</td>
</tr>
<tr>
<td>3. DPX-RDS63 SC 100 gai/ha, 40.5 gai/a, 6.8 fl oz/a + Induce at 0.125%</td>
<td>22.10a</td>
<td>10.65a</td>
<td>17.10b</td>
<td>27.75b</td>
<td>1.43b</td>
<td>10.75a</td>
<td>100a</td>
</tr>
<tr>
<td>4. DPX-RDS63 SC 150 gai/ha, 60.7 gai/a, 10.3 fl oz/a + Induce at 0.125%</td>
<td>23.00a</td>
<td>14.65a</td>
<td>13.90b</td>
<td>28.55b</td>
<td>1.45b</td>
<td>10.89a</td>
<td>100a</td>
</tr>
<tr>
<td>5. DPX-RDS63 SC 200 gai/ha, 80.8 gai/a, 13.7 fl oz/a + Induce at 0.125%</td>
<td>49.70a</td>
<td>28.35a</td>
<td>52.15a</td>
<td>80.50a</td>
<td>1.33b</td>
<td>10.28a</td>
<td>100a</td>
</tr>
<tr>
<td>6. Coragen 3.5 fl oz/a + Induce at 0.125%</td>
<td>29.15a</td>
<td>17.85a</td>
<td>18.15b</td>
<td>36.00b</td>
<td>1.33b</td>
<td>12.34a</td>
<td>100a</td>
</tr>
<tr>
<td>7. Coragen 5 fl oz/a + Induce at 0.125%</td>
<td>15.10a</td>
<td>5.80a</td>
<td>14.65b</td>
<td>20.45b</td>
<td>1.35b</td>
<td>10.30a</td>
<td>100a</td>
</tr>
<tr>
<td>8. Untreated Check</td>
<td>40.90a</td>
<td>22.90a</td>
<td>31.70ba</td>
<td>54.60ba</td>
<td>2.03a</td>
<td>9.68a</td>
<td>100a</td>
</tr>
</tbody>
</table>

*Means within columns followed by the same letter are not significantly different (LSD, P < 0.05).
Efficacy of Foliar Insecticides Against Silverleaf Whitefly in Snap Beans

Alton N. Sparks, Jr.
Department of Entomology, University of Georgia, Tifton, GA 31793

Materials and Methods

Crop: Snap beans (variety: Bronco)
Targeted pests: Silverleaf whitefly
Location: The University of Georgia, Horticulture Farm, Tifton Campus, Tifton, GA.
Experimental design: RCBD with four replications
Establishment: Direct seeded on 19 Sept. 2014
Plot size: One row (36-inch) by 30 feet

Treatments:
- Non-Treated Check
- Knack foliar at 8 oz/a
- Exirel foliar at 0.088 and 0.134 lb AI/a + Dyne-Amic at 0.25% v/v
- Verimark in-furrow spray at 13.5 oz/a

Application dates:
- In-furrow spray applied 19 Sept. 2014
- Foliar applications on 21 and 28 Oct. 2014. These were targeted at first bloom and one week later.

Application methods:
- In-furrow spray was applied in 6.3 gal/a in front of the planter press wheel.
- Foliar applications were made with a CO₂ pressurized backpack sprayer (60 psi) in 40 gal/a with three hollow-cone nozzles per row (one over-the-top, two on drops).

Data collection: Whitefly adults were counted at one day after the first foliar application. Adults were counted on five leaves per plot (one leaf of similar age/location was selected on five randomly selected plants in each plot).

Immature whitefly stages were monitored by collecting five leaves per plot and examining these under a microscope. One microscope field was counted on each leaf and all eggs, small nymphs (1st and 2nd instar) and large nymphs (3rd and 4th instar) were counted. Leaves of similar age/location were selected within a sample date (as population structure varies with leaf age).

Statistical analyses: PROC ANOVA in SAS Enterprise Guide (P < 0.05); LSD (P = 0.05).

Results and Discussion

Whitefly adult counts. Exirel appeared to provide roughly 65 to 70 percent control of adults (this is assumed to be contact knockdown activity). Verimark showed good activity against adults at 33 days after planting/treatment (this is assumed to be via ingestion).

Whitefly immature counts. Egg counts did not show significant differences on any dates (this is normal for small plot test where adults are killed but re-infestation occurs quickly). This does show consistent pest pressure across all treatments.

Nymphs counts. Primary emphasis is placed on large nymphs as small nymphs may have recently hatched and not had adequate time for exposure and mortality. In general, Knack did not perform as well as expected in this trial (do not know why), but did show population reductions on the last sample date. Exirel did show good activity against nymphs with no rate effect. Verimark showed excellent activity with significant effects through the last sample date (the long residual may be partially attributed to declining pest pressure late in the year; although, egg counts do suggest consistent pest pressure).

Adult whitefly counts, efficacy study in snap beans, UGA Horticulture Farm, Tifton, GA, 2014.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Check</th>
<th>Knack</th>
<th>Exirel 0.088</th>
<th>Exirel 0.134</th>
<th>Verimark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adults per five leaves</td>
<td>0.00 a</td>
<td>1.75 a</td>
<td>2.25 a</td>
<td>3.25 a</td>
<td>2.50 a</td>
</tr>
</tbody>
</table>

22 Oct. (1 DAT-1, 33 DAIf)*

Means within the same column followed by different letters are significantly different according to Fisher’s Least Significant Difference Test (P < 0.05).

*DAT = days after foliar treatment; DAIf = days after Verimark in-furrow spray
Immature whitefly counts, efficacy study in snap beans, UGA Horticulture Farm, Tifton, GA, 2014.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Number per Five Microscope Fields</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Eggs</td>
<td>Small Nymphs</td>
<td>Large Nymphs</td>
<td>Total Nymphs</td>
</tr>
<tr>
<td>October 28 (7 DAT-1; 32 DAIf)*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check</td>
<td>174.8 a</td>
<td>923.0 a</td>
<td>126.5 a</td>
<td>1049.5 a</td>
</tr>
<tr>
<td>Knack</td>
<td>152.5 a</td>
<td>1009.5 a</td>
<td>106.5 a</td>
<td>1116.0 a</td>
</tr>
<tr>
<td>Exirel 0.088</td>
<td>107.3 a</td>
<td>908.3 a</td>
<td>36.8 a</td>
<td>945.0 a</td>
</tr>
<tr>
<td>Exirel 0.134</td>
<td>109.0 a</td>
<td>606.5 a</td>
<td>20.5 a</td>
<td>627.0 a</td>
</tr>
<tr>
<td>Verimark</td>
<td>29.0 a</td>
<td>47.0 b</td>
<td>1.5 a</td>
<td>48.5 b</td>
</tr>
<tr>
<td>November 4 (7 DAT-2; 39 DAIf)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check</td>
<td>34.5 a</td>
<td>567.8 ab</td>
<td>100.0 b</td>
<td>667.8 b</td>
</tr>
<tr>
<td>Knack</td>
<td>63.0 a</td>
<td>1072.0 a</td>
<td>239.0 a</td>
<td>1311.0 a</td>
</tr>
<tr>
<td>Exirel 0.088</td>
<td>39.8 a</td>
<td>408.0 bc</td>
<td>19.8 bc</td>
<td>427.8 bc</td>
</tr>
<tr>
<td>Exirel 0.134</td>
<td>40.3 a</td>
<td>358.8 bc</td>
<td>13.0 bc</td>
<td>371.8 bc</td>
</tr>
<tr>
<td>Verimark</td>
<td>23.0 a</td>
<td>40.5 c</td>
<td>1.8 c</td>
<td>42.3 c</td>
</tr>
<tr>
<td>November 12 (15 DAT-2; 47 DAIf)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check</td>
<td>73.0 a</td>
<td>251.0 a</td>
<td>80.0 a</td>
<td>331.0 a</td>
</tr>
<tr>
<td>Knack</td>
<td>48.3 a</td>
<td>156.3 b</td>
<td>41.5 b</td>
<td>197.8 b</td>
</tr>
<tr>
<td>Exirel 0.088</td>
<td>34.8 a</td>
<td>36.3 c</td>
<td>5.5 c</td>
<td>41.8 c</td>
</tr>
<tr>
<td>Exirel 0.134</td>
<td>45.5 a</td>
<td>68.0 c</td>
<td>13.0 bc</td>
<td>81.0 bc</td>
</tr>
<tr>
<td>Verimark</td>
<td>47.5 a</td>
<td>24.3 c</td>
<td>3.8 c</td>
<td>28.0 c</td>
</tr>
</tbody>
</table>

Means within the same column followed by different letters are significantly different according to Fisher's Least Significant Difference Test (P < 0.05).

*DAT = days after foliar treatment; DAIf = days after Verimark in-furrow spray
Materials and Methods
Two randomized complete block trials of Bush beans, var. Roma II, was direct seeded into two rows per 6-ft beds on 2 May and 4 June 2014 and maintained with standard cultural practices at the Lang Farm, Coastal Plain Experiment Station at Tifton, GA. A total of 500 pounds of 10-10-10 was applied to Tift pebbly clay loam field plots initially for each of the two trials. Irrigation was applied at about one-third inch weekly with an overhead sprinkler system.

Scouting data were collected on 29 May and 3, 9, and 19 June for the first trial and on 30 June and 2, 9, 16 and 21 July for the second trial.

The harvest date for the first test was on 26 June and 29 July for the second test. Four applications of insecticide were made 30 May and 4, 10, and 18 June for the first trial and on 26 and 30 June and 8 and 15 July for the second trial. Beans were harvested from 10 ft of two rows. Beans were categorized as clean or lepidopteran larvae-damaged.

Data were analyzed using GLM and LSD tests for separation of means (SAS Institute 1990).

Results and Discussion
The results for the first trial (Tables 1 and 2) provided some efficacy data for thrips, primarily Frankliniella tritici, but F. occidentalis and F. fusca were present in lower numbers. The Rimon alternated with Radiant and Radiant only treatments provided the highest level of thrips control, but Timon alone did not separate out from the check. Rimon alternated with Radiant tended to have the lowest thrip immature (nymph) count of all the treatments. In the second trial (Table 3), thrips were too low to provide any significant data, but the incidence of Lepidoptera, primarily soybean looper, did show significant control of Lepidoptera damaged beans by the Rimon and Radiant treatments compared to the check.

Table 1. Trial #1 efficacy against thrips by date.

<table>
<thead>
<tr>
<th>Treatment - Rate per Acre (application events)*</th>
<th>Immature Thrips on June 9</th>
<th>F. tritici on June 19</th>
<th>Immature Thrips on June 19</th>
<th>Total Thrips on June 19</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Untreated check</td>
<td>2.50a*</td>
<td>27.25a</td>
<td>33.75ab</td>
<td>61.75a</td>
</tr>
<tr>
<td>2. Radiant 6oz/a</td>
<td>0.25a</td>
<td>8.00b</td>
<td>14.00bc</td>
<td>22.75b</td>
</tr>
<tr>
<td>3. Rimon 6 oz/a</td>
<td>1.00a</td>
<td>32.75a</td>
<td>37.50a</td>
<td>71.75a</td>
</tr>
<tr>
<td>4. Rimon 6 oz/a alternate with Radiant 6 oz/a then Rimon 6 oz/a</td>
<td>0.25a</td>
<td>6.50b</td>
<td>8.75c</td>
<td>15.25b</td>
</tr>
</tbody>
</table>

*Means within columns followed by the same letter are not significantly different (LSD, P < 0.05).

Table 2. Trial #1 efficacy against thrips overall and snap bean yield.

<table>
<thead>
<tr>
<th>Treatment - Rate per Acre (application events)*</th>
<th>F. tritici Over all Sample Dates</th>
<th>Total thrips Over all Sample Dates</th>
<th>Total Wt. (g) of Bush Beans/10 ft Single Harvest</th>
<th>Wt. (g) Lep. Damaged Bush Beans/10 ft</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Untreated check</td>
<td>24.13ab*</td>
<td>44.38ab</td>
<td>1518a</td>
<td>30.00a</td>
</tr>
<tr>
<td>2. Radiant 6oz/a</td>
<td>16.00bc</td>
<td>28.88bc</td>
<td>1366a</td>
<td>27.50a</td>
</tr>
<tr>
<td>3. Rimon 6 oz/a</td>
<td>30.00a</td>
<td>53.13a</td>
<td>1186a</td>
<td>6.25a</td>
</tr>
<tr>
<td>4. Rimon 6 oz/a alternate with Radiant 6 oz/a then Rimon 6 oz/a</td>
<td>11.13c</td>
<td>17.00c</td>
<td>1263a</td>
<td>8.75a</td>
</tr>
</tbody>
</table>

*Means within columns followed by the same letter are not significantly different (LSD, P < 0.05).
### Table 3. Trial #2 efficacy against Lepidoptera larvae and Lepidoptera damaged beans.

<table>
<thead>
<tr>
<th>Treatment - Rate per Acre (application events)*</th>
<th>Total Lep. on July 2</th>
<th>Avg. Lep. Overall</th>
<th>Total Wt. (g) of Bush Beans/10 ft</th>
<th>Wt. (g) Lep. Damaged Bush Beans/10 ft</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Untreated check</td>
<td>0.50a*</td>
<td>0.55a</td>
<td>556a</td>
<td>85.0a</td>
</tr>
<tr>
<td>2. Radiant 6oz/a **</td>
<td>0.00b</td>
<td>0.15a</td>
<td>600a</td>
<td>6.3b</td>
</tr>
<tr>
<td>3. Rimon 6 oz/a</td>
<td>0.00b</td>
<td>0.45a</td>
<td>799a</td>
<td>12.5b</td>
</tr>
<tr>
<td>4. Rimon 6 oz/a alternate with Radiant 6 oz/a</td>
<td>0.00b</td>
<td>0.25a</td>
<td>618a</td>
<td>22.5b</td>
</tr>
<tr>
<td>5. Pyrifluquinazon 20SC 2.4 fl oz/a</td>
<td>0.00b</td>
<td>0.25a</td>
<td>403a</td>
<td>42.5ab</td>
</tr>
<tr>
<td>6. Pyrifluquinazon 20SC 3.2 fl oz/a</td>
<td>0.00b</td>
<td>0.20a</td>
<td>560a</td>
<td>37.5ab</td>
</tr>
</tbody>
</table>

*Means within columns followed by the same letter are not significantly different (LSD, P < 0.05).

**Add 0.25% v/v non-ionic surfactant in each of the above insecticide treatments.
Materials and Methods

Southern pea, var. Pinkeye Purple Hull, was direct seeded into two rows per 6-ft beds on 28 May 2014 and maintained with standard cultural practices at the Lang Farm, Coastal Plain Experiment Station at Tifton, GA. A total of 500 pounds of 10-10-10 was applied to Tift pebbly clay loam field plots initially followed by 150 pounds of 10-10-10 at first side dressing and 150 pounds of ammonia nitrate at second side dressing. Irrigation was applied at about one-half inch weekly with an overhead sprinkler system.

Scouting was initiated on 15 March and continued weekly until a final damage rating on 23 May at harvest time. Five applications of insecticide were made: 30 June and 7, 10, 15, and 18 July.

Peas were harvested from 10 ft of two rows on 24 July 2014. A subsample of 100 pods was separated and categorized as “stung” (could be curculio or stinkbug injury) or blemish free. Peas were shelled and percent peas with curculio oviposition wounds were counted.

Data were analyzed using GLM and LSD tests for separation of means (SAS Institute 1990).

Results and Discussion

The results clearly indicated the severity of cowpea curculio damage in Southern peas, reaching an average of 52% peas in the check (Table 2), all of which are not only unmarketable but also represent a contaminant in the marketable peas. The entire insecticide treatments significantly reduced the percentage of damaged peas compared with the check, but Vydate was the best treatment. The addition of piperonyl butoxide (PBO) to Vydate did not significantly enhance control. Vydate is not currently labeled on Southern peas and will likely not be available for IR4 consideration before 2016. DoubleTake is also not currently labeled. There was no detectable rate response with Besiege, the lower rate performing as well as the high rate (Tables 1, 2, and 3). Stink bugs were not an issue in this test (Table 3), so all of the yield loss was attributable to cowpea curculio. Brigade provided significant control, and the highest amount of clean peas per acre (Table 3).

Table 1. Efficacy against cowpea curculio as indicated stung and blemish-free pods.

<table>
<thead>
<tr>
<th>Treatment - Rate per Acre (application events)*</th>
<th>No. of Pods Harvested per 10 ft</th>
<th>Wt. (g) of Blemish-Free Pods/100</th>
<th>Wt. (g) of Stung Pods/100</th>
<th>Wt. (g) of Blemish-Free Peas/100</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Untreated check</td>
<td>233.5a</td>
<td>6d</td>
<td>488ab</td>
<td>5d</td>
</tr>
<tr>
<td>2. Besiege 7.0 fl oz + MSO 0.25% v/v</td>
<td>301.8a</td>
<td>100abc</td>
<td>438abc</td>
<td>58abc</td>
</tr>
<tr>
<td>3. Besiege 10 fl oz + MSO 0.25% v/v</td>
<td>292.0a</td>
<td>28cd</td>
<td>525a</td>
<td>19cd</td>
</tr>
<tr>
<td>4. Double Take 2/1EC 4 fl oz + MSO</td>
<td>281.8a</td>
<td>40abc</td>
<td>525a</td>
<td>28cd</td>
</tr>
<tr>
<td>5. Lannate 2.4LV 3 pt + Dibrom 8EC 1.5 pt + PBO 4 fl oz</td>
<td>276.8a</td>
<td>60bcd</td>
<td>475ab</td>
<td>34cd</td>
</tr>
<tr>
<td>6. Brigade 2EC 6.4 fl oz + PBO 4 fl oz</td>
<td>322.5a</td>
<td>80bcd</td>
<td>475ab</td>
<td>46bc</td>
</tr>
<tr>
<td>7. Karate 2.08CS 1.92 fl oz + PBO 4 fl oz</td>
<td>244.8a</td>
<td>86bcd</td>
<td>475ab</td>
<td>59abc</td>
</tr>
<tr>
<td>8. Vydate 2L 4 pt + PBO 4 fl oz</td>
<td>240.5a</td>
<td>135ab</td>
<td>413bc</td>
<td>76ab</td>
</tr>
<tr>
<td>9. Vydate 2L 4 pt</td>
<td>258.3a</td>
<td>169a</td>
<td>375c</td>
<td>99a</td>
</tr>
</tbody>
</table>

*Means within columns followed by the same letter are not significantly different (LSD, P < 0.05).
### Table 2. Efficacy against cowpea curculio as indicated percent damaged peas.

<table>
<thead>
<tr>
<th>Treatment - Rate per Acre (application events)*</th>
<th>Percent Damaged Peas</th>
<th>Cowpea Cucurlio Larvae</th>
<th>Per Pod Wt. (g)</th>
<th>Total Clean Pea Wt. (g) /100</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Untreated check</td>
<td>52a</td>
<td>0.75a</td>
<td>4.94a</td>
<td>130d</td>
</tr>
<tr>
<td>2. Besiege 7.0 fl oz + MSO 0.25% v/v</td>
<td>25b</td>
<td>1.00a</td>
<td>5.38a</td>
<td>230c</td>
</tr>
<tr>
<td>3. Besiege 10 fl oz + MSO 0.25% v/v</td>
<td>33b</td>
<td>1.00a</td>
<td>5.53a</td>
<td>215c</td>
</tr>
<tr>
<td>4. Double Take 4 fl oz + MSO 0.25% v/v</td>
<td>23bc</td>
<td>0.50a</td>
<td>5.65a</td>
<td>249bc</td>
</tr>
<tr>
<td>5. Lannate 3 pt + Dibrom 1.5 pt + PBO 4 fl oz</td>
<td>22bcd</td>
<td>1.00a</td>
<td>5.35a</td>
<td>231c</td>
</tr>
<tr>
<td>6. Brigade 6.4 fl oz + PBO 4 fl oz</td>
<td>20bcd</td>
<td>0.75a</td>
<td>5.55a</td>
<td>252c</td>
</tr>
<tr>
<td>7. Karate 1.92 fl oz + PBO 4 fl oz</td>
<td>21bcd</td>
<td>1.25a</td>
<td>5.61a</td>
<td>263abc</td>
</tr>
<tr>
<td>8. Vydate 4 pt + PBO 4 fl oz</td>
<td>7cd</td>
<td>0.25a</td>
<td>5.48a</td>
<td>324a</td>
</tr>
<tr>
<td>9. Vydate 4 pt</td>
<td>5d</td>
<td>0.00a</td>
<td>5.44a</td>
<td>309ab</td>
</tr>
</tbody>
</table>

*Means within columns followed by the same letter are not significantly different (LSD, P < 0.05).

### Table 3. Efficacy against cowpea curculio as indicated by final weight of clean peas per acre.

<table>
<thead>
<tr>
<th>Treatment - Rate per Acre (application events)*</th>
<th>Total Clean Pea Wt. (g) /10 ft</th>
<th>Total Bushels of Pods per Acre</th>
<th>Total Wt. (lb) of Clean Peas per Acre*</th>
<th>Stinkbugs in Scouting</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Untreated check</td>
<td>327b</td>
<td>83a</td>
<td>523b</td>
<td>0.00a</td>
</tr>
<tr>
<td>2. Besiege 7.0 fl oz + MSO 0.25% v/v</td>
<td>722a</td>
<td>109a</td>
<td>1156a</td>
<td>0.08a</td>
</tr>
<tr>
<td>3. Besiege 10 fl oz + MSO 0.25% v/v</td>
<td>632a</td>
<td>110a</td>
<td>1012a</td>
<td>0.00a</td>
</tr>
<tr>
<td>4. Double Take 4 fl oz + MSO 0.25% v/v</td>
<td>706a</td>
<td>106a</td>
<td>1130a</td>
<td>0.00a</td>
</tr>
<tr>
<td>5. Lannate 3 pt + Dibrom 1.5 pt + PBO 4 fl oz</td>
<td>621ab</td>
<td>98a</td>
<td>994ab</td>
<td>0.00a</td>
</tr>
<tr>
<td>6. Brigade 6.4 fl oz + PBO 4 fl oz</td>
<td>817a</td>
<td>118a</td>
<td>1308a</td>
<td>0.00a</td>
</tr>
<tr>
<td>7. Karate 1.92 fl oz + PBO 4 fl oz</td>
<td>644a</td>
<td>90a</td>
<td>1030a</td>
<td>0.00a</td>
</tr>
<tr>
<td>8. Vydate 4 pt + PBO 4 fl oz</td>
<td>776a</td>
<td>88a</td>
<td>1242a</td>
<td>0.00a</td>
</tr>
<tr>
<td>9. Vydate 4 pt</td>
<td>798a</td>
<td>92a</td>
<td>1278a</td>
<td>0.00a</td>
</tr>
</tbody>
</table>

*Means within columns followed by the same letter are not significantly different (LSD, P < 0.05).

*Means within columns followed by the same letter are not significantly different (LSD, P < 0.10).
Efficacy of Foliar Applied Insecticides Against Cowpea Curculio in Southern Peas

Alton N. Sparks, Jr.
Department of Entomology, University of Georgia, Tifton, GA 31793

Materials and Methods
Crop: Cowpea, Southern pea
Targeted pests: Cowpea curculio
Location: The University of Georgia, Tifton Vegetable Park, Tifton Campus, Tifton, GA.
Experimental design: RCBD with four replications
Establishment: Direct seeded on 7 July 2014
Plot size: One row (on 6-foot bed, treated as 36-inch row) by 15 feet.

Treatments:
- Bifenthrin at 6.4 oz/a
- Karate at 1.92 oz/a
- Lannate at 3 pt/a
- Bifenthrin at 6.4 oz/a + Lannate at 3 pt/a
- Karate at 1.92 oz/a + Lannate at 3 pt/a
- Vydate at 4 pt/a
- Epsom salt at 2 lb/a + Karate at 1.92 oz/a
- Non-Treated Check

Application dates: 11, 15, 20, 26, and 29 Aug. 2014; initiated at first bloom.
Application methods: CO₂ pressurized backpack sprayer (60 psi) at 40 gal/a with three hollow-cone nozzles per row (one over-the-top, two on drops).

Data collection: On 25 Aug., 25 mature pods were collected from each plot and total number of punctures (oviposition and feeding) was counted. On 2 Sept., an additional 25 pods were collected from each plot and hand shelled. The seeds were placed into a seed counter. The first 150 seeds distributed by the counter were examined, and the number damaged and non-damaged were recorded.

Statistical analyses: PROC ANOVA in SAS Enterprise Guide (P < 0.05); LSD (P = 0.05).

Results
No statistical differences occurred in the number of oviposition punctures or percent of seeds damaged among any of the treatments. Even numerical trends were inconsistent and provided little evidence of efficacy against cowpea curculio. The timing of applications was intended to be on a four to day schedule and was delayed in one case to six days, but some level of efficacy was still expected.

Future work will be conducted with a shorter spray interval and will continue to evaluate new insecticides and insecticide combinations with potential efficacy.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Punctures (oviposition and feeding) per 25 Pods</th>
<th>Percent Damaged Seeds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check</td>
<td>572.0 a</td>
<td>72.0 a</td>
</tr>
<tr>
<td>Brigade</td>
<td>598.5 a</td>
<td>72.3 a</td>
</tr>
<tr>
<td>Karate</td>
<td>567.5 a</td>
<td>50.8 a</td>
</tr>
<tr>
<td>Lannate</td>
<td>536.0 a</td>
<td>61.8 a</td>
</tr>
<tr>
<td>Brigade + Lannate</td>
<td>461.8 a</td>
<td>46.7 a</td>
</tr>
<tr>
<td>Karate + Lannate</td>
<td>534.0 a</td>
<td>49.2 a</td>
</tr>
<tr>
<td>Karate + Salt</td>
<td>555.8 a</td>
<td>60.2 a</td>
</tr>
<tr>
<td>Vydate</td>
<td>439.8 a</td>
<td>67.7 a</td>
</tr>
</tbody>
</table>

Means within the same column followed by different letters are significantly different according to Fisher’s Least Significant Difference Test (P < 0.05).
Efficacy of Post-Harvest Soil Insecticide Treatments for Reduction of Emerging Cowpea Curculio from Cowpeas

Alton N. Sparks, Jr.
Department of Entomology, University of Georgia, Tifton, GA 31793

Materials and Methods
Crop: Cowpea, Southern pea
Targeted pests: Cowpea curculio
Location: The University of Georgia, Horticulture Farm, Tifton Campus, Tifton, GA.
Experimental design: RCBD with four replications
Establishment: Direct seeded on 7 July 2014. Planted test area with two rows of cowpea alternated with two rows fallow. Crop was grown without insecticides to allow cowpea curculio populations to establish. The experiment was established after crop maturity.
Plot size: Two rows (36-inch centers) by 35 feet
Treatments: Entire test area was shredded at harvest maturity and plots established.
1. Shred only
2. Shred; roto-till (one week after shredding)
3. Shred; treat with Lorsban 4 pt/a (one day after shredding)
4. Shred; treat with Lorsban 4 pt/a (one week after shredding)
5. Shred; treat with Lorsban 4 pt/a and roto-till (one day after shredding)
6. Shred; treat with Lorsban 4 pt/a and roto-till (one week after shredding)
7. Shred; treat with Lorsban 2 pt/a and roto-till (one day after shredding)
8. Shred; treat with Lorsban 2 pt/a and roto-till (one week after shredding)

Treatment dates:
• Entire area was shredded on 4 Sept. 2014.
• Day after shredding treatments were made on 5 Sept. 2014.
• Week after shredding treatments were made on 11 Sept. 2014.
• Roto-tilling was conducted within 15 minutes of the Lorsban applications.

Application methods: Lorsban was applied with a tractor mounted sprayer calibrated at 32 gal/a.

Data collection: Emergence cages (3-foot by 4-foot) were placed in each plot after all treatments had been applied (after the “week after shredding” treatments). A modified Tedder’s trap was placed inside each emergence cage to trap curculio emerging from the soil under the cage. This cage-trap combination should have only captured adults that completed development within the soil under the cage and emerged through that soil. Weevils were also collected from Tedder’s traps outside of the emergence cages (data not presented but discussed below).

Statistical analyses: PROC ANOVA in SAS Enterprise Guide (P < 0.05); LSD (P = 0.05).

Results
Tedder’s traps run outside of the emergence cages caught low numbers of weevils the day after initial set up (12 Sept.). Numbers increased dramatically between 15 and 22 Sept. (3.4 versus 12.9 per trap). Prior to 15 Sept., it is assumed these traps were collecting adults that had entered the crop from outside of the field (visual observations indicated little or no weevils inside the emergence cages at this time). The rapid increase in captures on 22 Sept. is assumed to be from weevil emergence within the field. Weevils were observed in the emergence cages and first sampled on 26 Sept. (roughly three weeks after shredding) and dropped rapidly after 6 Oct. (roughly four weeks after shredding). This suggests that emergence from infested fields should normally peak three to four weeks after weevil grubs enter the soil; thus, we may have made applications earlier than needed and lost some efficacy.

Because of high variability in trap captures, no significant differences were detected among treatments in the number of curculio caught. However, the treatment with Lorsban applied at the highest rate and roto-tilled at one week after shredding did provide the greatest numerical reduction in weevil captures.

Continued on next page.
Further, we failed to consider potential mortality after emergence from the treated soil (we should have held the adult curculios and monitored longevity) and, thus, may have underestimated potential efficacy of these treatments.

The trends in the data justify additional research in this area. Additional variables to consider include the timing of applications (with applications closer to time of emergence) and potential mortality of adults that successfully emerge.

### Cowpea curculio trap captures with emergence cages, post-harvest management evaluation, UGA Horticulture Farm, Tifton, GA, 2014.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Insecticide Rate</th>
<th>Tillage</th>
<th>Timing</th>
<th>Number of Adult Cowpea Curculio per Trap (inside emergence cages)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shreded</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roto-tilled</td>
<td></td>
<td>yes</td>
<td>1 week</td>
<td>5.50</td>
</tr>
<tr>
<td>Lorsban</td>
<td>4 pt</td>
<td></td>
<td>1 day</td>
<td>1.25</td>
</tr>
<tr>
<td>Lorsban</td>
<td>4 pt</td>
<td>yes</td>
<td>1 day</td>
<td>2.75</td>
</tr>
<tr>
<td>Lorsban</td>
<td>2 pt</td>
<td>yes</td>
<td>1 day</td>
<td>1.50</td>
</tr>
<tr>
<td>Lorsban</td>
<td>4 pt</td>
<td></td>
<td>1 week</td>
<td>3.25</td>
</tr>
<tr>
<td>Lorsban</td>
<td>4 pt</td>
<td>yes</td>
<td>1 week</td>
<td>0.25</td>
</tr>
<tr>
<td>Lorsban</td>
<td>2 pt</td>
<td>yes</td>
<td>1 week</td>
<td>2.00</td>
</tr>
<tr>
<td>Total weevils caught per sample period =&gt;</td>
<td>22.5</td>
<td>16.0</td>
<td>3</td>
<td>1.25</td>
</tr>
</tbody>
</table>
Sweet Corn Variety Trial: Spring 2014
Timothy Coolong
Extension Vegetable Specialist, Department of Horticulture, Tifton, GA 31793

Introduction
Sweet corn is a significant horticultural crop grown primarily in southwest Georgia in Decatur, Mitchell, Seminole, and other nearby counties. Sweet corn is routinely planted on more than 20,000 acres in Georgia for both spring and fall crops. While many of the major seed companies conduct on-farm trials in the region, there have not been comprehensive variety evaluations conducted by the University of Georgia in many years.

Materials and Methods
Location: Attapulgus, GA

Planting date: 24 March 2014, 30 varieties included (One non-commercial variety excluded from report).

Plant spacing: 30” between rows, 8” within row (Pop. 26,136 per acre).

Plot size: 62 seeds per plot, 2-row plots (20.7 ft long each) with 6-ft alleys between adjacent plots.

Fertility: UGA recommendations (250 lb N/a total, 1/3 preplant).

Herbicide: Atrazine + Prowl

Pest control: Fungicide as needed, Insecticide (coragen, pyrethroids, lannate) 3x per week.

Germination rating conducted: 11 April 2014

Vigor rating conducted: 22 April 2014 (1-9 scale: 1 = poor vigor, < 6” tall; 4-5 = average vigor; 9 = strong growth, > 24” tall).

Tiller rating: 6 June 2014 (all tillers counted in a plot and divided by no. plants in plot).

Harvest dates: 10, 13, and 18 June 2014. Plots harvested one time. All marketable ears harvested and counted. Quality evaluation conducted on 10 ears from each plot.

Average length and width based on aligning five shucked ears end to end and side to side from each plot. Tip coverage determined by measuring five ears per plot and averaging. Flag ratings were visual: none, small, med, and large. Tip fill based on a percent of ear filled 0-100%. Subjective observations made during harvest (ease of harvest, shank size, etcetera). Climate conditions: cool and wet after planting, warm and dry at harvest.

Results
The following varieties were harvested on the listed dates:

- 10 June (78 days): SS2742, CCAPBF10-411, 7932 MR, Rainier, Stellar XR, AP 426, 2974 MXR, Awesome XR
- 13 June (81 days): CSABF12-551, ACX SS7403, SC1336, Passion, CSAYF9-345, EX08737143, Bright White, 2577 XR, 3182 MR, 7902 R
- 18 June (86 days): QHW6RH1229, SV1580SC, Obsession, Obsession II, 3188 MR, 2760 MR, XTH1876, 2979 XR, Protector, BSS 0977, Battalion.

Tip fill was typically >95% and was not different among varieties trialed and is not presented in results tables.

Table 1. Entries included in the spring 2014 trial.

<table>
<thead>
<tr>
<th>Abbott and Cobb</th>
<th>Crookham</th>
<th>Harris Moran</th>
<th>Illinois Foundation Seed</th>
<th>Seminis</th>
<th>Syngenta</th>
</tr>
</thead>
<tbody>
<tr>
<td>3182 MR</td>
<td>Bright White</td>
<td>Rainier</td>
<td>Awesome XR</td>
<td>Obsession</td>
<td>BSS 0977</td>
</tr>
<tr>
<td>7932 MR</td>
<td>CSA8F12-551</td>
<td></td>
<td>Stellar XR</td>
<td>Passion</td>
<td>Battalion</td>
</tr>
<tr>
<td>2760 MR</td>
<td>CAPBF10-411</td>
<td></td>
<td>2974 MXR</td>
<td>EX08737143</td>
<td>Protector</td>
</tr>
<tr>
<td>3188 MR</td>
<td>CSAYF9-345</td>
<td></td>
<td>2977 XR</td>
<td>QHW6RH1229</td>
<td></td>
</tr>
<tr>
<td>SS2742</td>
<td>AP 426</td>
<td></td>
<td>2979 XR</td>
<td>SC1336</td>
<td></td>
</tr>
<tr>
<td>7902 R</td>
<td></td>
<td></td>
<td>XTH1876</td>
<td>SV1580SC</td>
<td></td>
</tr>
<tr>
<td>ACX SS7403RY</td>
<td></td>
<td></td>
<td></td>
<td>Obsession II</td>
<td></td>
</tr>
</tbody>
</table>

Continued on next page.
Table 2. Germination values for sweet corn trial in spring 2014, Attapulgus, GA.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Germination %</th>
</tr>
</thead>
<tbody>
<tr>
<td>XTH1876</td>
<td>97.6 a</td>
</tr>
<tr>
<td>BSS 0977</td>
<td>97.2 ab</td>
</tr>
<tr>
<td>CSABF12-551</td>
<td>97.2 a</td>
</tr>
<tr>
<td>EX08737143</td>
<td>97.2 ab</td>
</tr>
<tr>
<td>ACX SS7403RY</td>
<td>96.4 abc</td>
</tr>
<tr>
<td>Rainier</td>
<td>96.0 abc</td>
</tr>
<tr>
<td>2979 XR</td>
<td>95.6 abc</td>
</tr>
<tr>
<td>Awesome XR</td>
<td>95.6 abc</td>
</tr>
<tr>
<td>2577 XR</td>
<td>95.2 abc</td>
</tr>
<tr>
<td>CSAYF9-345</td>
<td>94.8 a-d</td>
</tr>
<tr>
<td>3188 MR</td>
<td>94.8 a-d</td>
</tr>
<tr>
<td>Passion</td>
<td>94.0 a-d</td>
</tr>
<tr>
<td>SS2742</td>
<td>94.0 a-d</td>
</tr>
<tr>
<td>QHW6RH1229</td>
<td>93.6 a-e</td>
</tr>
<tr>
<td>7932 MR</td>
<td>92.7 a-e</td>
</tr>
<tr>
<td>SV1580SC</td>
<td>92.7 a-e</td>
</tr>
<tr>
<td>2974 MXR</td>
<td>91.9 a-e</td>
</tr>
<tr>
<td>Bright White</td>
<td>91.9 a-e</td>
</tr>
<tr>
<td>CAPBF10-411</td>
<td>91.5 a-e</td>
</tr>
<tr>
<td>Battalion</td>
<td>91.1 a-e</td>
</tr>
<tr>
<td>AP 426</td>
<td>91.1 a-e</td>
</tr>
<tr>
<td>Obsession</td>
<td>90.3 b-e</td>
</tr>
<tr>
<td>2760 MR</td>
<td>90.0 cde</td>
</tr>
<tr>
<td>Stellar XR</td>
<td>90.0 cde</td>
</tr>
<tr>
<td>7902 R</td>
<td>87.9 de</td>
</tr>
<tr>
<td>SC 1336</td>
<td>86.7 ef</td>
</tr>
<tr>
<td>Protector</td>
<td>81.9 fg</td>
</tr>
<tr>
<td>3182 MR</td>
<td>78.2 g</td>
</tr>
<tr>
<td>Obsession II</td>
<td>42.3 h</td>
</tr>
</tbody>
</table>

Table 3. Vigor ratings (1-9) for sweet corn trial in spring 2014, Attapulgus, GA.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Vigor (1-9)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2974 MXR</td>
<td>7.25 a</td>
</tr>
<tr>
<td>BSS 0977</td>
<td>6.50 ab</td>
</tr>
<tr>
<td>Stellar XR</td>
<td>5.75 ab</td>
</tr>
<tr>
<td>2979 XR</td>
<td>5.75 ab</td>
</tr>
<tr>
<td>2577 XR</td>
<td>5.75 bc</td>
</tr>
<tr>
<td>Awesome XR</td>
<td>5.50 bc</td>
</tr>
<tr>
<td>CAPBF10-411</td>
<td>5.00 bcd</td>
</tr>
<tr>
<td>Protector</td>
<td>5.25 b-e</td>
</tr>
<tr>
<td>CSAYF9-345</td>
<td>5.25 b-e</td>
</tr>
<tr>
<td>XTH1876</td>
<td>4.75 c-f</td>
</tr>
<tr>
<td>3188MR</td>
<td>4.25 def</td>
</tr>
<tr>
<td>CSAPBF125</td>
<td>4.25 d-g</td>
</tr>
<tr>
<td>Rainier</td>
<td>4.25 d-g</td>
</tr>
<tr>
<td>7932MR</td>
<td>4.25 d-g</td>
</tr>
<tr>
<td>AP 426</td>
<td>4.00 e-h</td>
</tr>
<tr>
<td>QHW6RH1229</td>
<td>4.00 e-h</td>
</tr>
<tr>
<td>ACX SS7403RY</td>
<td>4.00 e-h</td>
</tr>
<tr>
<td>Battalion</td>
<td>4.00 e-h</td>
</tr>
<tr>
<td>7902 R</td>
<td>4.00 e-h</td>
</tr>
<tr>
<td>EX08737143</td>
<td>3.75 fgh</td>
</tr>
<tr>
<td>Bright White</td>
<td>3.75 f-i</td>
</tr>
<tr>
<td>Passion</td>
<td>3.75 f-i</td>
</tr>
<tr>
<td>SC1336</td>
<td>3.00 ghi</td>
</tr>
<tr>
<td>Obsession</td>
<td>3.00 ghi</td>
</tr>
<tr>
<td>2760 MR</td>
<td>2.75 hi</td>
</tr>
<tr>
<td>SV1580SC</td>
<td>2.50 i</td>
</tr>
<tr>
<td>3182 MR</td>
<td>2.50 i</td>
</tr>
<tr>
<td>Obsession II</td>
<td>1.0 j</td>
</tr>
</tbody>
</table>
Table 4. Yield and quality for sweet corn trial in spring 2014, Attapulgus, GA.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Yield A*</th>
<th>Yield B**</th>
<th>Avg. Ear Length</th>
<th>Avg. Ear Width</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>boxes (4 dz) per acre</td>
<td>inches</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2974MXR</td>
<td>529 a</td>
<td>576 a</td>
<td>8.0 b-e</td>
<td>2.0 ab</td>
</tr>
<tr>
<td>Awesome XR</td>
<td>510 ab</td>
<td>533 ab</td>
<td>7.8 d-j</td>
<td>1.9 abc</td>
</tr>
<tr>
<td>BSS 0977</td>
<td>503 abc</td>
<td>518 abc</td>
<td>7.2 k</td>
<td>1.8 e-i</td>
</tr>
<tr>
<td>C6AY9F9-345</td>
<td>499 a-d</td>
<td>526 ab</td>
<td>7.9 c-g</td>
<td>1.8 f-i</td>
</tr>
<tr>
<td>SS 2742</td>
<td>494 a-d</td>
<td>527 ab</td>
<td>7.9 d-h</td>
<td>1.6 ij</td>
</tr>
<tr>
<td>QHW6RH1229</td>
<td>492 a-d</td>
<td>525 ab</td>
<td>7.8 d-i</td>
<td>1.9 a-d</td>
</tr>
<tr>
<td>EX08737143</td>
<td>492 a-d</td>
<td>506 a-d</td>
<td>7.9 c-f</td>
<td>1.9 b-e</td>
</tr>
<tr>
<td>Stellar XR</td>
<td>481 a-e</td>
<td>535 ab</td>
<td>8.3 abc</td>
<td>2.0 ab</td>
</tr>
<tr>
<td>ACX ss7403RY</td>
<td>474 a-e</td>
<td>490 a-e</td>
<td>7.7 d-j</td>
<td>1.9 b-g</td>
</tr>
<tr>
<td>Passion</td>
<td>470 a-e</td>
<td>498 a-e</td>
<td>7.9 d-h</td>
<td>1.9 b-e</td>
</tr>
<tr>
<td>3188 MR</td>
<td>459 a-e</td>
<td>483 a-e</td>
<td>8.5 a</td>
<td>1.9 b-e</td>
</tr>
<tr>
<td>Bright White</td>
<td>450 a-f</td>
<td>490 a-e</td>
<td>7.8 d-j</td>
<td>1.8 b-h</td>
</tr>
<tr>
<td>CAPBF10-411</td>
<td>448 a-f</td>
<td>491 a-e</td>
<td>7.7 d-k</td>
<td>1.9 a-d</td>
</tr>
<tr>
<td>XTH1876</td>
<td>446 a-f</td>
<td>458 b-e</td>
<td>8.4 ab</td>
<td>1.9 a-d</td>
</tr>
<tr>
<td>2979 XR</td>
<td>439 a-f</td>
<td>459 b-e</td>
<td>8.3 abc</td>
<td>1.9 b-f</td>
</tr>
<tr>
<td>2577 XR</td>
<td>435 a-f</td>
<td>457 b-e</td>
<td>8.0 b-e</td>
<td>1.8 d-h</td>
</tr>
<tr>
<td>Protector</td>
<td>433 a-f</td>
<td>512 abc</td>
<td>7.5 f-k</td>
<td>1.8 c-h</td>
</tr>
<tr>
<td>7902R</td>
<td>428 a-f</td>
<td>489 a-e</td>
<td>7.6 g-k</td>
<td>1.9 a-e</td>
</tr>
<tr>
<td>Obsession</td>
<td>426 a-f</td>
<td>472 b-e</td>
<td>7.7 d-j</td>
<td>2.0 a</td>
</tr>
<tr>
<td>7932 MR</td>
<td>404 b-f</td>
<td>435 b-e</td>
<td>7.7 d-k</td>
<td>1.6 j</td>
</tr>
<tr>
<td>Battalion</td>
<td>401 b-f</td>
<td>436 b-e</td>
<td>7.5 g-k</td>
<td>1.9 abc</td>
</tr>
<tr>
<td>CSABF12-551</td>
<td>398 c-f</td>
<td>409 c-e</td>
<td>8.1 b-e</td>
<td>1.7 ghi</td>
</tr>
<tr>
<td>AP 426</td>
<td>395 c-f</td>
<td>432 b-e</td>
<td>7.6 e-k</td>
<td>1.7 hi</td>
</tr>
<tr>
<td>Rainier</td>
<td>395 c-f</td>
<td>412 c-e</td>
<td>7.5 h-k</td>
<td>1.9 b-e</td>
</tr>
<tr>
<td>3182 MR</td>
<td>389 def</td>
<td>479 a-e</td>
<td>8.1 bcd</td>
<td>1.7 g-i</td>
</tr>
<tr>
<td>SV 1580SC</td>
<td>371 ef</td>
<td>400 de</td>
<td>7.4 jk</td>
<td>1.9 b-e</td>
</tr>
<tr>
<td>SC1336</td>
<td>340 fg</td>
<td>391 e</td>
<td>7.8 d-j</td>
<td>1.9 b-g</td>
</tr>
<tr>
<td>Obsession II</td>
<td>264 g</td>
<td>501 a-e</td>
<td>7.4 ijk</td>
<td>1.9 b-f</td>
</tr>
<tr>
<td>2760 MR</td>
<td>253 g</td>
<td>282 f</td>
<td>7.7 d-j</td>
<td>1.7 ij</td>
</tr>
</tbody>
</table>

*Yield A is yield harvested per plot based on population of seeds planted (62 per plot); this is what a grower would have expected per acre.

**Yield B is yield calculated based on the number of plants that germinated, therefore, a variety with lower germination would have a much higher Yield B than Yield A. Yield B is relevant for research purposes only as it shows yield potential regardless of germination. For those with a high germination percentage, the difference between A and B would be minimal.
Table 5. Frequency of tillers, tip coverage, flags, and kernel rows for sweet corn trial in spring 2014, Attapulgus, GA.

<table>
<thead>
<tr>
<th>Variety (alphabetical order)</th>
<th>Tillers* (%)</th>
<th>Tip Coverage (inches)</th>
<th>Kernel Rows (range)</th>
<th>Flags</th>
</tr>
</thead>
<tbody>
<tr>
<td>2577 XR</td>
<td>5.9</td>
<td>1.8</td>
<td>14-20</td>
<td>medium</td>
</tr>
<tr>
<td>2760 MR</td>
<td>6.7</td>
<td>2.4</td>
<td>14-16</td>
<td>medium-large</td>
</tr>
<tr>
<td>2974MRX R</td>
<td>4.9</td>
<td>2.0</td>
<td>14-18</td>
<td>medium</td>
</tr>
<tr>
<td>2979 XR</td>
<td>1.7</td>
<td>1.6</td>
<td>14-20</td>
<td>large</td>
</tr>
<tr>
<td>3182 MR</td>
<td>7.6</td>
<td>1.8</td>
<td>14-18</td>
<td>medium-large</td>
</tr>
<tr>
<td>3188 MR</td>
<td>3.4</td>
<td>2.1</td>
<td>14-16</td>
<td>medium</td>
</tr>
<tr>
<td>7902R</td>
<td>11.7</td>
<td>2.5</td>
<td>14-20</td>
<td>small</td>
</tr>
<tr>
<td>7932 MR</td>
<td>8.2</td>
<td>2.4</td>
<td>14-16</td>
<td>medium</td>
</tr>
<tr>
<td>ACX ss7403RY</td>
<td>16.7</td>
<td>2.4</td>
<td>14-18</td>
<td>none-small</td>
</tr>
<tr>
<td>AP 426</td>
<td>13.2</td>
<td>2.6</td>
<td>14-18</td>
<td>large</td>
</tr>
<tr>
<td>Awesome XR</td>
<td>5.5</td>
<td>1.9</td>
<td>14-16</td>
<td>large</td>
</tr>
<tr>
<td>Battalion</td>
<td>4.4</td>
<td>1.9</td>
<td>14-16</td>
<td>small</td>
</tr>
<tr>
<td>Bright White</td>
<td>7.0</td>
<td>1.8</td>
<td>14-18</td>
<td>none-small</td>
</tr>
<tr>
<td>BSS 0977</td>
<td>4.2</td>
<td>1.3</td>
<td>12-18</td>
<td>medium</td>
</tr>
<tr>
<td>CAPBF10-411</td>
<td>1.0</td>
<td>1.6</td>
<td>14-16</td>
<td>small</td>
</tr>
<tr>
<td>CSABF12-551</td>
<td>0.4</td>
<td>2.0</td>
<td>14-16</td>
<td>medium</td>
</tr>
<tr>
<td>CSAYF9-345</td>
<td>2.1</td>
<td>1.8</td>
<td>14-16</td>
<td>none-small</td>
</tr>
<tr>
<td>EX08737143</td>
<td>4.6</td>
<td>1.4</td>
<td>16-18</td>
<td>small-medium</td>
</tr>
<tr>
<td>Obsession</td>
<td>9.2</td>
<td>0.8</td>
<td>16-18</td>
<td>small</td>
</tr>
<tr>
<td>Obsession II</td>
<td>40.7</td>
<td>1.1</td>
<td>14-18</td>
<td>small</td>
</tr>
<tr>
<td>Passion</td>
<td>8.1</td>
<td>1.9</td>
<td>16-18</td>
<td>small-medium</td>
</tr>
<tr>
<td>Protector</td>
<td>17.5</td>
<td>1.4</td>
<td>12-16</td>
<td>none-small</td>
</tr>
<tr>
<td>QHW6RH1229</td>
<td>5.5</td>
<td>1.7</td>
<td>14-16</td>
<td>small-medium</td>
</tr>
<tr>
<td>Rainier</td>
<td>4.6</td>
<td>2.0</td>
<td>14-16</td>
<td>small</td>
</tr>
<tr>
<td>SC1336</td>
<td>16.4</td>
<td>1.4</td>
<td>16-20</td>
<td>none-small</td>
</tr>
<tr>
<td>SS 2742</td>
<td>17.2</td>
<td>2.9</td>
<td>14-16</td>
<td>medium-large</td>
</tr>
<tr>
<td>Stellar XR</td>
<td>5.5</td>
<td>1.7</td>
<td>14-16</td>
<td>large</td>
</tr>
<tr>
<td>SV 1580SC</td>
<td>11.4</td>
<td>1.5</td>
<td>14-18</td>
<td>small-medium</td>
</tr>
<tr>
<td>XTH1876</td>
<td>0.0</td>
<td>1.8</td>
<td>14-20</td>
<td>small-medium</td>
</tr>
</tbody>
</table>

*Tillers (%) based on number of tillers counted divided by plant total population in a plot. Tillers recorded on 6/6/14.

Note: Averages of four replications. Tip coverage measured on five ears per replication/plot and rows counted on two ears per replication/plot.
Sweet Corn Variety Trial: Fall 2014
Timothy Coolong
Extension Vegetable Specialist, Department of Horticulture, Tifton, GA 31793

Introduction
Sweet corn is a significant horticultural crop grown primarily in southwest Georgia. While spring production often is met with challenges due to cold soil temperatures and rains, fall production often encounters heavy pest pressure and hot, dry conditions during germination and emergence. Because of the significant differences in spring and fall production, it is necessary to conduct variety trials in both seasons.

Materials and Methods
Location: Tifton, GA

Planting Date: 12 Aug. 2014, 28 varieties included (one non-commercial line removed upon request).

Plant Spacing: 30” between rows, 8” within row (Pop. 26,136 per acre).

Plot size: 2-row, 20-ft long plots (40 ft per plot total) with 8-ft alleys between adjacent plots.

Fertility: (330 lb N/a total, 1/3 preplant using 10-10-10) with side-dress applications of urea and ammonium nitrate approximately two and four weeks after planting.

Herbicide: Atrazine + Prowl

Pest control: Fungicide (Headline AMP or Quadris every two weeks starting at v3 stage. Insecticides: coragen drench at planting then daily insecticides starting at first sign of silking (lannate + bifenthrin with coragen weekly) through the last harvest. Approximately 26 insecticide applications were made.

Plot stand rating conducted: 16 Oct. 2014

Vigor rating conducted: In fall all varieties had desirable vigor with no significant differences observed.

Tiller rating: few tillers were observed, unlike during the spring trial; only a few tillers were recorded and there was not a significant difference in varieties.

Harvest dates: 16-24 Oct. Plots harvested one time. All marketable ears harvested and counted. In some cases marketable second ears were picked. Varieties were ready 65-73 days after seeding.

Quality evaluation conducted on 10 ears from each plot. Average length and width based on aligning five shucked ears end to end and side to side from each plot. Tip coverage determined by measuring five ears per plot and averaging. Flag ratings were visual: none, small, med, and large. Subjective observations made during harvest (ease of harvest, shank size, etcetera). Kernel rows were counted on two ears per plot (eight total per variety).

Lodging: A strong storm was observed on 14 Oct., which caused several varieties to lodge severely. Lodging ratings were conducted on 16 Oct. Varieties that had lodged were still harvested, although it is doubtful a commercial grower would have been able to harvest.

Southern corn leaf blight: During harvest, symptoms of Southern corn leaf blight were apparent, plants were no longer being sprayed with fungicide at this time and a rating for SCLB was taken on 3 Nov. 2014, approximately 10 days after last harvest. The symptoms of the disease were variable, and there were no significant differences between varieties.

Results
Tip fill was excellent in all varieties. No insects were observed in any harvested ears and no disease symptoms (rust, etc.) were present on the husks. Yields were better in fall than in spring, and many varieties that performed poorly in the spring performed well in fall. Very little suckering (tillering) was noted in the field.

Yields were high, with Obsession having the greatest yield, though 16 varieties were not statistically different from Obsession in terms of yield. Average ear length was noticeably greater in 3188 MR and XTH1876, with both having an average ear length of greater than 8 inches. Several varieties had an average width greater than 2 inches. Tip coverage was good in all varieties, with 2760 MR and Protector having greater than 2.5 inches of tip coverage. Kernel rows were varied, though not noticeably different from in spring. Flags appeared to be larger in the fall-grown corn, however, with some varieties having much larger flags in fall than in spring.

Four varieties, noted in Table 2, experienced lodging in at least two of four plots due to a heavy storm on 14 Oct. Although average lodging rates in some other varieties (not in the top four) were high, this was generally due to a single plot heaving heavy rates of lodging. The effects were dramatic as they were isolated to a single plot, with plants in adjacent plots appearing fine after the storm.

Continued on next page.
### Table 1. Entries included in the fall 2014 trial.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Abbott and Cobb</th>
<th>Crookham</th>
<th>Harris Moran</th>
<th>Illinois Foundation Seed</th>
<th>Seminis</th>
<th>Syngenta</th>
</tr>
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<tbody>
<tr>
<td>CRSS3880 MR</td>
<td>Bright White</td>
<td>CRSS3880 MR</td>
<td>CRSS3880 MR</td>
<td>Awesome XR</td>
<td>Obsession</td>
<td>BSS 0977</td>
</tr>
<tr>
<td>3188 MR</td>
<td>CSABF12-551</td>
<td>3188 MR</td>
<td>3188 MR</td>
<td>Stellar XR</td>
<td>Passion</td>
<td>Battalion</td>
</tr>
<tr>
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<td>2760 MR</td>
<td>2760 MR</td>
<td>2974 MXR</td>
<td>EX08737143</td>
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<td>CSAYF9-345</td>
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<td>1760 MR</td>
<td>2977 XR</td>
<td>QHW6RH1229</td>
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<tr>
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<td>AP 426</td>
<td>ss8902 MR</td>
<td>ss8902 MR</td>
<td>2979 XR</td>
<td>SC1336</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>XTH1876</td>
<td>SV1580SC</td>
<td></td>
</tr>
</tbody>
</table>

### Table 2. Average lodging values (four replications) for sweet corn trial in fall 2014, Tifton, GA.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Lodging (% of plants)</th>
<th>Range of Lodging (%) Between Plots</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bright White</td>
<td>75.0 a</td>
<td>25-100</td>
</tr>
<tr>
<td>Rainier</td>
<td>65.0 ab</td>
<td>0-100</td>
</tr>
<tr>
<td>Stellar XR</td>
<td>65.0 ab</td>
<td>20-100</td>
</tr>
<tr>
<td>CAPBF10-411</td>
<td>40.0 ab</td>
<td>20-75</td>
</tr>
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<td>2974MXR</td>
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<td>0-100</td>
</tr>
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<td>20.0 cd</td>
<td>0-80</td>
</tr>
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<td>0-50</td>
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<tr>
<td>Passion</td>
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<td>XTH1876</td>
<td>6.3 cd</td>
<td>0-25</td>
</tr>
<tr>
<td>2979 XR</td>
<td>6.3 cd</td>
<td>0-25</td>
</tr>
<tr>
<td>CSABF12-551</td>
<td>6.3 cd</td>
<td>0-25</td>
</tr>
<tr>
<td>EX08737143</td>
<td>5.0 cd</td>
<td>0-20</td>
</tr>
<tr>
<td>2760 MR</td>
<td>5.0 cd</td>
<td>0-20</td>
</tr>
<tr>
<td>BSS 0977</td>
<td>1.7 d</td>
<td>0-5</td>
</tr>
<tr>
<td>SC1336</td>
<td>0.0 d</td>
<td>0</td>
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<tr>
<td>SV 1580SC</td>
<td>0.0 d</td>
<td>0</td>
</tr>
<tr>
<td>8902 MR</td>
<td>0.0 d</td>
<td>0</td>
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<tr>
<td>CSAYF9-345</td>
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<td>0</td>
</tr>
<tr>
<td>Protector</td>
<td>0.0 d</td>
<td>0</td>
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<tr>
<td>3880 MR</td>
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<td>0</td>
</tr>
<tr>
<td>AP 426</td>
<td>0.0 d</td>
<td>0</td>
</tr>
<tr>
<td>Battalion</td>
<td>0.0 d</td>
<td>0</td>
</tr>
<tr>
<td>1760 MR</td>
<td>0.0 d</td>
<td>0</td>
</tr>
<tr>
<td>Obsession II</td>
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</tr>
<tr>
<td>3188 MR</td>
<td>0.0 d</td>
<td>0</td>
</tr>
</tbody>
</table>

Lodging was variable among plots, but the four varieties with highest lodging incidence were noticeably affected more than others.

### Table 3. Total marketable yield for fall 2014.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Yield * boxes (4 dz) per acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obsession</td>
<td>640 a</td>
</tr>
<tr>
<td>QHW6RH1229</td>
<td>630 ab</td>
</tr>
<tr>
<td>SC1336</td>
<td>610 abc</td>
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<tr>
<td>EX08737143</td>
<td>600 a-d</td>
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<tr>
<td>CAPBF10-411</td>
<td>600 a-d</td>
</tr>
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<td>2577 XR</td>
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<tr>
<td>SV 1580SC</td>
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<tr>
<td>CSAYF9-345</td>
<td>550 a-g</td>
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<tr>
<td>Passion</td>
<td>550 a-g</td>
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<tr>
<td>2979 XR</td>
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<tr>
<td>Protector</td>
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</tr>
<tr>
<td>Bright White</td>
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<td>CSABF12-551</td>
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<tr>
<td>Awesome XR</td>
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</tr>
<tr>
<td>Rainier</td>
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</tr>
<tr>
<td>Battalion</td>
<td>490 d-h</td>
</tr>
<tr>
<td>1760 MR</td>
<td>480 d-h</td>
</tr>
<tr>
<td>2760 MR</td>
<td>470 e-h</td>
</tr>
<tr>
<td>Obsession II</td>
<td>460 fgh</td>
</tr>
<tr>
<td>Stellar XR</td>
<td>450 fgh</td>
</tr>
<tr>
<td>3188 MR</td>
<td>450 gh</td>
</tr>
</tbody>
</table>

*Yield is yield harvested per plot based on row-feet planted (40 feet per plot) and a per acre yield estimated for 17,240 row feet (30” centers with 8” in-row spacing).
### Table 4. Ear quality assessment for fall 2014.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Avg. Ear Length</th>
<th>Avg. Ear Width</th>
<th>Tip Coverage</th>
<th>Kernel Rows</th>
<th>Flags</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>inches</td>
<td>range (subjective rating)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3188 MR</td>
<td>8.13 a</td>
<td>1.86 fgh</td>
<td>1.25 efg</td>
<td>14-18</td>
<td>none - small</td>
</tr>
<tr>
<td>XTH1876</td>
<td>8.08 ab</td>
<td>1.99 b-e</td>
<td>1.72 a-g</td>
<td>16-18</td>
<td>med-lg</td>
</tr>
<tr>
<td>2979 XR</td>
<td>7.73 cd</td>
<td>1.88 fgh</td>
<td>1.38 d-g</td>
<td>14-18</td>
<td>med-lg</td>
</tr>
<tr>
<td>Obsession II</td>
<td>7.58 cde</td>
<td>2.11 a</td>
<td>1.53 d-g</td>
<td>16-18</td>
<td>sm-med</td>
</tr>
<tr>
<td>2760 MR</td>
<td>7.55 cde</td>
<td>1.86 fgh</td>
<td>2.63 abc</td>
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<td>sm-med</td>
</tr>
<tr>
<td>QHW6RH1229</td>
<td>7.51 c-f</td>
<td>1.93 d-g</td>
<td>1.72 a-g</td>
<td>14-18</td>
<td>sm-med</td>
</tr>
<tr>
<td>3880 MR</td>
<td>7.47 c-g</td>
<td>1.85 gh</td>
<td>1.38 d-g</td>
<td>14-18</td>
<td>none-sm</td>
</tr>
<tr>
<td>2577 XR</td>
<td>7.43 d-g</td>
<td>1.91 d-h</td>
<td>1.09 efg</td>
<td>12-16</td>
<td>lg</td>
</tr>
<tr>
<td>SV 1580SC</td>
<td>7.38 e-h</td>
<td>1.95 c-g</td>
<td>1.19 efg</td>
<td>14-18</td>
<td>sm-med</td>
</tr>
<tr>
<td>AP 426</td>
<td>7.36 e-i</td>
<td>1.96 c-f</td>
<td>1.56 c-g</td>
<td>14-18</td>
<td>med</td>
</tr>
<tr>
<td>Obsession</td>
<td>7.33 e-i</td>
<td>1.99 b-e</td>
<td>2.13 a-e</td>
<td>16-20</td>
<td>med</td>
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<td>2974MXR</td>
<td>7.33 e-i</td>
<td>2.08 ab</td>
<td>2.44 a-d</td>
<td>16-20</td>
<td>lg</td>
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<tr>
<td>SC1336</td>
<td>7.30 e-i</td>
<td>2.05 abc</td>
<td>1.88 a-f</td>
<td>18-20</td>
<td>sm-med</td>
</tr>
<tr>
<td>Passion</td>
<td>7.29 e-i</td>
<td>1.94 d-g</td>
<td>1.66 a-g</td>
<td>14-16</td>
<td>sm-med</td>
</tr>
<tr>
<td>8902 MR</td>
<td>7.26 e-i</td>
<td>1.91 d-h</td>
<td>1.94 a-f</td>
<td>12-18</td>
<td>med-lg</td>
</tr>
<tr>
<td>CSABF12-551</td>
<td>7.25 e-i</td>
<td>1.86 fgh</td>
<td>1.59 b-g</td>
<td>12-16</td>
<td>med</td>
</tr>
<tr>
<td>EX08737143</td>
<td>7.22 e-i</td>
<td>1.91 d-h</td>
<td>1.78 a-g</td>
<td>14-18</td>
<td>med</td>
</tr>
<tr>
<td>1760 MR</td>
<td>7.21 e-i</td>
<td>1.94 d-g</td>
<td>2.65 ab</td>
<td>14-18</td>
<td>med</td>
</tr>
<tr>
<td>Stellar XR</td>
<td>7.18 f-j</td>
<td>1.99 b-e</td>
<td>0.75 g</td>
<td>12-18</td>
<td>med-lg</td>
</tr>
<tr>
<td>Battalion</td>
<td>7.13 g-j</td>
<td>1.90 e-g</td>
<td>1.92 a-f</td>
<td>14-18</td>
<td>med-lg</td>
</tr>
<tr>
<td>Bright White</td>
<td>7.05 h-k</td>
<td>1.98 b-e</td>
<td>1.38 d-g</td>
<td>14-18</td>
<td>sm</td>
</tr>
<tr>
<td>CSAYF9-345</td>
<td>7.00 ijk</td>
<td>1.96 c-f</td>
<td>1.75 a-g</td>
<td>14-18</td>
<td>sm-med</td>
</tr>
<tr>
<td>Awesome XR</td>
<td>6.85 kj</td>
<td>2.00 b-e</td>
<td>0.88 fg</td>
<td>12-16</td>
<td>med-lg</td>
</tr>
<tr>
<td>Rainier</td>
<td>6.85 kj</td>
<td>2.05 abc</td>
<td>1.06 efg</td>
<td>14-18</td>
<td>med</td>
</tr>
<tr>
<td>BSS 0977</td>
<td>6.75 kl</td>
<td>1.82 h</td>
<td>2.04 a-e</td>
<td>14-16</td>
<td>sm-med</td>
</tr>
<tr>
<td>Protector</td>
<td>6.74 kl</td>
<td>1.94 d-g</td>
<td>2.68 a</td>
<td>14-16</td>
<td>med</td>
</tr>
<tr>
<td>CAPBF10-411</td>
<td>6.50 l</td>
<td>2.01 bcd</td>
<td>1.19 efg</td>
<td>12-16</td>
<td>sm</td>
</tr>
</tbody>
</table>
Efficacy of Spray Schedules for Management of Ear-Damaging Insects in Stacked-Gene Bt Sweet Corn

Alton N. Sparks, Jr.
Department of Entomology, University of Georgia, Tifton, GA 31793

Materials and Methods

Crop: Sweet corn

Targeted pests: Lepidoptera pests and secondary pests; primarily corn earworm and sap beetles

Locations:
- The University of Georgia, Horticulture Farm, Tifton Campus, Tifton, GA.
- The University of Georgia, Attapulgus Research and Education Center, Attapulgus, GA.

Experimental design: RCBD with three replications at each location

Establishment: Direct seeded

Plot size: Four rows (on 36-inch centers) by 25 feet (Tifton) or 30 feet (Attapulgus)

Varieties:
- Conventional: EX08767143
- Performance Series (stacked gene; Cry1A.105 and Cry2Ab): SV9010SA
- Attribute II (stacked gene; Cry1Ab and Vip3A): Protector

Treatments:
- Conventional: No foliar insecticide (drenched with Coragen at-planting)
- Attribute II: no insecticide
- Attribute II: Two-three day schedule (M, W, F)
- Attribute II: Four-five day schedule (M, F, W)
- Attribute II: Seven day schedule
- Performance Series: No insecticide
- Performance Series: Two-three day schedule (M, W, F)
- Performance Series: Four-five day schedule (M, F, W)
- Performance Series: Seven day schedule

Insecticide treatments were initiated at or near first silk (on a Monday, Wednesday, or Friday) and applied on the designated schedule thereafter. All insecticide treatments were a tank mix of Karate 2.08 SC at 1.92 oz/a plus Lannate at 1.5 pt/a.

Application dates:
- Tifton – Two-three day schedule: 12, 15, 17, 19, 22, 24, 26, and 29 Sept.; Four-five day schedule: 15, 19, 24, and 29 Sept.; Seven day schedule: 15, 22, and 29 Sept.
- Attapulgus – Two-three day schedule: 1, 4, 6, 8, 11, 13, 15, and 18 Aug; Four-five day schedule: 1, 6, 11, and 15 Aug.; Seven day schedule: 1, 8, and 15 Aug.

Application methods:
- Tifton – Applications made with tractor mounted sprayer (29.66 gal/a; 60 PSI; 3.6 mph; three hollow cone nozzles per row [one over-the-top, two on drops targeting the ear zone]).
- Attapulgus – Applications made with a Lee Spider Sprayer (15 gal/a, broadcast over the top).

Data collection:
- Harvest data – At harvest maturity, 25 primary ears of harvestable size were collected from each plot. Each ear was examined and rated for damage by insects and presence of insects. External damage by caterpillars was recorded as presence/absence. Damage to the ears by caterpillars was rated as 0 = none, 1 = damage at tip with less than five kernels damaged, 2 = damage at tip with more than five kernels damaged and not extending greater than 1 inch down the ear, 3 = damage at tip extending greater than 1 inch down the ear, or 4 = damage through the husk below the tip of the ear. Damage by secondary pests (sap beetles and/or silk flies) was rated on a similar 0 to 3 scale. Corn earworm and fall armyworm larvae were identified and classified as small (1st and 2nd instar), medium (3rd to 4th instar), or large (4th to 5th instar) and counted. Data calculated from the above included number of ears with damage rated 2 or 3 (this would be unmarketable ears) for both caterpillars and secondary pests, number
of ears with any damage (any rating above 0 for caterpillars or secondary pests), and total number of corn earworm and fall armyworm larvae.

**Statistical analyses:** PROC ANOVA in SAS Enterprise Guide (P < 0.05); LSD (P = 0.05).

**Results**

Pest pressure was higher in Attapulgus, with the Conventional plots having no marketable ears, while in Tifton the Conventional plots averaged 13.67 marketable ears out of 25 (with no foliar insecticides).

In general, the Attribute II variety produced more marketable ears than the Performance Series variety, particularly under the heavier pest pressure in Attapulgus. In Tifton, there were no significant differences in marketable ears or caterpillar damaged ears among the Bt varieties, nor among insecticide schedules within the varieties. In Attapulgus, the Attribute II variety produced more marketable ears with no caterpillar damage to the ears. Addition of insecticides increased marketable ears and decreased caterpillar damage within the Performance Series variety; however, even with applications on a two to three day schedule, caterpillar damage averaged 3.67 ears (of 25) with unacceptable levels of damage in this variety. Secondary pest damage was minor in Tifton. Secondary pest damage in Attapulgus was generally decreased within both Bt varieties with increased use of insecticides.

**Ear damage, stacked-gene Bt sweet corn spray schedule test, Attapulgus, GA, 2014.**

<table>
<thead>
<tr>
<th>Variety</th>
<th>Insecticide Spray Schedule</th>
<th>Number of Ears with Damage (of 25 ears)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>External</td>
</tr>
<tr>
<td>Conventional</td>
<td>None</td>
<td>24.67 a</td>
</tr>
<tr>
<td>Perf. Series</td>
<td>None</td>
<td>6.67 b</td>
</tr>
<tr>
<td>Perf. Series</td>
<td>7 day</td>
<td>3.00 c</td>
</tr>
<tr>
<td>Perf. Series</td>
<td>4-5 day</td>
<td>5.00 bc</td>
</tr>
<tr>
<td>Perf. Series</td>
<td>2-3 day</td>
<td>3.67 c</td>
</tr>
<tr>
<td>Attribute II</td>
<td>None</td>
<td>0.67 d</td>
</tr>
<tr>
<td>Attribute II</td>
<td>7 day</td>
<td>0.00 d</td>
</tr>
<tr>
<td>Attribute II</td>
<td>4-5 day</td>
<td>0.00 d</td>
</tr>
<tr>
<td>Attribute II</td>
<td>2-3 day</td>
<td>0.00 d</td>
</tr>
</tbody>
</table>

Means within the same column followed by different letters are significantly different according to Fisher’s Least Significant Difference Test (P < 0.05).

**Ear insect infestation, stacked-gene Bt sweet corn spray schedule test, Attapulgus, GA, 2014.**

<table>
<thead>
<tr>
<th>Variety</th>
<th>Insecticide Spray Schedule</th>
<th>CEW Larvae per 25 Ears</th>
<th>FAW Larvae per 25 Ears (total)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Small</td>
<td>Medium</td>
</tr>
<tr>
<td>Conventional</td>
<td>None</td>
<td>0.67 b</td>
<td>3.33 b</td>
</tr>
<tr>
<td>Perf. Series</td>
<td>None</td>
<td>2.33 a</td>
<td>5.33 a</td>
</tr>
<tr>
<td>Perf. Series</td>
<td>7 day</td>
<td>2.67 a</td>
<td>2.33 bc</td>
</tr>
<tr>
<td>Perf. Series</td>
<td>4-5 day</td>
<td>2.00 a</td>
<td>1.33 cd</td>
</tr>
<tr>
<td>Perf. Series</td>
<td>2-3 day</td>
<td>0.33 b</td>
<td>1.00 cd</td>
</tr>
<tr>
<td>Attribute II</td>
<td>None</td>
<td>0.00 b</td>
<td>0.00 d</td>
</tr>
<tr>
<td>Attribute II</td>
<td>7 day</td>
<td>0.00 b</td>
<td>0.00 d</td>
</tr>
<tr>
<td>Attribute II</td>
<td>4-5 day</td>
<td>0.00 b</td>
<td>0.00 d</td>
</tr>
<tr>
<td>Attribute II</td>
<td>2-3 day</td>
<td>0.33 b</td>
<td>0.00 d</td>
</tr>
</tbody>
</table>

Means within the same column followed by different letters are significantly different according to Fisher’s Least Significant Difference Test (P < 0.05).
Ear damage, stacked-gene Bt sweet corn spray schedule test, Tifton, GA, 2014.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Insecticide Spray Schedule</th>
<th>Number of Ears with Damage (of 25 ears)</th>
<th>External</th>
<th>Marketable</th>
<th>Damaged (any level by any pest)</th>
<th>Caterpillar Damage 2,3</th>
<th>Secondary Pest Damage 2,3</th>
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</thead>
<tbody>
<tr>
<td>Conventional</td>
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<td></td>
<td>0 a</td>
<td>13.67 b</td>
<td>12.00 a</td>
<td>11.33 a</td>
<td>0.33 a</td>
</tr>
<tr>
<td>Perf. Series</td>
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<td></td>
<td>0 a</td>
<td>22.67 a</td>
<td>4.67 b</td>
<td>2.00 b</td>
<td>0.67 a</td>
</tr>
<tr>
<td>Perf. Series</td>
<td>7 day</td>
<td></td>
<td>0 a</td>
<td>23.67 a</td>
<td>4.00 bc</td>
<td>1.33 b</td>
<td>0.00 a</td>
</tr>
<tr>
<td>Perf. Series</td>
<td>4-5 day</td>
<td></td>
<td>0 a</td>
<td>23.33 a</td>
<td>1.67 cd</td>
<td>1.67 b</td>
<td>0.00 a</td>
</tr>
<tr>
<td>Perf. Series</td>
<td>2-3 day</td>
<td></td>
<td>0 a</td>
<td>24.33 a</td>
<td>1.00 d</td>
<td>0.67 b</td>
<td>0.00 a</td>
</tr>
<tr>
<td>Attribute II</td>
<td>None</td>
<td></td>
<td>0 a</td>
<td>24.67 a</td>
<td>0.33 d</td>
<td>0.00 b</td>
<td>0.33 a</td>
</tr>
<tr>
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<td></td>
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<td>25.00 a</td>
<td>0.00 d</td>
<td>0.00 b</td>
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</tr>
<tr>
<td>Attribute II</td>
<td>4-5 day</td>
<td></td>
<td>0 a</td>
<td>24.67 a</td>
<td>0.33 d</td>
<td>0.00 b</td>
<td>0.33 a</td>
</tr>
<tr>
<td>Attribute II</td>
<td>2-3 day</td>
<td></td>
<td>0 a</td>
<td>25.00 a</td>
<td>0.33 d</td>
<td>0.00 b</td>
<td>0.00 a</td>
</tr>
</tbody>
</table>

Means within the same column followed by different letters are significantly different according to Fisher’s Least Significant Difference Test (P < 0.05).


<table>
<thead>
<tr>
<th>Variety</th>
<th>Insecticide Spray Schedule</th>
<th>CEW Larvae per 25 Ears</th>
<th>FAW Larvae per 25 Ears (total)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Small</td>
<td>Medium</td>
</tr>
<tr>
<td>Conventional</td>
<td>None</td>
<td>0.67 b</td>
<td>4.67 a</td>
</tr>
<tr>
<td>Perf. Series</td>
<td>None</td>
<td>3.67 a</td>
<td>1.33 a</td>
</tr>
<tr>
<td>Perf. Series</td>
<td>7 day</td>
<td>3.00 a</td>
<td>0.00 a</td>
</tr>
<tr>
<td>Perf. Series</td>
<td>4-5 day</td>
<td>0.33 b</td>
<td>0.33 a</td>
</tr>
<tr>
<td>Perf. Series</td>
<td>2-3 day</td>
<td>0.00 b</td>
<td>0.00 a</td>
</tr>
<tr>
<td>Attribute II</td>
<td>None</td>
<td>0.00 b</td>
<td>0.00 a</td>
</tr>
<tr>
<td>Attribute II</td>
<td>7 day</td>
<td>0.00 b</td>
<td>0.00 a</td>
</tr>
<tr>
<td>Attribute II</td>
<td>4-5 day</td>
<td>0.00 b</td>
<td>0.00 a</td>
</tr>
<tr>
<td>Attribute II</td>
<td>2-3 day</td>
<td>0.00 b</td>
<td>0.00 a</td>
</tr>
</tbody>
</table>

Means within the same column followed by different letters are significantly different according to Fisher’s Least Significant Difference Test (P < 0.05).
Comparison of Bt Sweet Corn Technologies for Management of Lepidoptera Pests
Alton N. Sparks, Jr.
Department of Entomology, University of Georgia, Tifton, GA 31793

Materials and Methods

Crop: Sweet corn

Targeted pests: Lepidoptera; fall armyworm and corn earworm

Location: The University of Georgia, Attapulgus Research and Education Center, Attapulgus, GA

Experimental design: RCBD with three replications

Establishment: Direct seeded on 18 June 2014

Plot size: Four rows (on 36-inch centers) by 30 feet

Varieties:
- Conventional: EX08767143
- Attribute (single gene; Cyr1Ab): GSS 0966
- Performance Series (stacked gene; Cry1A.105 and Cry2Ab): SV9010SA
- Attribute II (stacked gene; Cry1Ab and Vip3A): Protector

Insecticide applications: The entire test area was treated with Karate 2.08SC at 1.92 oz/a plus Lannate at 1.5 pt/a on a four to five day spray schedule starting at first silk (initiated at first silk and sprayed on a Monday, Friday, Wednesday schedule). Applications were made with a Lee Spider Sprayer in 15 gal/a broadcast over the top.

Data collection:
- Whorl damage. All plants on the middle two rows of each plot were visually examined for damage to the whorl at tassel push (tassels visible in the whorl). Plants with significant damage were counted (minor etching was ignored; only plants with an unacceptable level of damage were counted).

- Harvest data. At harvest maturity, 25 primary ears of harvestable size were collected from each plot. Each ear was examined and rated for damage by insects and presence of insects. External damage by caterpillars was recorded as presence/absence. Damage to the ears by caterpillars was rated as 0 = none, 1 = damage at tip with less than five kernels damaged, 2 = damage at tip with more than five kernels damaged and not extending greater than 1 inch down the ear, 3 = damage at tip extending greater than 1 inch down the ear, 4 = damage through the husk below the tip. Damage by secondary pests (sap beetles and/or silk flies) was rated on a similar 0 to 3 scale. Corn earworm and fall armyworm larvae were identified and counted. The presence or absence of sap beetles (adults or larvae) and silk flies (larvae) was also noted. Data calculated from the above included number of ears with damage rated 2 or 3 (this would be unmarketable ears) for both caterpillars and secondary pests and number of ears with any damage (any rating above 0 for caterpillars or secondary pests).

Statistical analyses: PROC ANOVA in SAS Enterprise Guide (P < 0.05); LSD (P = 0.05).

Results and Discussion

Whorl damage. Both stacked gene varieties provided excellent reductions in whorl stage damage (fall armyworm control) with no damage observed in these varieties. The single gene variety reduced whorl damage as compared to the conventional variety, but had unacceptable levels of damage.

Ear damage. All three Bt varieties reduced ear damage by caterpillars, as compared to the conventional variety. Within the Bt varieties, damage by caterpillars was worst in the single-gene variety with over 50% of ears with unacceptable damage by caterpillars. The Attribute II stacked-gene showed zero damage to ears by caterpillars. The Performance Series was intermediate with reductions closer to that of the Attribute II, but with significant caterpillar damage (18.6%) under the severe pest pressure in Attapulgus. Secondary pest damage was not eliminated by the four to five day spray schedule (which was the target of these sprays), but did show good reductions in both stacked gene varieties. Because of high variability, there was no significant difference in the number of corn earworm and fall armyworm larvae collected in each variety; however, corn earworm was able to develop on all except the Attribute II variety. Fall armyworm was not collected from either stacked-gene variety. Sap beetle adult infestation appeared very similar to secondary pest damage with both stacked-gene varieties having greatly reduced infestation levels. Silk fly infestation levels were low in this test with no differences among varieties.

Continued on next page.
### Whorl and ear damage, Bt sweet corn technology test, Attapulgus, GA, 2014.

<table>
<thead>
<tr>
<th>Technology</th>
<th>Number of Plants with Whorl Damage</th>
<th>Number of Ears (of 25)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Marketable</td>
<td>Damaged (any level by any pest)</td>
</tr>
<tr>
<td>Conventional</td>
<td>88.33 a</td>
<td>0.33 c</td>
<td>24.67 a</td>
</tr>
<tr>
<td>Attribute</td>
<td>29.33 b</td>
<td>2.33 c</td>
<td>23.33 b</td>
</tr>
<tr>
<td>Per. Series</td>
<td>0.00 c</td>
<td>18.33 b</td>
<td>9.00 c</td>
</tr>
<tr>
<td>Attribute II</td>
<td>0.00 c</td>
<td>25.00 a</td>
<td>0.00 d</td>
</tr>
</tbody>
</table>

Means within the same column followed by different letters are significantly different according to Fisher’s Least Significant Difference Test (P < 0.05).

### Pest infestation, Bt sweet corn technology test, Attapulgus, GA, 2014.

<table>
<thead>
<tr>
<th>Technology</th>
<th>CEW Larvae per 25 Ears</th>
<th>FAW Larvae per 25 Ears</th>
<th>Ears (of 25) Infested by Sap Beetle</th>
<th>Ears (of 25) Infested by Silk Fly</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional</td>
<td>9.00 a</td>
<td>3.00 a</td>
<td>17.67 a</td>
<td>2.33 a</td>
</tr>
<tr>
<td>Attribute</td>
<td>6.00 a</td>
<td>2.67 a</td>
<td>15.00 a</td>
<td>3.00 a</td>
</tr>
<tr>
<td>Per. Series</td>
<td>4.33 a</td>
<td>0.00 a</td>
<td>1.33 b</td>
<td>1.00 a</td>
</tr>
<tr>
<td>Attribute II</td>
<td>0.00 a</td>
<td>0.00 a</td>
<td>0.00 b</td>
<td>0.00 a</td>
</tr>
</tbody>
</table>

Means within the same column followed by different letters are significantly different according to Fisher’s Least Significant Difference Test (P < 0.05).
Efficacy of Pre-Tassel Foliar Insecticides for Management of Lepidoptera Pests in Sweet Corn

Alton N. Sparks, Jr.
Department of Entomology, University of Georgia, Tifton, GA 31793

Materials and Methods
Crop: Sweet corn
Targeted pests: Lepidoptera, primarily fall armyworm
Location: The University of Georgia, Tifton Vegetable Park, Tifton Campus, Tifton, GA
Experimental design: RCBD with four replications
Establishment: Direct seeded
Plot size: Two rows (on 36-inch centers) by 25 feet

Treatments:
- Rimon at 6 oz/a first application, 4 oz/a thereafter
- Rimon at 6 oz/a
- Rimon at 9 oz/a
- Blackhawk at 3.3 oz/a
- Belt at 3 oz/a
- Coragen at 3.5 oz/a
- Avaunt at 3.5 oz/a
- Coragen at 3.5 oz (1st app) followed by Dipel granular at 10 lb/a on a four-five day schedule
- Coragen at 3.5 oz (1st app) followed Dipel granular at 10 lb/a on a nine day schedule
- Non-Treated Check

Application dates:
- Foliar spray treatments: 29 Aug. and 3, 8, 12, and 17 Sept. 2014.
- Dipel treatments: On four-five day schedule – Coragen on 29 Aug.; Dipel on 3, 8, 12, and 17 Sept. On nine day schedule – Coragen on 29 Aug.; dipel on 3 and 12 Sept.

Application methods:
- Foliar applications were made with a CO$_2$ pressurized backpack sprayer (60 psi) in 40 gal/a with two hollow-cone nozzles per row (broadcast over-the-top).
- Dipel granular applications were applied with a modified salt shaker with the measured amount over each row. Rate was based on an assumed 1-foot band.

Data collection: All plants in each plot were visually examined for damage to the whorl by caterpillars. All plants with moderate or severe damage were counted and recorded. Moderate and severe damage was combined for analyses (severe damage was extremely rare in this test).

Statistical analyses: PROC ANOVA in SAS Enterprise Guide (P < 0.05); LSD (P = 0.05).

Results and Discussion
Pest pressure was fairly light in this test. All insecticide treatments reduced amount of damage as compared to the Non-Treated Check. On this first sample date, Avaunt had significantly more damage than most of the other insecticide treatments, but was very light. On the second sample, Avaunt and the nine-day-schedule Dipel had numerically (but not statistically) more damage.

Whorl damage data, pre-tassel sweet corn test, UGA Tifton Vegetable Park, Tifton, GA, 2014.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Damaged (moderate or severe) Plants per Plot</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>15 Sept.</td>
</tr>
<tr>
<td>Check</td>
<td></td>
</tr>
<tr>
<td>Avaunt</td>
<td>6.25 a</td>
</tr>
<tr>
<td>Belt</td>
<td>2.50 b</td>
</tr>
<tr>
<td>Blackhawk</td>
<td>0.50 c</td>
</tr>
<tr>
<td>Coragen</td>
<td>0.00 c</td>
</tr>
<tr>
<td>Dipel 4-5 day</td>
<td>0.50 c</td>
</tr>
<tr>
<td>Dipel 9 day</td>
<td>1.25 bc</td>
</tr>
<tr>
<td>Rimon 6 oz, 4 oz</td>
<td>1.00 c</td>
</tr>
<tr>
<td>Rimon 6 oz</td>
<td>0.00 c</td>
</tr>
<tr>
<td>Rimon 9 oz</td>
<td>0.00 c</td>
</tr>
</tbody>
</table>

Means within the same column followed by different letters are significantly different according to Fisher’s Least Significant Difference Test (P < 0.05).
Slicing Cucumber Variety Evaluation: Spring 2014

Timothy Coolong
Department of Horticulture, University of Georgia, Tifton, GA 31793

Introduction
Slicing cucumbers are a significant horticultural crop for Georgia. With spring and fall growing seasons, Georgia consistently ranks in the top three states for slicing (fresh market) cucumber production. Cucumbers are grown in Georgia using a wide range of techniques, though the majority of acres are gynoecious types grown on plastic mulch. There have been several new introductions for slicing cucumbers in the past several years; however, the University of Georgia has not conducted any comprehensive variety trials. Therefore this trial was implemented to evaluate performance of new varieties for the slicing cucumber market in Georgia.

Materials and Methods
This trial was located in Tifton, GA. Approximately 2-week old transplants were planted into black TIF plastic mulch on 1 May 2014. Transplants were spaced on 8-inch in-row spacing (10,890 plants per acre) with rows spaced on 6-foot centers. There were 12 plants per plot and four plots per variety. Soils were fumigated when plastic was laid. There were 1,000 pounds of 5-10-15 fertilizer (Agrium-Rainbow) placed beneath the plastic mulch, and 7-0-7 liquid fertilizer was applied at a rate of 12-pounds of N per week starting 1-week after planting for a total of 146 pounds of N for the season. Herbicides between rows consisted of Dual II Magnum and Curbit. Pest control consisted of weekly fungicide sprays according to UGA recommendations (+ copper). Imidacloprid was used at planting.

Harvest dates were 2, 8, 10, 15, 19, and 23 June 2014. The initial three harvests had a high percentage of Super Selects and Selects, while the last three harvests had a very high percentage of culls. Nearly all culls appeared curved/misshapen regardless of variety. Fruit were graded into Super Select and Select, and then cull counted and weighed. Length to width ratio and shape recorded (harvest No. 3 only for shape). Color was recorded, but no differences were apparent, all had a similar deep-dark green color. Yield data presented for all harvests in 24-count boxes per acre.

Results and Discussion
Early harvests had a low percentage of cull fruit, while later (15, 19, 23 June) had high cull percentages and would not likely have been harvested by a commercial grower. The greatest total marketable and yield of Super Select fruit was found in SV4719CS. Although numerically different, there were no statistical differences between the other nine varieties that were trialed for total marketable yield. There were no significant differences in yield of Select fruit among any of the varieties. Length to width ratio was recorded throughout harvests. Though not statistically significant, the length to width ratio decreased slightly over time. Superior had the highest length to width ratio (4:1), while SV3462CS had the lowest at 3:1. Shape was recorded during the third harvest. Impact had the most uniform shape. Nonetheless, all varieties tested would have had a shape that was marketable (5 or less) across the entire third harvest. Because of the high cull rates and misshapen fruit late in the harvest period, those varieties that produced a large proportion of yield in the first or second harvest would have had a greater marketable yield (Table 1 and Figures 1-2).
Table 1. Yields and quality measurements for 10 varieties of cucumber grown in Tifton, GA, spring 2014.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Total Marketable Yieldz,y</th>
<th>Super Select</th>
<th>Select</th>
<th>Length:Width</th>
<th>Shapex</th>
</tr>
</thead>
<tbody>
<tr>
<td>SV4719CS</td>
<td>1590 a</td>
<td>940 a</td>
<td>650 a</td>
<td>3.3:1 bc</td>
<td>4.0 b</td>
</tr>
<tr>
<td>USACX10428</td>
<td>1360 ab</td>
<td>590 bc</td>
<td>780 a</td>
<td>3.9:1 a</td>
<td>3.8 ab</td>
</tr>
<tr>
<td>Diomede</td>
<td>1230 b</td>
<td>650 bc</td>
<td>580 a</td>
<td>3.9:1 a</td>
<td>4.3 b</td>
</tr>
<tr>
<td>USACX10429</td>
<td>1230 b</td>
<td>550 bc</td>
<td>680 a</td>
<td>3.8:1 ab</td>
<td>3.8 ab</td>
</tr>
<tr>
<td>SV3462CS</td>
<td>1220 b</td>
<td>570 bc</td>
<td>660 a</td>
<td>3.1 c</td>
<td>4.3 b</td>
</tr>
<tr>
<td>Superior</td>
<td>1210 b</td>
<td>600 bc</td>
<td>610 a</td>
<td>4.1 a</td>
<td>3.3 ab</td>
</tr>
<tr>
<td>Impact</td>
<td>1170 b</td>
<td>670 bc</td>
<td>500 a</td>
<td>3.7:1 ab</td>
<td>2.0 a</td>
</tr>
<tr>
<td>Cobra</td>
<td>1150 b</td>
<td>500 c</td>
<td>650 a</td>
<td>3.5:1 ab</td>
<td>3.3 ab</td>
</tr>
</tbody>
</table>

z Due to rounding and accounting for significant digits, total yield may not be the exact sum of Super Select and Select yields.

y Yield calculated in 24-count boxes per acre.

x Shape calculated on a 1-9 scale with 1 = perfectly straight and ideal, 5 = market average, 9 = curved, completely unmarketable. Shape based on entire harvest.

---

**Figure 1: Yield of Super Select Fruit**

- Cobra
- Diomede
- Impact
- Superior
- SV3462CS
- SV4719CS
- USACX10428
- USACX10429

**Figure 2: Yield of Select Fruit**

- Cobra
- Diomede
- Impact
- Superior
- SV3462CS
- SV4719CS
- USACX10428
- USACX10429
Slicing Cucumber Variety Evaluation: Fall 2014
Timothy Coolong
Department of Horticulture, University of Georgia, Tifton, GA 31793

Introduction
With shorter days and hot temperatures going into cool conditions, fall cucumber production is much different than in the spring. In the fall, disease pressure for pathogens, such as downy mildew and powdery mildew, is increased. Slicing cucumbers are a significant horticultural crop for Georgia. With spring and fall growing seasons, Georgia consistently ranks in the top three states for slicing (fresh market) cucumber production. Cucumbers are grown in Georgia using a wide range of techniques, though the majority of acres are gynoecious types grown on plastic mulch. There have been several new introductions for slicing cucumbers in the past several years; however, the University of Georgia has not conducted any comprehensive variety trials. Therefore this trial was implemented to evaluate performance of new varieties for the slicing cucumber market in Georgia.

Materials and Methods
This trial was located in Tifton, GA. Approximately 11-day old transplants were planted on 15 Aug. 2014. Transplants were spaced on 8-inch in-row spacing (10,890 plants per acre) with rows spaced on 6-foot centers. There were 12-plants per plot and four plots per variety. Soils were fumigated when plastic was laid. There were 1,000 pounds of 5-10-15 fertilizer (Agrium-Rainbow) placed beneath the plastic mulch and 7-0-7 liquid fertilizer was applied weekly at 12 lb N/a per week starting one week after planting. Total for the season was 146 lb N/a. Herbicide between rows consisted of Dual II Magnum, Curbit, Valor, and Round Up. Pests were controlled with weekly fungicide sprays according to UGA recommendations (+ copper). Venom and Coragen were applied during growth. Poinsett 76 was utilized between plots (two per plot) plant as a pollinizer.

Fruit were harvested on: 10, 12, 15, 18, 22, and 24 Sept. 2014 and 2 Oct. 2014. Fruit picked on the 24 Sept. harvest were poorly shaped. All fruit were removed on 26 Sept. and plants were harvested again on 2 Oct. Nearly all culls appeared curved/misshapen regardless of variety. Fruit were graded into Super Select and Select, and then cull counted and weighed.

Length to width ratio, color, and uniformity were recorded for the second and third harvests and averaged for each variety. Shape was recorded for the second, third, fifth and sixth harvest and averaged for each variety. Downy mildew was rated on 16 Oct. 2014. Plants had few if any symptoms during harvest, but after the last harvest, fungicide programs were terminated and disease symptoms were quickly observed and documented.

Results
There were four varieties that were closely grouped for highest total yield, though statistically there were no significant differences in total yield among the top eight yielding varieties. It should be noted that if the trial had been terminated after the 24 Sept. harvest, the results would have been slightly different. A significant (approx. one-third) portion of total yield occurred on the last harvest date, 2 Oct. 2014. As noted in the methods section, the harvest on 24 Sept. was low with many fruit being misshapen and culled. After all misshapen (immature and mature) fruit were pulled on 26 Sept., new fruit were set, resulting in an exceptionally large harvest of plots on 2 Oct. Please see Figure 1 for a comparison of the proportion of total fruit that were harvested early. Nonetheless, while total yields were much greater in the fall, relative yields amongst varieties were similar to those in the spring trial. There were also differences in downy mildew symptoms as illustrated in Table 3.
Table 1. Yields and quality measurements for cucumber grown in Tifton, GA, fall 2014.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Total Marketable Yield(^{z,y})</th>
<th>Super Select</th>
<th>Select</th>
<th>Cull</th>
</tr>
</thead>
<tbody>
<tr>
<td>SV3462CS</td>
<td>2400 a</td>
<td>930 abc</td>
<td>1470 a</td>
<td>22.2 abc</td>
</tr>
<tr>
<td>Dasher II</td>
<td>2390 a</td>
<td>980 ab</td>
<td>1410 ab</td>
<td>25.8 abc</td>
</tr>
<tr>
<td>USACX10428</td>
<td>2360 a</td>
<td>1040 a</td>
<td>1320 abc</td>
<td>18.4 bc</td>
</tr>
<tr>
<td>SV4719CS</td>
<td>2180 abc</td>
<td>820 a-d</td>
<td>1370 abc</td>
<td>25.1 abc</td>
</tr>
<tr>
<td>Impact</td>
<td>2080 abc</td>
<td>860 a-d</td>
<td>1220 abc</td>
<td>22.9 abc</td>
</tr>
<tr>
<td>Cobra</td>
<td>2070 abc</td>
<td>1000 a</td>
<td>1070 bc</td>
<td>18.0 c</td>
</tr>
<tr>
<td>Superior</td>
<td>1860 bc</td>
<td>830 a-d</td>
<td>1030 c</td>
<td>22.1 abc</td>
</tr>
<tr>
<td>USACX10429</td>
<td>1790 c</td>
<td>690 cd</td>
<td>1100 bc</td>
<td>25.5 abc</td>
</tr>
<tr>
<td>Diomede</td>
<td>1780 c</td>
<td>730 bcd</td>
<td>1050 bc</td>
<td>28.4 a</td>
</tr>
<tr>
<td>Darlington</td>
<td>1740 c</td>
<td>660 d</td>
<td>1070 bc</td>
<td>19.6 bc</td>
</tr>
<tr>
<td>Laser</td>
<td>1710 c</td>
<td>650 d</td>
<td>1060 bc</td>
<td>26.3 ab</td>
</tr>
</tbody>
</table>

\(^{z}\) Due to rounding and accounting for significant digits, total yield may not be the exact sum of Super Select and Select yields.

\(^{y}\) Yield calculated in 24-count boxes per acre.

Table 2. Quality measurements for cucumber grown in Tifton, GA, fall 2014.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Shape(^{z})</th>
<th>Uniformity(^{y})</th>
<th>Length:Width(^{x})</th>
<th>Color(^{w})</th>
</tr>
</thead>
<tbody>
<tr>
<td>Superior</td>
<td>4.2 a</td>
<td>3.6 a</td>
<td>4.0 a</td>
<td>4.2 a</td>
</tr>
<tr>
<td>Impact</td>
<td>4.3 a</td>
<td>4.0 ab</td>
<td>4.1 a</td>
<td>3.8 a</td>
</tr>
<tr>
<td>Cobra</td>
<td>4.4 a</td>
<td>4.0 ab</td>
<td>3.8 a</td>
<td>3.8 a</td>
</tr>
<tr>
<td>SV3462CS</td>
<td>4.6 ab</td>
<td>4.0 ab</td>
<td>3.6 a</td>
<td>4.3 a</td>
</tr>
<tr>
<td>USACX10428</td>
<td>4.6 ab</td>
<td>3.6 a</td>
<td>3.8 a</td>
<td>4.8 a</td>
</tr>
<tr>
<td>Diomede</td>
<td>4.9 bc</td>
<td>4.0 ab</td>
<td>4.1 a</td>
<td>4.8 a</td>
</tr>
<tr>
<td>SV4719CS</td>
<td>5.2 abc</td>
<td>4.9 ab</td>
<td>3.7 a</td>
<td>4.0 a</td>
</tr>
<tr>
<td>Dasher II</td>
<td>5.4 bc</td>
<td>4.9 ab</td>
<td>3.7 a</td>
<td>4.9 a</td>
</tr>
<tr>
<td>Laser</td>
<td>5.4 bc</td>
<td>4.8 ab</td>
<td>4.2 a</td>
<td>4.5 a</td>
</tr>
<tr>
<td>USACX10429</td>
<td>5.5 bc</td>
<td>4.4 ab</td>
<td>3.8 a</td>
<td>4.1 a</td>
</tr>
<tr>
<td>Darlington</td>
<td>6.0 c</td>
<td>4.4 ab</td>
<td>4.0 a</td>
<td>4.8 a</td>
</tr>
</tbody>
</table>

\(^{z}\) Shape calculated on a 1-9 scale with 1 = perfectly straight and ideal, 5 = market average, 9 = curved, completely unmarketable. Shape based on entire harvest.

\(^{y}\) Uniformity on a 1-9 scale with 1 = highly uniform, 5 = average, 9 = high variability.

\(^{x}\) Length to width ratio of fruit.

\(^{w}\) Color on a 1-9 scale with 1 = deep dark green, 5 = average medium green, 9 = pale green (poor color for market).
Table 3. Downy mildew ratings for cucumber grown in Tifton, GA, fall 2014.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Downy Mildew&lt;sup&gt;a&lt;/sup&gt; (1-9 scale)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SV4719CS</td>
<td>34 a</td>
</tr>
<tr>
<td>SV3462CS</td>
<td>35 ab</td>
</tr>
<tr>
<td>Cobra</td>
<td>38 abcd</td>
</tr>
<tr>
<td>Impact</td>
<td>41 bcde</td>
</tr>
<tr>
<td>USACX10428</td>
<td>43 cde</td>
</tr>
<tr>
<td>USACX10429</td>
<td>45 de</td>
</tr>
<tr>
<td>Dasher II</td>
<td>46 de</td>
</tr>
<tr>
<td>Laser</td>
<td>46 de</td>
</tr>
<tr>
<td>Darlington</td>
<td>46 de</td>
</tr>
<tr>
<td>Superior</td>
<td>49 e</td>
</tr>
<tr>
<td>Diomede</td>
<td>49 e</td>
</tr>
</tbody>
</table>

<sup>a</sup>Downy mildew Rated on a 1-100 scale with 0 = no evidence of downy mildew and 100 = complete coverage of all leaves with symptoms of downy mildew.
Cucumber Plant Physiology and Fruit Yield as Affected by the Plant Biostimulant MaxCel® and the Fertilizer Magnesium Sulfate

Juan Carlos Díaz-Pérez
Department of Horticulture, University of Georgia, Tifton, GA 31793

Introduction
Cucumber is an important vegetable crop in Georgia, with a surface of 4,200 acres and a farm gate value of $41 million. Cucumber is exposed to heat stress conditions that affect fruit quality and yield. Crop biostimulants have been shown to increase crop yield and quality under adverse environmental conditions (Kauffman et al., 2007; Srivastava et al., 2008; Yvin, 1997). Plant biostimulant MaxCel® (6-benzyladenine) is used for fruit thinning in apples and other fruit trees. The objective of this work was to determine the effects of the plant biostimulant MaxCel® alone or in combination with the fertilizer magnesium sulfate on chlorophyll SPAD values, plant growth, leaf gas exchange, leaf fluorescence, and fruit yield in cucumber.

Materials and Methods
The experiment was conducted at the Horticulture Farm (Tifton, GA), University of Georgia, during the fall season of 2010. The soil of the experimental area is loamy sand, with a pH of about 6.5. The experimental design was a randomized complete block with six replications and six treatments (Table 1). The experiment was conducted at the Horticulture Farm (Tifton, GA), University of Georgia, during the fall season of 2010. The soil of the experimental area is loamy sand, with a pH of about 6.5. The experimental design was a randomized complete block with six replications and six treatments (Table 1). The experimental plot consisted of a 5 m long bed section, leaving a 1.6 m separation between plots within the same bed.

Crop management. Cucumber (‘Dasher II’) was direct-seeded on 23 Aug. on raised beds (on 1.8 m centers). Plants were established using two rows per bed (36 cm apart) with a distance of 30 cm between plants within the row. The beds were covered with 1.5-m-wide, low-density polyethylene, white plastic mulch. One drip tape line (John Deere, 10-cm separation between emitters) was placed 2-3 cm deep into the soil in the center of the bed.

The field was fertilized before planting with 672 kg/ha of 10N–10P₂O₅–10K₂O fertilizer. After planting, N and K₂O were applied weekly through the drip tape. Total amount of N and K₂O applied were 169 kg/ha. Magnesium sulfate (10% Mg and 12.9% S) was applied four times at 34 kg/ha each application for a total of 136 kg/ha. The total amount of Mg and S applied were 13.6 and 17.5 kg/ha, respectively. Magnesium sulfate was applied in the same fertilizer solution containing N and K.

Plants were irrigated with an amount of water equivalent to 100% crop evapotranspiration (ETc). Crop evapotranspiration was calculated by multiplying the reference evapotranspiration (ETo) by the crop factor (dependent on the crop stage of development). Water was applied when cumulative ETc was 1.2 mm, which corresponded to about every two to three days in mature plants (mean ETo was about 6 mm/day). Weather data (air temperature and ETo) were obtained from a nearby UGA weather station (< 300 m).

Biostimulant application. Plant biostimulant MaxCel® (6-benzyladenine; Valent BioSciences) was applied with a backpack sprayer, providing full coverage of the plant canopy. For biostimulant application, water pH was about 6-7 and a non-ionic surfactant (80-20 surfactant; UCPA LLC, Eagan, MN) was used at 0.05%. MaxCel® was sprayed five times during the growing season, about every 10 days, at either 1 mL/L MaxCel® (20 ppm 6-benzyladenine) or 3 mL/L MaxCel® (60 ppm 6-benzyladenine), using sufficient volume to ensure full canopy coverage. MaxCel® was applied the same day that magnesium sulfate was injected through the drip system.

Leaf chlorophyll. Leaf chlorophyll was estimated by means of a chlorophyll meter (SPAD-502, Minolta) in five mature, well exposed leaves per plot. Chlorophyll measurements were conducted twice per week.

Leaf gas exchange and fluorescence. Plant gas exchange (leaf net photosynthesis and stomatal conductance) was measured with a gas exchange system (LI-1600, LI-COR) several times after the applications of the treatments. Leaf fluorescence (photosystem II efficiency) was measured in light-adapted leaves with a leaf chamber fluorometer (LI-6400-40, LI-COR), attached to the gas exchange system. Water use efficiency was calculated as the ratio between net photosynthesis and transpiration, as measured with the gas exchange system.

Phytotoxicity. Phytotoxicity symptoms were evaluated one to two days after the application of biostimulants using a 1-5 visual rating scale (1 = no symptoms; 2 = mild; 3 = moderate; 4 = large; 5 = severe) to grade the entire plot.

Fruit yield. Fruit were harvested 11 times from 28 Sept. to 2 Nov. and graded as marketable and culls, according to the U.S. Grading Standards (USDA, 2005). The number and weight of fruit in each grading category was determined. After the last harvest, all plants in each plot were excised at the base of the stem and the weight of the vines (vegetative top fresh weight) was immediately determined.

Statistical analysis. Data were analyzed using the GLM procedure of SAS (SAS 9.1; SAS Inst. Inc., Cary, NC).

Continued on next page.
Results

Weather. Maximal and minimal temperatures during the growing season are shown in Figure 1. The mean temperature was 23.45°C and the cumulative rainfall was 114 mm. Air temperature was low in late October and early November, causing some foliar damage and fruit malformations due to poor pollination.

Leaf chlorophyll. Leaf chlorophyll SPAD values were lowest in the plants treated with MaxCel® at 3 mL/L (Table 1). Magnesium sulfate had no effect on chlorophyll SPAD values.

Top vegetative fresh weight. The top vegetative fresh weight was highest in the untreated controls and lowest in plants treated with MaxCel® at 3 mL/L (Table 1). The vegetative top fresh weight data are consistent with the field observations that plants treated with MaxCel® looked more vegetative compared to the untreated controls. This enhanced vegetative growth was most evident at the highest rate of MaxCel®. Magnesium sulfate had no significant effect on vegetative top fresh weight.

Soil water content. Soil water content was similar among treatments (Table 1), suggesting that plant water utilization was not affected by either MaxCel® or magnesium sulfate.

Gas exchange and fluorescence. Leaf gas exchange measured as net photosynthesis (mean = 24.4 µmol m⁻² s⁻¹), stomatal conductance (mean = 0.291 mol m⁻² s⁻¹), water use efficiency (mean = 4.14 µmol mmol⁻¹), and leaf fluorescence measured as Photosystem II efficiency (mean = 0.168) were not affected by MaxCel® or magnesium sulfate (Table 2).

Phytotoxicity. There were no phytotoxicity symptoms in any of the treatments.

Fruit yield. The effects of MaxCel® and magnesium sulfate on cucumber yields are shown in Table 3. There were few differences in both cumulative marketable and cumulative total yields among treatments after 11 harvests. There were, however, differences in the trends of marketable yield over time among the biostimulant treatments (Figure 2). Marketable yields were numerically consistently highest in the untreated controls except at the end of the growing season when the treatment MaxCel® 1 mL/L + MN reached similar marketable yield values compared to the untreated controls. MaxCel®-treated plots showed a delay in fruit production, but at the end of the growing season, plants were more vigorous and produced more fruit than the untreated control. These yield differences among treatments are probably due to the effect of MaxCel® in promoting vegetative growth at the expense of reproductive growth. Magnesium sulfate had no consistent effects on either marketable or total yields.

Conclusions

The biostimulant MaxCel® was associated with reductions in chlorophyll SPAD values, particularly at high MaxCel® rate. MaxCel® had no effect on leaf gas exchange or leaf fluorescence. MaxCel® had no consistent effect on cumulative marketable yield, although marketable yields tended to be lower in MaxCel®-treated plants than in the untreated controls. MaxCel®-treated plants showed a delay in fruit production but a more enhanced vegetative top growth. Application of magnesium sulfate had no significant effects on chlorophyll SPAD values, vegetative top growth, leaf gas exchange, leaf fluorescence, or fruit yields.

Literature Cited


Acknowledgements

My sincere gratitude to Jesús Bautista and Nélida Bautista for their invaluable technical support. Thanks also to Jason Brock of the Plant Disease Clinic, University of Georgia, Tifton Campus, for identification of plant diseases. Financial support provided by the Georgia agricultural experiment stations and Valent BioSciences is highly appreciated.
Table 1. Chlorophyll (SPAD) values, vegetative top fresh weight, and soil water content in cucumber as affected by the biostimulant MaxCel® and micronutrients. Tifton, GA, fall 2010.¹

<table>
<thead>
<tr>
<th>Biostimulant</th>
<th>Chlorophyll (SPAD)</th>
<th>Vegetative Top Fresh Wt. (kg/plant)</th>
<th>Soil Water Content (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>UTC</td>
<td>50.4 a</td>
<td>276 c</td>
<td>7.9</td>
</tr>
<tr>
<td>UTC + MN</td>
<td>49.2 ab</td>
<td>288 c</td>
<td>8.0</td>
</tr>
<tr>
<td>MaxCel® at 1 m/L</td>
<td>49.2 ab</td>
<td>372 b</td>
<td>7.8</td>
</tr>
<tr>
<td>MaxCel® at 1 m/L + MN</td>
<td>50.1 a</td>
<td>375 b</td>
<td>7.8</td>
</tr>
<tr>
<td>MaxCel® at 3 m/L</td>
<td>48.1 b</td>
<td>445 a</td>
<td>8.0</td>
</tr>
<tr>
<td>MaxCel® at 3 m/L + MN</td>
<td>48.5 b</td>
<td>482 a</td>
<td>7.8</td>
</tr>
<tr>
<td><strong>P</strong></td>
<td><strong>0.0006</strong></td>
<td><strong>&lt; 0.0001</strong></td>
<td><strong>0.790</strong></td>
</tr>
</tbody>
</table>

¹Means followed by the same letter are not significantly different based on Fisher’s protected least significant test at 95% confidence.

UTC = untreated control; MN = micronutrients, applied as magnesium sulfate at 136 kg/ha.

Table 2. Gas exchange and fluorescence of cucumber leaves as affected by the biostimulant MaxCel® and micronutrients. Tifton, GA, fall 2010.²

<table>
<thead>
<tr>
<th>Biostimulant</th>
<th>Net Photosynthesis (µmol m⁻² s⁻¹)</th>
<th>Stomatal Conductance (mol m⁻² s⁻¹)</th>
<th>Water Use Efficiency (µmol/mmol)</th>
<th>PSII Efficiency ³</th>
</tr>
</thead>
<tbody>
<tr>
<td>UTC</td>
<td>23.9</td>
<td>0.287</td>
<td>4.1</td>
<td>0.17</td>
</tr>
<tr>
<td>UTC + MN</td>
<td>24.0</td>
<td>0.289</td>
<td>4.2</td>
<td>0.16</td>
</tr>
<tr>
<td>MaxCel® at 1 m/L</td>
<td>24.6</td>
<td>0.279</td>
<td>4.3</td>
<td>0.17</td>
</tr>
<tr>
<td>MaxCel® at 1 m/L + MN</td>
<td>25.3</td>
<td>0.307</td>
<td>4.1</td>
<td>0.18</td>
</tr>
<tr>
<td>MaxCel® at 3 m/L</td>
<td>23.8</td>
<td>0.268</td>
<td>4.2</td>
<td>0.16</td>
</tr>
<tr>
<td>MaxCel® at 3 m/L + MN</td>
<td>24.7</td>
<td>0.313</td>
<td>4.0</td>
<td>0.17</td>
</tr>
<tr>
<td><strong>P</strong></td>
<td><strong>0.826</strong></td>
<td><strong>0.330</strong></td>
<td><strong>0.166</strong></td>
<td><strong>0.481</strong></td>
</tr>
</tbody>
</table>

²Means followed by the same letter are not significantly different based on Fisher’s protected least significant test at 95% confidence.

³Photosystem II (PSII) efficiency. It is the fraction of absorbed PSII photons that are used in photochemistry.

UTC = untreated control; MN = micronutrients, applied as magnesium sulfate at 136 kg/ha.

Table 3. Cumulative fruit yields of cucumber as affected by the biostimulant MaxCel® and micronutrients. Tifton, GA, fall 2010.⁴

<table>
<thead>
<tr>
<th>Biostimulant</th>
<th>Marketable</th>
<th>Cull</th>
<th>Total</th>
<th>Fruit Wt. (g/fruit)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000/ha t/ha</td>
<td>1000/ha t/ha</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UTC</td>
<td>170.2 a</td>
<td>26.90</td>
<td>58.2</td>
<td>5.46</td>
</tr>
<tr>
<td>UTC + MN</td>
<td>172.7 ab</td>
<td>26.77</td>
<td>64.8</td>
<td>6.33</td>
</tr>
<tr>
<td>MaxCel® at 1 m/L</td>
<td>137.3 bc</td>
<td>23.24</td>
<td>50.8</td>
<td>5.68</td>
</tr>
<tr>
<td>MaxCel® at 1 m/L + MN</td>
<td>161.7 ab</td>
<td>26.40</td>
<td>50.4</td>
<td>5.34</td>
</tr>
<tr>
<td>MaxCel® at 3 m/L</td>
<td>127.7 c</td>
<td>20.75</td>
<td>51.8</td>
<td>5.38</td>
</tr>
<tr>
<td>MaxCel® at 3 m/L + MN</td>
<td>145.3 abc</td>
<td>25.21</td>
<td>59.8</td>
<td>5.79</td>
</tr>
<tr>
<td><strong>P</strong></td>
<td><strong>0.026</strong></td>
<td><strong>0.278</strong></td>
<td><strong>0.361</strong></td>
<td><strong>0.807</strong></td>
</tr>
</tbody>
</table>

⁴Means followed by the same letter are not significantly different based on Fisher’s protected least significant test at 95% confidence.

UTC = untreated control; MN = micronutrients, applied as magnesium sulfate at 136 kg/ha.
Figure 1: Max and Min Air Temperatures in Cucumbers From Planting (23 Aug. 2010) to the Last Harvest (2 Nov. 2010), Tifton, GA.

Figure 2: Cumulative Marketable Yield of Cucumber as Affected by the Biostimulant MaxCel® and Micronutrients (MN) Applied as Magnesium Sulfate
Evaluation of Cantaloupe Varieties for Georgia Production

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²Department of Horticulture, University of Georgia, Tifton, GA 31793

Introduction

Cantaloupes are one of the many vegetable crops produced in Georgia. There was almost $22 million worth of cantaloupes produced in Georgia in 2012, which represents over 3,500 acres (Wolfe and Stubbs, 2013).

Cantaloupe production has been dominated by the variety ‘Athena’ and varieties similar to it. This type is considered an ‘Eastern’ shipping type, which has orange flesh, a netted rind, and may have a faint suture line. There is, however, interest in new types, such as long shelf life (LSL) melons, and specialty melons, such as crenshaws and casabas. This study was undertaken to evaluate cantaloupe varieties grown under south Georgia conditions. Yield and fruit characteristics were evaluated.

Materials and Methods

Fifteen varieties were sown on 24 March 2014 in Fafard mix 3B (Conrad Fafard, Inc., Agawam, MA) into 6-pak inserts. Seedlings were grown in the greenhouse at the Durham Horticulture Farm in Watkinsville, GA. 20-20-20 fertilizer (J.R. Peters, Inc., Allentown, PA) was applied once at 781 ppm.

Land was prepared at the Tifton Vegetable Research Park in Tifton, GA, according to University of Georgia Cooperative Extension recommendations. The land was fumigated with Pic-Chlor 60 in February and covered with black plastic TIF mulch. Prior to laying the plastic, the land was fertilized with 1,000 lb/a 5-10-15. Plants were transplanted on 22 April 2014 with an in-row spacing of 2 ft and a between-row spacing of 6 ft. Plots were fertilized with 7-0-7 weekly at 12 lb N/a per week starting one week after planting. The total amount of fertilizer used had 170 lb/a of nitrogen. Weeds were controlled between rows with Dual II Magnum + Curbit (Sonalan) applied according to label directions. Weekly fungicide sprays were applied according to UGA recommendations, which included copper based materials. Imidacloprid insecticide was applied at planting; Venom and Agrimek insecticides were applied during production when needed. Finally, Quintec and Torino fungicides were applied for powdery mildew control.

There were three harvests, which occurred on 17 and 23 June and 3 July 2014. The total marketable weight and count were recorded for each plot. In addition, two fruit from each plot were measured for length, width, flesh depth, soluble solids (percent sugar) and firmness (lb/ft with an 8 mm probe).

Data were analyzed with an analysis of covariance using the stand count as a covariate. Both a coefficient of variation (CV) and Fisher’s Protected Least Significant Difference (LSD) were calculated.

Results and Discussion

Yields ranged from 9,819 to 80,164 lb/a. Caution should be exercised in interpreting these yields per acre results. Typical production of cantaloupes ranges from 20,000 to 40,000 lb/a. These results are, however, valid to assess performance between varieties in this trial.

‘Avatar’ had the highest yield of 80,164 lb/a, which was significantly greater than the next highest yielding entry, ‘Earldew,’ which is a honeydew type. ‘Avatar’ also had better yields than ‘Athena,’ which had the third highest yield at 62,844 lb/a.

Among the specialty melons, casaba, yellow canary, crenshaw, and Charentais, ‘Amy,’ a casaba melon type, had the greatest yield with 57,005 lb/a. These specialty melons tended to have the lowest yields among the melons trialed. ‘Versallies’ and ‘Savor,’ both Charentais types, had low yields with 20,051 and 9,819 lb/a, respectively. ‘Savor’ is the more typical Charentais type with ‘Versallies’ having both netting and sutures, which are not typical for this melon type. The specialty melons had some of the sweetest fruit measured. ‘Versallies’ had the highest average soluble solids at 14.4%, which differed significantly from all entries with less than 11.6% soluble solids.

Overall, the trial went very well. CV values were 18% or less, which is extremely good for a trial of this type. Typically, trials such as these will have CV values of 30-40%.

In conclusion, the trial had good results. The best performing varieties based on yield remain, for the most part, standard ‘Eastern’ melons. We did not conduct any postharvest evaluations to assess the value of Long Shelf Life (LSL) melon types. The specialty melons tended to have lower yields, but often had higher sugar content.

Literature Cited

Continued on next page.
Table 1. Cantaloupe variety trial conducted at the Tifton Vegetable Park, 2014.

<table>
<thead>
<tr>
<th>Entry</th>
<th>Seed Company</th>
<th>Type</th>
<th>Yield (lb/a)</th>
<th>Weight/Fruit (no./a)</th>
<th>Width (inches)</th>
<th>Length (inches)</th>
<th>Flesh Depth (%)</th>
<th>Soluble Solids (lb/8 mm probe)</th>
<th>Firmness (lb/ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avatar</td>
<td>Sakata</td>
<td>Eastern</td>
<td>80,164</td>
<td>11,798</td>
<td>6.9</td>
<td>7.5</td>
<td>7.4</td>
<td>2.0</td>
<td>11.2</td>
</tr>
<tr>
<td>Earlidew</td>
<td>Harris Seed</td>
<td>Honeydew</td>
<td>63,425</td>
<td>16,789</td>
<td>3.8</td>
<td>5.8</td>
<td>6.1</td>
<td>1.6</td>
<td>11.3</td>
</tr>
<tr>
<td>Athena</td>
<td>Syngenta</td>
<td>Eastern</td>
<td>62,844</td>
<td>14,157</td>
<td>4.5</td>
<td>6.5</td>
<td>6.7</td>
<td>1.8</td>
<td>10.8</td>
</tr>
<tr>
<td>Samoa</td>
<td>Harris Moran</td>
<td>LSL Harper</td>
<td>61,088</td>
<td>14,520</td>
<td>4.2</td>
<td>6.0</td>
<td>6.2</td>
<td>1.8</td>
<td>8.0</td>
</tr>
<tr>
<td>Infinite Gold</td>
<td>Sakata LSL</td>
<td>LSL Western</td>
<td>60,780</td>
<td>13,976</td>
<td>4.4</td>
<td>6.2</td>
<td>7.2</td>
<td>1.8</td>
<td>8.8</td>
</tr>
<tr>
<td>Tirreno</td>
<td>Enza Zaden</td>
<td>Eastern</td>
<td>60,621</td>
<td>15,246</td>
<td>4.0</td>
<td>6.3</td>
<td>6.6</td>
<td>1.9</td>
<td>9.5</td>
</tr>
<tr>
<td>Majus</td>
<td>Enza Zaden</td>
<td>Eastern</td>
<td>60,249</td>
<td>14,066</td>
<td>4.3</td>
<td>6.3</td>
<td>6.3</td>
<td>1.8</td>
<td>11.8</td>
</tr>
<tr>
<td>Amy</td>
<td>Harris Seed</td>
<td>Casaba</td>
<td>57,005</td>
<td>20,510</td>
<td>2.8</td>
<td>5.3</td>
<td>5.2</td>
<td>1.5</td>
<td>13.1</td>
</tr>
<tr>
<td>Aphrodite</td>
<td>Syngenta</td>
<td>Eastern</td>
<td>53,062</td>
<td>10,436</td>
<td>5.1</td>
<td>6.7</td>
<td>6.8</td>
<td>1.7</td>
<td>12.2</td>
</tr>
<tr>
<td>Atlantis</td>
<td>Sakata</td>
<td>Eastern</td>
<td>52,916</td>
<td>10,890</td>
<td>4.9</td>
<td>6.7</td>
<td>7.0</td>
<td>1.6</td>
<td>9.2</td>
</tr>
<tr>
<td>RML0609</td>
<td>Syngenta</td>
<td>Eastern</td>
<td>50,448</td>
<td>11,616</td>
<td>4.4</td>
<td>5.9</td>
<td>6.0</td>
<td>1.9</td>
<td>11.5</td>
</tr>
<tr>
<td>Sunbeam</td>
<td>Harris Moran</td>
<td>Yellow canary</td>
<td>49,913</td>
<td>16,154</td>
<td>3.2</td>
<td>4.9</td>
<td>6.3</td>
<td>1.5</td>
<td>10.1</td>
</tr>
<tr>
<td>Early Crenshaw</td>
<td>Burpee</td>
<td>Crenshaw</td>
<td>39,063</td>
<td>4,810</td>
<td>8.2</td>
<td>7.7</td>
<td>9.4</td>
<td>2.0</td>
<td>10.8</td>
</tr>
<tr>
<td>Versailles</td>
<td>Harris Moran</td>
<td>Charentais</td>
<td>20,051</td>
<td>8,440</td>
<td>2.4</td>
<td>5.0</td>
<td>4.8</td>
<td>1.5</td>
<td>14.4</td>
</tr>
<tr>
<td>Savor</td>
<td>Johnny’s</td>
<td>Charentais</td>
<td>9,819</td>
<td>6,171</td>
<td>1.6</td>
<td>4.7</td>
<td>4.7</td>
<td>1.3</td>
<td>12.3</td>
</tr>
<tr>
<td><strong>CV</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LSD (p ≤ 0.05)</td>
<td></td>
<td></td>
<td>13,214</td>
<td>2,941</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Evaluation of Insecticide Treatments in Cantaloupe

David G. Riley
Department of Entomology, University of Georgia, Tifton, GA 31793

Materials and Methods
Cantaloupe, ‘Planters Jumbo,’ seeds were direct planted into 1-row per 6-ft whitefly plastic mulch beds on 8 Aug. 2014 in 80 ft treatment plots. The test was maintained with standard cultural practices at the Lang-Rigdon Farm, Coastal Plain Experiment Station at Tifton, GA. An evaluation of foliar sprays was compared to a non-sprayed check. A total of 500 lb/a of 10-10-10 was applied at planting to Tifton pebbly clay loam field plots prior to bed formation and direct seeding. Irrigation was applied weekly with drip system if no rain. Spray application for treatments were made on 21 Aug. and 2, 12, 17, and 23 Sept. using a tractor mounted sprayer. For sprays there were five TX 18 hollow cone spray nozzles per row delivering 53 gallons per acre. Cantaloupe foliage was scouted on 4, 12, 18, and 25 Sept. and 3 Oct. Five leaves per plot were sampled per date to assess control of whitefly eggs and nymphs. Cantaloupe was harvested on 9 Oct. Fruit were categorized as marketable, pickleworm damage, or undetermined damaged (likely pickleworm), and the average weight were measured. Data were analyzed using GLM and LSD tests for separation of means (SAS Institute 1990).

Results
The predominant insects in the scouting reports were whiteflies and pickleworm, and both pests impacted yield (Table 3). IKI 3106 resulted in a significant reduction in whitefly nymphs and adults, but it took until Sept. 18 — after three applications had been made. Most of the direct damage to fruit was a result of pickleworm infestation (Table 2), and both rates of IKI 3106 significantly reduced total damaged fruit (Table 3).

Table 1. Treatment effects on whiteflies (WF) at the Lang Farm, Tifton, GA in 2014.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>WF Adults 18 Sept.</th>
<th>WF Adults 25 Sept.</th>
<th>WF Adults 3 Oct.</th>
<th>Avg. WF Adults</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Untreated Check</td>
<td>33.33a</td>
<td>5.92a</td>
<td>13.25a</td>
<td>18.37a</td>
</tr>
<tr>
<td>2. IKI 3106 11 fl oz/a</td>
<td>23.33b</td>
<td>11.29a</td>
<td>12.71a</td>
<td>17.72a</td>
</tr>
<tr>
<td>3. IKI 3106 16.4 fl oz/a</td>
<td>22.50b</td>
<td>2.92a</td>
<td>11.54a</td>
<td>14.02a</td>
</tr>
</tbody>
</table>

* Means within columns followed by the same letter are not significantly different (LSD, P < 0.05) with significant treatment effect (P < 0.05).

Table 2. Treatment effects on whitefly nymphs at the Lang Farm, Tifton, GA in 2014.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Untreated Check</td>
<td>18.25a</td>
<td>12.40a</td>
<td>27.95a</td>
<td>11.75a</td>
</tr>
<tr>
<td>2. IKI 3106 11 fl oz/a</td>
<td>13.65a</td>
<td>3.10b</td>
<td>22.00a</td>
<td>3.25a</td>
</tr>
<tr>
<td>3. IKI 3106 16.4 fl oz/a</td>
<td>8.60a</td>
<td>7.10ba</td>
<td>19.70a</td>
<td>2.25a</td>
</tr>
</tbody>
</table>

* Means within columns followed by the same letter are not significantly different (LSD, P < 0.05) with significant treatment effect (P < 0.05).

Table 3. Treatment effects on whiteflies at the Lang Farm, Tifton, GA, 9 Oct. 2014.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Good Wt.</th>
<th>Other Damaged Fruit</th>
<th>Percent Good Fruit</th>
<th>Percent Damaged Fruit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Untreated Check</td>
<td>47.65b</td>
<td>16.75a</td>
<td>0.63b</td>
<td>0.37a</td>
</tr>
<tr>
<td>2. IKI 3106 11 fl oz/a</td>
<td>67.98ba</td>
<td>3.50b</td>
<td>0.91a</td>
<td>0.09b</td>
</tr>
<tr>
<td>3. IKI 3106 16.4 fl oz/a</td>
<td>82.53a</td>
<td>2.75b</td>
<td>0.93a</td>
<td>0.07b</td>
</tr>
</tbody>
</table>

* Means within columns followed by the same letter are not significantly different (LSD, P < 0.05) with significant treatment effect (P < 0.05).
Squash and Zucchini Variety Trials: Spring and Fall 2014

Timothy Coolong
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Introduction

Georgia is consistently ranked at or near the top of summer squash production nationally. Combined, there were approximately 8,000 acres of yellow squash and zucchini grown in Georgia in the 2013 spring and fall growing seasons with a value of more than $50 million. Choosing the correct squash or zucchini variety requires a compromise between productivity, quality, color, disease resistance, spinelessness (if available) and market requirements. In order to provide current information for growers variety trials are necessary. This report details the results of spring and fall trials conducted in 2014.

Materials and Methods

This trial was located in Tifton, GA. Approximately 2-week old transplants were planted on 28 March and 18 Aug. 2014. Transplants were spaced on 12-inch in-row spacing (7,260 plants per acre) with rows spaced on 6-foot centers. There were 12-plants per plot and four plots per variety. Soils were fumigated when plastic was laid. Black TIF plastic was used in the spring and white TIF plastic was used for fall trials. There were 1,000 pounds of 5-10-15 fertilizer (Agrium-Rainbow) placed beneath the plastic mulch and 7-0-7 liquid fertilizer was applied weekly at 12 lb N/a per week starting one week after planting. Total for the season was 146 lb N/a. Herbicide between rows consisted of Dual II Magnum, Curbit, Valor, and Round Up. Pests were controlled with weekly fungicide sprays according to UGA recommendations (+ copper). Venom and Coragen were applied during growth. Twelve harvests were conducted in spring and fall. Squash graded into “fancy” (US No. 1) and “medium size” categories. Fancy squash weighed approximately 0.35 lb each, while medium fruit weighed approximately 0.65 lb each. Fruit were culled for misshapenness, virus symptoms, disease (choanephora rot), and poor color. Cull rates were high in fall primarily due to misshapen fruit. Cull rates escalated near the fifth harvest in the fall, remaining high until termination.

Results

Spring yields were higher for both squash and zucchini than in the fall. This was due to the higher cull rates in the fall, which were generally the result of virus damage. Virus damage was minimal except for Precious II and Gentry or misshapen fruit. Misshapen fruit were more prevalent in the fall. For yellow squash, Gentry was the highest yielder in both spring and fall, followed by Solstice. Respect was the highest yielding zucchini the fall and was attractive throughout. Reward also looked promising, but in both seasons poor germination limited the planting to a single replication. Yield data are presented as fruit per acre. Yield over time is presented as number of Fancy fruit per acre per harvest.

Table 1. Yellow squash yields for spring 2014 in Tifton, GA.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Total Yield</th>
<th>Fancy Yield</th>
<th>Medium Yield</th>
<th>Cull</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(fruit/a)^1</td>
<td>(fruit/a)^1</td>
<td>(fruit/a)^1</td>
<td>(%)^1</td>
</tr>
<tr>
<td>Gentry</td>
<td>120290 a</td>
<td>92900 a</td>
<td>27390 a</td>
<td>5.5 b</td>
</tr>
<tr>
<td>Solstice</td>
<td>108900 ab</td>
<td>84580 ab</td>
<td>24320 ab</td>
<td>7.1 ab</td>
</tr>
<tr>
<td>Precious II</td>
<td>99620 bc</td>
<td>76750 bc</td>
<td>22870 ab</td>
<td>9.5 a</td>
</tr>
<tr>
<td>Cosmos</td>
<td>97730 bc</td>
<td>67310 c</td>
<td>30420 ab</td>
<td>7.9 ab</td>
</tr>
<tr>
<td>Conqueror III</td>
<td>91480 bc</td>
<td>67700 c</td>
<td>23780 ab</td>
<td>5.7 b</td>
</tr>
<tr>
<td>Gold Star</td>
<td>88560 c</td>
<td>67620 c</td>
<td>20950 b</td>
<td>8.8 ab</td>
</tr>
<tr>
<td>Lioness</td>
<td>88390 c</td>
<td>62620 c</td>
<td>25780 ab</td>
<td>7.4 ab</td>
</tr>
<tr>
<td>Cheetah</td>
<td>86860 c</td>
<td>62200 c</td>
<td>24660 ab</td>
<td>7.4 ab</td>
</tr>
<tr>
<td>Enterprise</td>
<td>84780 c</td>
<td>62700 c</td>
<td>22080 ab</td>
<td>9.7 a</td>
</tr>
</tbody>
</table>

^1Yield based on average fancy fruit and medium fruit graded and counted. Yield determined by dividing the fruit harvested by the plot stand (12 plants) and multiplying by a plant population of 7,260 plants per acre. Twelve harvests were conducted. Due to conserving significant digits and rounding, total number of fruit may not be the exact sum of fancy and medium fruit.

^1Cull percentage based on number of cull fruit divided by total number of fruit harvested.
Table 2. Yellow squash yields for fall 2014 in Tifton, GA.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Total Yield</th>
<th>Fancy Yield</th>
<th>Medium Yield</th>
<th>Cull (%)</th>
<th>Reason for Culling</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(fruit/a)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gentry</td>
<td>93070 a</td>
<td>77940 a</td>
<td>15140 ab</td>
<td>17.2 ef</td>
<td>viral symptoms</td>
</tr>
<tr>
<td>Solstice</td>
<td>79780 b</td>
<td>61680 b</td>
<td>18100 ab</td>
<td>17.2 ef</td>
<td>shape</td>
</tr>
<tr>
<td>Conqueror III</td>
<td>78050 bc</td>
<td>58320 bc</td>
<td>19720 a</td>
<td>18.8 def</td>
<td>“sutures” on fruit</td>
</tr>
<tr>
<td>Cosmos</td>
<td>71900 bcd</td>
<td>56550 bc</td>
<td>15350 ab</td>
<td>27.9 b</td>
<td>shape</td>
</tr>
<tr>
<td>Gold Star</td>
<td>65770 cde</td>
<td>53390 cde</td>
<td>13380 b</td>
<td>13.2 f</td>
<td>sponginess in tip</td>
</tr>
<tr>
<td>Enterprise</td>
<td>63370 de</td>
<td>79710 cde</td>
<td>13670 b</td>
<td>25.1 bcd</td>
<td>poor shape, ridging</td>
</tr>
<tr>
<td>Lioness</td>
<td>61710 de</td>
<td>46590 de</td>
<td>15130 ab</td>
<td>25.9 bc</td>
<td>shape – ridging, significant crooking</td>
</tr>
<tr>
<td>Cheetah</td>
<td>54460 e</td>
<td>40100 ef</td>
<td>14370 ab</td>
<td>20.0 cde</td>
<td>shape</td>
</tr>
<tr>
<td>Precious II</td>
<td>40980 f</td>
<td>33590 f</td>
<td>7380 c</td>
<td>49.9 a</td>
<td>significant viral symptoms</td>
</tr>
</tbody>
</table>

*Yield based on average fancy fruit and medium fruit graded and counted. Yield determined by dividing the fruit harvested by the plot stand (12 plants) and multiplying by a plant population of 7,260 plants per acre. Twelve harvests were conducted. Due to conserving significant digits and rounding, total number of fruit may not be the exact sum of fancy and medium fruit.

*Cull percentage based on number of cull fruit divided by total number of fruit harvested.

*Culls were higher in fall than in spring, consistent reasons for culling were noted.

Table 3. Zucchini yields for spring 2014 in Tifton, GA.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Total Yield</th>
<th>Fancy Yield</th>
<th>Medium Yield</th>
<th>Cull (%)</th>
<th>Reason for Culling</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(fruit/a)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SV6009YG</td>
<td>77890 a</td>
<td>48200 a</td>
<td>29700 a</td>
<td>8.3 ab</td>
<td></td>
</tr>
<tr>
<td>Respect</td>
<td>67090 ab</td>
<td>45090 a</td>
<td>22000 ab</td>
<td>12.8 a</td>
<td></td>
</tr>
<tr>
<td>Justice III</td>
<td>55960 b</td>
<td>37850 a</td>
<td>18110 bc</td>
<td>11.1 a</td>
<td></td>
</tr>
<tr>
<td>Esteem</td>
<td>37030 c</td>
<td>26140 b</td>
<td>10890 c</td>
<td>1.9 c</td>
<td></td>
</tr>
</tbody>
</table>

*Yield based on average fancy fruit and medium fruit graded and counted. Yield determined by dividing the fruit harvested by the plot stand (12 plants) and multiplying by a plant population of 7,260 plants per acre. Twelve harvests were conducted. Due to conserving significant digits and rounding, total number of fruit may not be the exact sum of fancy and medium fruit.

*Cull percentage based on number of cull fruit divided by total number of fruit harvested.

Table 4. Zucchini yields for fall 2014 in Tifton, GA.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Total Yield</th>
<th>Fancy Yield</th>
<th>Medium Yield</th>
<th>Cull (%)</th>
<th>Reason for Culling</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(fruit/a)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Respect</td>
<td>66930 a</td>
<td>47440 a</td>
<td>19500 a</td>
<td>12.9 d</td>
<td>some bulbing at tip</td>
</tr>
<tr>
<td>SV6009YG</td>
<td>58900 b</td>
<td>40604 b</td>
<td>17490 ab</td>
<td>15.0 cd</td>
<td>some bulbing at tip</td>
</tr>
<tr>
<td>Payload</td>
<td>57120 b</td>
<td>42280 ab</td>
<td>14850 abc</td>
<td>18.1 bcd</td>
<td></td>
</tr>
<tr>
<td>Paycheck</td>
<td>48400 c</td>
<td>32370 c</td>
<td>16030 ab</td>
<td>22.0 bc</td>
<td>ridging, pale late</td>
</tr>
<tr>
<td>Esteem</td>
<td>41700 cde</td>
<td>28350 c</td>
<td>13350 bc</td>
<td>21.0 bc</td>
<td></td>
</tr>
<tr>
<td>Justice III</td>
<td>39630 def</td>
<td>26620 dc</td>
<td>13010 bc</td>
<td>34.3 a</td>
<td>pointed tip, shape</td>
</tr>
<tr>
<td>Spineless King</td>
<td>34580 ef</td>
<td>19340 de</td>
<td>15250 abc</td>
<td>35.6 a</td>
<td>shape (ridging), curving</td>
</tr>
<tr>
<td>Spineless Beauty</td>
<td>32110 f</td>
<td>21330 de</td>
<td>10780 c</td>
<td>27.9 b</td>
<td>shape (ridging), curving, pale late</td>
</tr>
<tr>
<td>Precious II</td>
<td>40980 f</td>
<td>33590 f</td>
<td>7380 c</td>
<td>49.9 a</td>
<td>significant viral symptoms</td>
</tr>
</tbody>
</table>

*The variety Reward was also included in this trial but due to seed issues, only one replication was included. Therefore, the data was not included in the statistical analysis.

*Yield based on average fancy fruit and medium fruit graded and counted. Yield determined by dividing the fruit harvested by the plot stand (12 plants) and multiplying by a plant population of 7,260 plants per acre. Twelve harvests were conducted. Due to conserving significant digits and rounding, total number of fruit may not be the exact sum of fancy and medium fruit.

*Cull percentage based on number of cull fruit divided by total number of fruit harvested.

*Culls were higher in fall than in spring, consistent reasons for culling were noted.

Continued on next page.
Table 5. Plant characteristics for squash and zucchini varieties grown in fall 2014.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Spines (1-9)</th>
<th>Plant Habit (1-5)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Yellow Squash</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cheetah</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Conqueror III</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Cosmos</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Enterprise</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Gentry</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Gold Star</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Lioness</td>
<td>5</td>
<td>4.5</td>
</tr>
<tr>
<td>Precious II</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Solstice</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td><strong>Zucchini</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Esteem</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>Justice III</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>Paycheck</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>Payload</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>Respect</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Reward</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Spineless Beauty</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>Spineless King</td>
<td>9</td>
<td>3.5</td>
</tr>
<tr>
<td>SV6009YG</td>
<td>7</td>
<td>2</td>
</tr>
</tbody>
</table>

*Spine rankings on a 1-9 scale where 1 = extremely spiny and 9 = spineless and smooth.

*Plant habit based on a 1-5 scale where 1 = upright and compact, 3 = average semi-vine, and 5 = strongly vining.*
Efficacy of Insecticides for Management of Silverleaf in Fall Squash
Alton N. Sparks, Jr.
Department of Entomology, University of Georgia, Tifton, GA 31793

Materials and Methods

Three tests were conducted to evaluate efficacy of insecticides for management of silverleaf in squash. One test evaluated soil-applied systemic insecticides, one evaluated foliar insecticides, and one compared soil and foliar applications of a new insecticide (Sivanto) to current standards.

Crop: Squash (var. Lioness)

Targeted pests: Silverleaf whitefly

Location: The University of Georgia, Tifton Vegetable Park, Tifton Campus, Tifton, GA.

Experimental design: RCBD with four replications

Establishment: Direct seeded on 16 Sept. 2014

Plot size: One row by 25 feet in all three tests. The soil-applied test was planted with two rows on six foot beds (no concerns for drift with soil applications). Both tests with foliar applications were planted with one row on a 6-foot bed (but treated as a 36-inch row).

Treatments:
- Soil applied insecticide test. Non-Treated Check, Admire Pro at 10.5 oz/a, Venom at 6 oz/a, Coragen at 5 oz/a, Verimark at 13.5 oz/a, Sivanto at 28 oz/a.
- Foliar insecticide test (all insecticide treatments were tank mixed with Dyne-Amic at 0.25% v/v). Non-Treated Check, Venom at 4 oz/a, Courier SC at 13.6 oz/a, Coragen at 7 oz/a, Knack at 10 oz/a, Oberon at 8.5 oz/a, Movento at 5 oz/a, Closer at 4.5 oz/a, Exirel at 13.5 oz/a, Sivanto at 12 oz/a.
- Sivanto test. Non-Treated Check; Foliar spray: Sivanto at 7 and 12 oz/a, Coragen at 3.5 oz/a; and Soil drench: Sivanto at 21 and 28 oz/a, Coragen at 5 oz/a.

Application methods:
- Foliar applications: CO2 pressurized backpack sprayer (60 psi) at 40 gal/a with three hollow-cone nozzles per row (one over-the-top, two on drops).
- Soil applications: applied as a row drench roughly 4-inch band) in 3,000 ml per plot.

Application dates: (across all three tests)
- Soil applications: 18 Sept. 2014
- Foliar applications: 2 and 8 Oct. 2014

Data collection: Silverleaf ratings (particularly light ratings) were difficult as the variety of squash grown exhibited patchy leaf discoloration similar to zucchini squash. Plots were visually examined and rated for silverleaf on the following scale: 0 = none, 1 = light (difficult to determine in this variety), 2 = moderate (requires additional treatment), 3 = severe. Statistical analyses. PROC ANOVA in SAS Enterprise Guide (P < 0.05); LSD (P = 0.05).

Results

Silverleaf developed much slower in these tests than expected from prior experience with no silverleaf noted on 6 Oct. (20 days after planting). The variety grown may have some resistance to silverleaf symptoms. I caution against interpreting the length of residual control from these tests, but I do feel comfortable with differences among insecticides (e.g., I would feel comfortable saying that product X lasted longer than product Y if the data indicates such; I would not feel comfortable saying product X will provide 42 days of activity even if the data from these tests indicated such).

Soil applied test. Admire Pro was not distinguishable from the Check in this test; however, the first rating was conducted at 32 days after treatment. The remaining products performed similarly, with Venom and Verimark trending toward slightly longer residual control (remained below a rating of 2 for two to three days longer).

Foliar insecticide test. All of the insecticide treatments initially suppressed silverleaf as compared to the Non-Treated Check. Exirel provided the longest residual control followed closely by Coragen, which was followed by Oberon, Sivanto, Venom, and Knack. Closer, Movento and Courier were showing moderate silverleaf symptoms on the first rating date.

Sivanto Test. Within the drench treatments, Coragen and Sivanto performed similarly; however, only the higher rate of Sivanto was significantly different on the first two rating dates. Thus, Sivanto showed a slight rate effect with the higher rate lasting slightly longer. Within the foliar application treatments, Coragen and Sivanto performed similarly with suppression of silverleaf through the end of the experiment. A slight rate effect is suggested in the Sivanto data with the higher rate performing similar to Coragen.
**Table 1.** Silverleaf ratings, soil applied insecticide test in fall squash, UGA Tifton Vegetable Park, Tifton, GA, 2014.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Silverleaf Rating (0 to 3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check</td>
<td></td>
</tr>
<tr>
<td>Admire Pro</td>
<td>2.00 a</td>
</tr>
<tr>
<td>Coragen</td>
<td>1.00 ab</td>
</tr>
<tr>
<td>Sivanto</td>
<td>0.00 b</td>
</tr>
<tr>
<td>Verimark</td>
<td>0.50 b</td>
</tr>
<tr>
<td>Venom</td>
<td>0.00 b</td>
</tr>
</tbody>
</table>

Means within the same column followed by different letters are significantly different according to Fisher’s Least Significant Difference Test (P < 0.05)

*DADr = days after drench application.

**Table 2.** Silverleaf ratings, foliar applied insecticide test in fall squash, UGA Tifton Vegetable Park, Tifton, GA, 2014.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Silverleaf Rating (0 to 3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check</td>
<td>3.00 a</td>
</tr>
<tr>
<td>Courier</td>
<td>2.00 b</td>
</tr>
<tr>
<td>Movento</td>
<td>1.75 b</td>
</tr>
<tr>
<td>Closer</td>
<td>1.75 b</td>
</tr>
<tr>
<td>Knack</td>
<td>0.75 c</td>
</tr>
<tr>
<td>Oberon</td>
<td>0.00 d</td>
</tr>
<tr>
<td>Sivanto</td>
<td>0.00 d</td>
</tr>
<tr>
<td>Venom</td>
<td>0.00 d</td>
</tr>
<tr>
<td>Coragen</td>
<td>0.00 d</td>
</tr>
<tr>
<td>Exirel</td>
<td>0.00 d</td>
</tr>
</tbody>
</table>

Means within the same column followed by different letters are significantly different according to Fisher’s Least Significant Difference Test (P < 0.05)

*DAT-2 = days after second foliar treatment.

**Table 3.** Silverleaf ratings, Sivanto test in fall squash, UGA Tifton Vegetable Park, Tifton, GA, 2014.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Silverleaf Rating (0 to 3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check</td>
<td>3.00 a</td>
</tr>
<tr>
<td>Coragen drench 5oz</td>
<td>2.00 ab</td>
</tr>
<tr>
<td>Sivanto drench 21oz</td>
<td>2.25 ab</td>
</tr>
<tr>
<td>Sivanto drench 28oz</td>
<td>1.50 b</td>
</tr>
<tr>
<td>Coragen foliar 3.5oz</td>
<td>0.00 c</td>
</tr>
<tr>
<td>Sivanto foliar 7oz</td>
<td>0.00 c</td>
</tr>
<tr>
<td>Sivanto foliar 12oz</td>
<td>0.00 c</td>
</tr>
</tbody>
</table>

Means within the same column followed by different letters are significantly different according to Fisher’s Least Significant Difference Test (P < 0.05)

*DAT-2 = days after second foliar treatment.

**DADr = days after drench application.**
Evaluation of Insecticide Treatments in Squash: Spring 2014

David G. Riley
Department of Entomology, University of Georgia, Tifton, GA 31793

Materials and Methods

Yellow crook-neck squash were direct seeded into 2-row per 6-ft bare ground beds on 7 May 2014 in 50 ft treatment plots. The test was maintained with standard cultural practices at the TVP, Coastal Plain Experiment Station at Tifton, GA. An evaluation of drench treatments was compared to foliar sprays. A total of 500 lb/a of 10-10-10 was applied at planting to Tift pebbly clay loam field plots prior to bed formation and direct seeding. Irrigation was applied weekly with drip system if no rain. Spray application for treatments were made on 23 May, 28 May, and 3 June using a tractor mounted sprayer. For sprays there were three TX 18 hollow cone spray nozzles per row delivering 53 gallons per acre.

Yellow squash was scouted on 20 May, 28 May, 30 May, and 4 June, but no silverleaf rating was required due to low whiteflies. Six leaf samples were taken to assess control of thrips and aphids.

Squash was harvested the whole plot on 13, 17, and 20 June. Fruit were categorized as marketable, pickleworm damage, or virus damaged and the average weight was measured. Squash fruit color ratings for whitefly induced lightening were also reported with 0 = no fruit 1 = all white colored fruit, 2 = mixed white and yellow fruit, and 3 = normal yellow colored fruit.

Data were analyzed using GLM and LSD tests for separation of means (SAS Institute 1990).

Results

The predominant insects in the scouting reports were thrips (Frankliniella spp.), predominantly flower thrips and a few melon aphids (Tables 1 and 2). There were no whiteflies in this test as indicated by the lack of silver-leaf symptoms and no effect on fruit color (Table 3). Pryifluquinazon and IKI 3106 significantly reduced aphids on one date. Flower thrips were significantly reduced by the IKI 3106 treatment on a few dates. There was a treatment effect on squash yield only on the first harvest, likely due to thrips damage since only IKI 3106 significantly improved yield over the check. Aphids and/or mosaic viruses were not present in sufficient frequency to have any impact on squash yield.

Continued on next page.

Table 1. Treatment effects on melon aphids and thrips at the Lang Farm, Tifton, GA, in 2014.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Aphids 28 May</th>
<th>Thrips 28 May</th>
<th>Thrips 30 May</th>
<th>Aphids 04 June</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Untreated Check</td>
<td>0.21a*</td>
<td>7.21ba</td>
<td>3.75bac</td>
<td>0.29a</td>
</tr>
<tr>
<td>2. Pryifluquinazon 20SC 2.4 fl oz/a</td>
<td>0.00b</td>
<td>7.58ba</td>
<td>4.67ba</td>
<td>0.00a</td>
</tr>
<tr>
<td>3. Pryifluquinazon 20SC 3.2 fl oz/a</td>
<td>0.04ba</td>
<td>8.54a</td>
<td>5.63a</td>
<td>0.13a</td>
</tr>
<tr>
<td>4. IKI 3106 11 fl oz/a</td>
<td>0.00b</td>
<td>2.96d</td>
<td>1.88dc</td>
<td>0.21a</td>
</tr>
<tr>
<td>5. IKI 3106 16.4 fl oz/a</td>
<td>0.17ba</td>
<td>3.50dc</td>
<td>1.63d</td>
<td>0.13a</td>
</tr>
<tr>
<td>6. Beleaf 50SG 2.8 oz/a</td>
<td>0.04ba</td>
<td>5.71bc</td>
<td>2.75bdc</td>
<td>0.25a</td>
</tr>
</tbody>
</table>

* Means within columns followed by the same letter are not significantly different (LSD, P < 0.05) with significant treatment effect (P < 0.05) unless indicated by “*” (P < 0.1).
Table 2. Treatment effects on thrips and the first squash harvest at Tifton, GA, in 2014.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Thrips 04 June</th>
<th>Thrips Overall</th>
<th>Total Fruit 13 June</th>
<th>Clean Fruit 13 June</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Untreated Check</td>
<td>0.42b&quot;</td>
<td>2.84bac&quot;</td>
<td>15.8bc</td>
<td>15.8bc</td>
</tr>
<tr>
<td>2. Pryifluquinazon 20SC 2.4 fl oz/a</td>
<td>1.13a</td>
<td>3.36ba</td>
<td>18.3bc</td>
<td>18.5bc</td>
</tr>
<tr>
<td>3. Pryifluquinazon 20SC 3.2 fl oz/a</td>
<td>0.63ba</td>
<td>3.72a</td>
<td>12.8c</td>
<td>12.5c</td>
</tr>
<tr>
<td>4. IKI 3106 11 fl oz/a</td>
<td>0.25b</td>
<td>1.29c</td>
<td>33.3a</td>
<td>33.3a</td>
</tr>
<tr>
<td>5. IKI 3106 16.4 fl oz/a</td>
<td>0.42b</td>
<td>1.41bc</td>
<td>28.5ba</td>
<td>28.8ba</td>
</tr>
<tr>
<td>6. Beleaf 50SG 2.8 oz/a</td>
<td>0.63ba</td>
<td>2.29bac</td>
<td>22.0bac</td>
<td>22.0bac</td>
</tr>
</tbody>
</table>

* Means within columns followed by the same letter are not significantly different (LSD, P < 0.05) with significant treatment effect (P < 0.05) unless indicated by "m" (P < 0.1).

Table 3. Treatment effects on total squash yield at the Lang Farm, Tifton, GA, in 2014.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Color 20 June</th>
<th>Total Clean No.</th>
<th>Total Clean Wt.</th>
<th>Damaged Fruit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Untreated Check</td>
<td>1.03a</td>
<td>186.0a</td>
<td>60.9a</td>
<td>1.00a</td>
</tr>
<tr>
<td>2. Pryifluquinazon 20SC 2.4 fl oz/a</td>
<td>1.00a</td>
<td>236.3a</td>
<td>87.8a</td>
<td>2.75a</td>
</tr>
<tr>
<td>3. Pryifluquinazon 20SC 3.2 fl oz/a</td>
<td>1.00a</td>
<td>224.0a</td>
<td>74.4a</td>
<td>2.00a</td>
</tr>
<tr>
<td>4. IKI 3106 11 fl oz/a</td>
<td>1.00a</td>
<td>239.3a</td>
<td>79.0a</td>
<td>2.75a</td>
</tr>
<tr>
<td>5. IKI 3106 16.4 fl oz/a</td>
<td>1.00a</td>
<td>264.3a</td>
<td>95.9a</td>
<td>2.75a</td>
</tr>
<tr>
<td>6. Beleaf 50SG 2.8 oz/a</td>
<td>1.00a</td>
<td>186.8a</td>
<td>60.9a</td>
<td>3.25a</td>
</tr>
</tbody>
</table>

* Means within columns followed by the same letter are not significantly different (LSD, P < 0.05) with significant treatment effect (P < 0.05).
Evaluation of Insecticide Treatments in Squash: Fall 2014
David G. Riley
Department of Entomology, University of Georgia, Tifton, GA 31793

Materials and Methods
Yellow squash, hybrid Cougar, were direct seeded (only Treatment 2 was transplanted) into one row per 6-ft bare ground beds on 27 and 28 Aug., in 50-ft treatment plots. The test was maintained with standard cultural practices at the Lang-Rigdon Farm, Coastal Plain Experiment Station at Tifton, GA. A total of 500 lb/a of 10-10-10 was applied at planting to Tift pebbly clay loam field plots prior to bed formation and direct seeding. Irrigation was applied weekly with drip system if no rain.

An evaluation of drench treatments was compared to foliar sprays. For Treatments 2 and 3, a drench application was made on 26 Aug. For Treatments 11, 12, and 13, a drench was applied on 28 Aug. For Treatments 4 and 5, a drench was applied on 5 Sept. Spray applications for treatments 6, 7, 8, 9, and 10 were made on 5, 12, and 17 Sept. using a tractor mounted sprayer. For sprays there were five TX 18 hollow cone spray nozzles per row delivering 53 gallons per acre.

Yellow squash was scouted on 2, 12, 18, and 25 Sept. and 2 Oct. and a whole plot per plant silver-leaf rating was done on 18 and 25 Sept. and 2 Oct. Five leaf samples were taken to assess control of whitefly and aphid nymphs per square inch of underside leaf surface.

Squash was harvested on 25 and 30 Sept. and 7 Oct. Fruit were categorized as clean/marketable or damaged, and the average weight was measured. Squash fruit color ratings for whitefly induced lightening were also reported with 0 = no fruit, 1 = all white colored fruit, 2 = mixed white and yellow fruit, and 3 = normal yellow colored fruit (not reported in tables because of lack of significance). Data were analyzed using GLM and LSD tests for separation of means (SAS Institute 1990).

Results
As expected, per-leaf adult whitefly counts (Table 1) have very little value in assessing the overall impact of whitefly insecticides on squash yield and quality. We detected a reduction in adult numbers only on the first sampling date, 12 Sept., and even that was variable across treatments. The silver-leaf ratings (Table 2) and whitefly nymph counts (Tables 3 and 4) were more aligned with effects on squash yield (Table 5), with the exception of Treatment 2. The transplants used only in Treatment 2 did not perform as well as direct seeded squash in the rest of the experimental treatments (Table 5).

Two of the best treatments in terms of yield (greater than 50 pounds of clean squash weight per plot overall) were Treatment 5 (Sivanto 28 oz/a drench) and Treatment 8 (Venom 3 oz/a spray) (Table 5). They also had some of the lowest silver-leaf ratings overall (Table 2) and overall whitefly nymph counts (Table 4). Treatment 11 (Verimark 13.5 fl oz in-furrow) had the highest yield response (Table 5), but did not reduce the whitefly nymph count as well as Treatments 5 and 8 (Table 4). Treatments 4-13 all significantly reduced silver-leaf compared to both the check and the reduced seedling-only Sivanto (Treatments 2 and 3).

By 25 Sept. all trace of the seed drench for Treatment 3 was gone in terms of silver-leaf rating, but the same drench that was applied to the transplant root ball before transplanting in Treatment 2 still exhibited a slight effect on the same date (Table 2). Even so, it is important to note that the reduced Sivanto rate of 0.975 ml/1,000 transplants already shows some increased silver-leaf symptoms by 18 Sept., approximately three weeks after treatment compared to the in-field full Sivanto rate soil drench. Also, it is important to note that the soil-surface, banded-application of Verimark tended not perform as well as the drench treatment, indicating that the soil barrier between the seed and the band and/or the addition of drench water affected Verimark efficacy.

Continued on next page.
Table 1. Treatment effects on predatory arthropods, cucumber beetles, and whitefly adults at the Lang Farm, Tifton, GA, in 2014.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Untreated Check</td>
<td>79.17a</td>
<td>73.75bdac</td>
<td>1.00b</td>
<td>14.88b</td>
<td>0.25a</td>
<td>35.18a</td>
<td>0.00b</td>
</tr>
<tr>
<td>2. Sivanto 0.975 ml/1,000 transplants(^1)</td>
<td>58.33ebdac</td>
<td>89.17a</td>
<td>0.25b</td>
<td>27.45a</td>
<td>0.00a</td>
<td>37.82a</td>
<td>0.05b</td>
</tr>
<tr>
<td>3. Sivanto 0.975 ml/1,000 seed holes(^1)</td>
<td>65.42bac</td>
<td>86.25ba</td>
<td>0.25b</td>
<td>8.62b</td>
<td>0.25a</td>
<td>33.95a</td>
<td>0.00b</td>
</tr>
<tr>
<td>4. Sivanto 21 oz/a(^1)</td>
<td>61.67bac</td>
<td>58.75dc</td>
<td>0.25b</td>
<td>6.83b</td>
<td>1.25a</td>
<td>27.26a</td>
<td>0.05b</td>
</tr>
<tr>
<td>5. Sivanto 28 oz/a(^1)</td>
<td>51.67ebdac</td>
<td>52.92d</td>
<td>0.25b</td>
<td>11.45b</td>
<td>0.50a</td>
<td>24.71a</td>
<td>0.00b</td>
</tr>
<tr>
<td>6. Sivanto 12 oz/a(^1)</td>
<td>30.00e</td>
<td>50.00d</td>
<td>0.00b</td>
<td>6.92b</td>
<td>0.50a</td>
<td>18.79a</td>
<td>0.00b</td>
</tr>
<tr>
<td>7. Sivanto 7 oz/a(^1)</td>
<td>32.08ed</td>
<td>50.00d</td>
<td>0.00b</td>
<td>6.71b</td>
<td>0.25a</td>
<td>19.11a</td>
<td>0.05b</td>
</tr>
<tr>
<td>8. Venom WG 3 oz/a(^1)</td>
<td>32.08ed</td>
<td>50.00d</td>
<td>0.50b</td>
<td>9.08b</td>
<td>0.75a</td>
<td>19.80a</td>
<td>0.00b</td>
</tr>
<tr>
<td>9. Movento 240 SC 5 fl oz/a(^1)</td>
<td>48.33ebdc</td>
<td>80.42bac</td>
<td>0.50b</td>
<td>6.04b</td>
<td>0.00a</td>
<td>28.45a</td>
<td>0.00b</td>
</tr>
<tr>
<td>10. Exirel 0.83 SE 13.5 fl oz/a(^1)</td>
<td>40.42edc</td>
<td>61.67bdc</td>
<td>0.25b</td>
<td>10.92b</td>
<td>0.25a</td>
<td>24.03a</td>
<td>0.10b</td>
</tr>
<tr>
<td>11. Verimark 13.5 fl oz/a – in furrow(^1)</td>
<td>73.33ba</td>
<td>88.33a</td>
<td>0.50b</td>
<td>9.71b</td>
<td>0.75a</td>
<td>35.90a</td>
<td>0.20a</td>
</tr>
<tr>
<td>12. Verimark 13.5 fl oz/a – banded(^1)</td>
<td>59.58bdac</td>
<td>89.17a</td>
<td>0.00b</td>
<td>13.54b</td>
<td>0.75a</td>
<td>33.69a</td>
<td>0.00b</td>
</tr>
<tr>
<td>13. Verimark 13.5 fl oz/a – soil drench(^1)</td>
<td>54.58ebdac</td>
<td>83.33bac</td>
<td>1.50a</td>
<td>13.08b</td>
<td>1.00a</td>
<td>32.44a</td>
<td>0.00b</td>
</tr>
</tbody>
</table>

*Means within columns followed by the same letter are not significantly different (LSD, P < 0.05).
\(^1\)Treatments 2,3,4,5,13 were drench applications.
\(^2\)Treatments 6,7,8,9,10 were spray applications.
\(^3\)Treatments 11 and 12 were single banded spray applications.

Table 2. Treatment effects on whitefly nymph-induced silver-leaf symptoms on squash at the Lang Farm, Tifton, GA, in 2014.

<table>
<thead>
<tr>
<th>Treatment - rate per acre</th>
<th>SQUASH Silver-Leaf Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Untreated Check</td>
<td>79.17a</td>
</tr>
<tr>
<td>2. Sivanto 0.975 ml/1,000 transplants(^1)</td>
<td>58.33ebdac</td>
</tr>
<tr>
<td>3. Sivanto 0.975 ml/1,000 seed holes(^1)</td>
<td>65.42bac</td>
</tr>
<tr>
<td>4. Sivanto 21 oz/a(^1)</td>
<td>61.67bac</td>
</tr>
<tr>
<td>5. Sivanto 28 oz/a(^1)</td>
<td>51.67ebdac</td>
</tr>
<tr>
<td>6. Sivanto 12 oz/a(^1)</td>
<td>30.00e</td>
</tr>
<tr>
<td>7. Sivanto 7 oz/a(^1)</td>
<td>32.08ed</td>
</tr>
<tr>
<td>8. Venom WG 3 oz/a(^1)</td>
<td>32.08ed</td>
</tr>
<tr>
<td>9. Movento 240 SC 5 fl oz/a(^1)</td>
<td>48.33ebdc</td>
</tr>
<tr>
<td>10. Exirel 0.83 SE 13.5 fl oz/a(^1)</td>
<td>40.42edc</td>
</tr>
<tr>
<td>11. Verimark 13.5 fl oz/a – in furrow(^1)</td>
<td>73.33ba</td>
</tr>
<tr>
<td>12. Verimark 13.5 fl oz/a – banded(^1)</td>
<td>59.58bdac</td>
</tr>
<tr>
<td>13. Verimark 13.5 fl oz/a – soil drench(^1)</td>
<td>54.58ebdac</td>
</tr>
</tbody>
</table>

*Means within columns followed by the same letter are not significantly different (LSD, P < 0.05).
\(^1\)Treatments 2,3,4,5,13 were drench applications.
\(^2\)Treatments 6,7,8,9,10 were spray applications.
\(^3\)Treatments 11 and 12 were single banded spray applications.
Table 3. Treatment effects on whitefly immature stages per square inch of squash leaf at the Lang Farm, Tifton, GA, in 2014.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Untreated Check</td>
<td>223.00c</td>
<td>162.85a</td>
<td>15.70a</td>
<td>178.55a</td>
<td>214.20bac</td>
<td>287.30ba</td>
<td>28.10a</td>
</tr>
<tr>
<td>2. Sivanto 0.975 ml/1,000 transplants¹</td>
<td>373.25ba</td>
<td>80.10bc</td>
<td>3.10b</td>
<td>83.20bcd</td>
<td>300.05ba</td>
<td>270.10bac</td>
<td>5.75b</td>
</tr>
<tr>
<td>3. Sivanto 0.975 ml/1,000 seed holes¹</td>
<td>421.70a</td>
<td>194.05a</td>
<td>5.50b</td>
<td>199.55a</td>
<td>347.80a</td>
<td>438.1a</td>
<td>23.10a</td>
</tr>
<tr>
<td>4. Sivanto 21 oz/a¹</td>
<td>93.40c</td>
<td>54.75c</td>
<td>1.05b</td>
<td>55.80bcd</td>
<td>102.60c</td>
<td>90.5bd</td>
<td>0.30b</td>
</tr>
<tr>
<td>5. Sivanto 28 oz/a¹</td>
<td>100.25c</td>
<td>32.05cd</td>
<td>0.55b</td>
<td>32.60cd</td>
<td>61.40d</td>
<td>57.9dc</td>
<td>4.00b</td>
</tr>
<tr>
<td>6. Sivanto 12 oz/a¹</td>
<td>118.20c</td>
<td>31.55cd</td>
<td>0.05b</td>
<td>31.60cd</td>
<td>72.10dc</td>
<td>85.3bd</td>
<td>2.05b</td>
</tr>
<tr>
<td>7. Sivanto 7 oz/a¹</td>
<td>103.50c</td>
<td>53.80c</td>
<td>0.00b</td>
<td>53.80c</td>
<td>82.75dc</td>
<td>75.0bd</td>
<td>1.95b</td>
</tr>
<tr>
<td>8. Venom WG 3 oz/a¹</td>
<td>117.45c</td>
<td>86.65cb</td>
<td>0.05b</td>
<td>86.70c</td>
<td>58.35d</td>
<td>61.4dc</td>
<td>4.85b</td>
</tr>
<tr>
<td>9. Movento 240 SC 5 fl oz/a¹</td>
<td>128.30c</td>
<td>90.95b</td>
<td>3.20b</td>
<td>94.15b</td>
<td>130.65c</td>
<td>189.4bdc</td>
<td>3.75b</td>
</tr>
<tr>
<td>10. Exirel 0.83 SE 13.5 fl oz/a¹</td>
<td>96.80c</td>
<td>26.45d</td>
<td>0.00b</td>
<td>26.45d</td>
<td>86.50c</td>
<td>52.3d</td>
<td>0.10b</td>
</tr>
<tr>
<td>11. Verimark 13.5 fl oz/a – in furrow³</td>
<td>119.70c</td>
<td>66.35c</td>
<td>0.10b</td>
<td>66.45c</td>
<td>151.75c</td>
<td>217.1bc</td>
<td>11.95ba</td>
</tr>
<tr>
<td>12. Verimark 13.5 fl oz/a – banded³</td>
<td>224.40bc</td>
<td>91.65a</td>
<td>0.00b</td>
<td>91.65c</td>
<td>198.50bdc</td>
<td>145.3bc</td>
<td>1.80b</td>
</tr>
<tr>
<td>13. Verimark 13.5 fl oz/a – soil drench³</td>
<td>110.10c</td>
<td>49.35c</td>
<td>0.00b</td>
<td>49.35c</td>
<td>71.50dc</td>
<td>67.0dc</td>
<td>3.15b</td>
</tr>
</tbody>
</table>

*Means within columns followed by the same letter are not significantly different (LSD, P < 0.05).
¹Treatments 2,3,4,5,13 were drench applications. ²Treatments 6,7,8,9,10 were spray applications. ³Treatments 11 and 12 were single banded spray applications.

Table 4. Treatment effects on immature whitefly stage at the Lang Farm, Tifton, GA in 2014 (cont.).

<table>
<thead>
<tr>
<th>Treatment - rate per acre</th>
<th>WF Sm. Nymphs 02 Oct.</th>
<th>WF Sm. Nymphs 07 Oct.</th>
<th>WF All Nymphs 07 Oct.</th>
<th>WF Eggs Overall</th>
<th>WF Sm. Nymphs Overall</th>
<th>WF Lg. Nymphs Overall</th>
<th>WF All Nymphs Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Untreated Check</td>
<td>115.45bdec</td>
<td>34.60bdac</td>
<td>48.85bdc</td>
<td>136.02bc</td>
<td>127.68ba</td>
<td>17.10ba</td>
<td>144.78b</td>
</tr>
<tr>
<td>2. Sivanto 0.975 ml/1,000 transplants¹</td>
<td>138.6bac</td>
<td>57.85a</td>
<td>98.30a</td>
<td>203.85a</td>
<td>115.44bc</td>
<td>13.33bc</td>
<td>128.77cb</td>
</tr>
<tr>
<td>3. Sivanto 0.975 ml/1,000 seed holes¹</td>
<td>207.85a</td>
<td>48.20a</td>
<td>74.50ba</td>
<td>221.33a</td>
<td>186.19a</td>
<td>23.34a</td>
<td>209.53a</td>
</tr>
<tr>
<td>4. Sivanto 21 oz/a¹</td>
<td>64.90dec</td>
<td>13.50dc</td>
<td>14.55d</td>
<td>70.51d</td>
<td>50.82fed</td>
<td>2.189d</td>
<td>53.01ed</td>
</tr>
<tr>
<td>5. Sivanto 28 oz/a¹</td>
<td>48.45e</td>
<td>15.20bdc</td>
<td>19.05d</td>
<td>59.92d</td>
<td>33.01f</td>
<td>2.91d</td>
<td>35.92e</td>
</tr>
<tr>
<td>6. Sivanto 12 oz/a¹</td>
<td>58.65de</td>
<td>19.20bdc</td>
<td>28.35dc</td>
<td>79.11cd</td>
<td>43.93ef</td>
<td>3.39d</td>
<td>47.32e</td>
</tr>
<tr>
<td>7. Sivanto 7 oz/a¹</td>
<td>56.25dc</td>
<td>18.35cd</td>
<td>27.50d</td>
<td>83.19cd</td>
<td>48.47fed</td>
<td>4.69cd</td>
<td>53.16ed</td>
</tr>
<tr>
<td>8. Venom WG 3 oz/a¹</td>
<td>76.65bdac</td>
<td>18.10bdc</td>
<td>24.30d</td>
<td>72.28bc</td>
<td>54.48fedc</td>
<td>4.03d</td>
<td>58.51ed</td>
</tr>
<tr>
<td>9. Movento 240 SC 5 fl oz/a¹</td>
<td>41.95e</td>
<td>13.05d</td>
<td>17.50d</td>
<td>91.35cd</td>
<td>73.97becd</td>
<td>4.58cd</td>
<td>78.55ced</td>
</tr>
<tr>
<td>10. Exirel 0.83 SE 13.5 fl oz/a¹</td>
<td>43.65e</td>
<td>20.30bdc</td>
<td>32.00bdc</td>
<td>80.03cd</td>
<td>37.81f</td>
<td>2.73d</td>
<td>40.54e</td>
</tr>
<tr>
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<td>50.10bdc</td>
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<td>62.62fedc</td>
<td>3.43d</td>
<td>66.05ced</td>
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*Means within columns followed by the same letter are not significantly different (LSD, P < 0.05).
¹Treatments 2,3,4,5,13 were drench applications. ²Treatments 6,7,8,9,10 were spray applications. ³Treatments 11 and 12 were single banded spray applications.

Continued on next page.
### Table 5. Treatment effects on squash yield at the Lang Farm, Tifton, GA in 2014.

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\(\d\) Means within columns followed by the same letter are not significantly different (LSD, P < 0.05).
\(\d\) Treatments 2, 3, 4, 5, 13 were drench applications. \(\d\) Treatments 6, 7, 8, 9, 10 were spray applications. \(\d\) Treatments 11 and 12 were single banded spray applications.
Seedless Watermelon Variety Evaluation: 2014
Timothy Coolong
Department of Horticulture, University of Georgia, Tifton, GA 31793

Introduction
Georgia is a leading producer of seedless watermelons in the U.S. With more than 20,000 acres of spring-planted watermelons valued at over $150 million in 2013, Georgia is consistently ranked in the Top 3 producers of the crop nationally. Watermelons are grown over a wide area of Georgia primarily for a pre-July 4th market. Due to the importance of this crop, it is necessary to conduct annual variety evaluations of the numerous selections available to growers. This trial documents the results of a spring 2014 trial in Georgia.

Materials and Methods
Watermelons were seeded on 14 Feb. into 200 cell trays and transplanted on 31 March. Rows were 6’ on center with 36” in-row spacing (2,420 per acre population). Plots contained 10 plants per plot with 15 foot alleys between adjacent plots. Plants were grown on black, TIF plastic with 1,000 lb/a 5-10-15 preplant under plastic and fertigations of soluble urea or 7-0-7 weekly at 10-12 lb N/a per week starting two weeks after planting. Magnesium sulfate was applied three times through drip irrigation at a rate of 3 lb Mg/a. Total application of N for the season was 180 lb/a. Plants were irrigated with 1-inch of water per week until full vining, and then 2-inches per week, which was reduced to 1 inch two weeks prior to initial harvest (irrigation reduced approx. 10 June).

Between row herbicides Dual II Magnum + Curbit + Reflex were used. Weekly fungicide sprays were made according to UGA recommendations (+ copper initially for Pseudomonas sp.). Imidacloprid was applied at planting and Venom and Agrimek applied during growth. Plants were pollinized with ‘SP-6’, placed after every third plant (three per plot) in all plots. ‘Wildcard’ pollinizers were placed in plots of ‘Bold Ruler,’ ‘Charismatic,’ and ‘Secretariat’ in addition to the ‘SP-6’ pollinizers.

Harvest dates were 24 June and 2 and 9 July. Fruit were harvested when tendril at attachment node had browned and ground-spot yellowed. Fruit below 9 lb and misshapen/cull fruit were not harvested. Fruit were weighed individually for grading into 60, 45, 36, and 30 count classes. The following classes and weights were determined by the National Watermelon Research and Development Group to be used for watermelon variety trials to aid in unifying trial results: 60 count: 9-13.5 lb, 45 count: 13.6-17.5 lb, 36 count: 17.6-21.4 lb, 30 count: 21.5+ lb.

At second harvest (2 July) a subset of four representative fruit from each treatment/rep (16 per variety total) were utilized for quality measurements. Average firmness was determined using an 11 mm probe with a hand-held firmness tester from two locations in four melons (eight readings) per replication. Average brix was obtained from a teaspoon sample of flesh from each of the four melon subset per replication, which was crushed using a hand-held lemon press and read using a hand-held refractometer. Average number of hard seed was determined by counting the total number of hard seed per four melon subsample. Each melon was quartered and the number of black, hard seed counted in two quarters of each melon. Average hollow heart was rated by slicing melons in half (length-wise) and ranking melons on a 1-4 scale. On this scale: 1 < 0.25 inch-wide, cracking in one direction, still marketable; 2 = 0.25-0.75 inch, cracking in a single or multiple directions, not marketable; 3 = 0.75-1.5 cracking in one or multiple directions, not marketable; and 4 > 1.5 inch, cracking in multiple directions, not marketable. Average lengths and widths of each of the melons were also recorded. Climate conditions: cool and wet initially, turning to warm and dry during harvest.

Data analysis conducted using SAS version 9.3. Proc GLM and Fisher’s least significant test were conducted when appropriate.

Results
Yield data from the first two harvests (Tables 1 and 2) and the total from all harvests are presented. Average melon weight for each harvest can be found in Table 6, and quality data is presented in Table 7. There are two advanced selections (non-commercial), which have data removed from the tables out of request from the participant.

Continued on next page.
After planting, cold temperatures were experienced for several weeks, slowing initial growth. Fruit were estimated to be approximately one week behind previous years in the Tifton, GA, region due to this cool weather.

Yields were high for all varieties tested. The highest yielder was 9651 HQ, which was a solid-patterned fruit, producing a large number of 45 and 36 count fruit. It had an average weight of 16.0 pounds, which would put it in a 45 count category. There were 10 varieties that had yields that were not significantly different from 9651 HQ. Other varieties in this group included ACX6177, Wolverine, Declaration, Troubadour, Nun01009, 7387 HQ, Crunchy Red, and Distinction.

The largest average fruit were USAWX90020, 7387 HQ, and Crunchy Red. Average fruit weight declined over the three harvest periods in most, but not all fruit. Several varieties increased in average fruit weight. Quality of all fruit was high with sugar content ranging from 10.8-12.3%.

Hollow heart was ranked on a 1-4 scale, and there was not a significant difference between varieties. Most varieties with the highest scores for hollow heart (Wolverine, Melody, 7187) had a small number of fruit with severe (4) ratings of hollow heart allowing for a higher average. Several varieties had no symptoms of hollow heart visible in any fruit rated. Firmness was not significantly correlated with hollow heart (data not shown). Firmness was highest in Crunchy Red.

Hard seed were low in all melons. Typically when a large number of hard seeds were found, it was in a single fruit sampled.
Table 1. Yield in pounds and bins per acre as well as percent of melons in each size category for the first harvest (24 June 2014). Varieties ranked in descending order based on total yield in lb/a.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Total Yield (lb/a)</th>
<th>60 Count (lb/a)</th>
<th>45 Count (lb/a)</th>
<th>36 Count (lb/a)</th>
<th>30 Count (lb/a)</th>
<th>Percent 60 Count (%)</th>
<th>Percent 45 Count (%)</th>
<th>Percent 36 Count (%)</th>
<th>Percent 30 Count (%)</th>
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*Percent of fruit in each category determined by dividing the yield of a given size class by the total yield for that variety.  
Number of bins per acre determined by dividing the number of fruit per acre by the count of each bin.
Table 2. Yield in pounds and bins per acre as well as percent of melons in each size category for the second harvest (2 July 2014). Varieties ranked in descending order based on total yield in lb/a.

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<th>45 Count</th>
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1Percent of fruit in each category determined by dividing the yield of a given size class by the total yield for that variety.
2Number of bins per acre determined by dividing the number of fruit per acre by the count of each bin.
### Table 3
Total harvested yield in pounds and bins per acre as well as percent of melons in each size category for three harvests. Varieties ranked in descending order based on total yield in lb/a.

<table>
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<tr>
<th>Variety</th>
<th>Total Yield (lb/a)</th>
<th>Yield (45 + 36) Count (lb/a)</th>
<th>60 Count (lb/a)</th>
<th>45 Count (lb/a)</th>
<th>36 Count (lb/a)</th>
<th>30 Count (lb/a)</th>
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* Means within the same column followed by the same letters are not significantly different according to Fisher’s least significant difference test, P < 0.05.
Table 4. Total harvested yield in pounds and bins per acre as well as percent of melons in each size category for three harvests. Varieties ranked in descending order based on total combined yield of 36 and 45 count fruit.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Total Yield (lb/a)</th>
<th>Yield (45 + 36) Count (lb/a)</th>
<th>60 Count (lb/a)</th>
<th>45 Count (lb/a)</th>
<th>36 Count (lb/a)</th>
<th>30 Count (lb/a)</th>
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<td>16894 c-g</td>
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* Means within the same column followed by the same letters are not significantly different according to Fisher’s least significant difference test, P < 0.05.
Table 5. Total harvested yield in pounds and bins per acre as well as percent of melons in each size category for three harvests. Varieties ranked in descending order based on total yield of 36 count fruit.

<table>
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<th>Total Yield (lb/a)</th>
<th>Yield (45 + 36) Count (lb/a)</th>
<th>60 Count (lb/a)</th>
<th>45 Count (lb/a)</th>
<th>36 Count (lb/a)</th>
<th>30 Count (lb/a)</th>
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Means within the same column followed by the same letters are not significantly different according to Fisher’s least significant difference test, P < 0.05.

Continued on next page.
Table 6. Average fruit weight for each variety for the total trial and each harvest (first, second, and third) as well as the percentage of fruit in each class (60 count, 45 count, 36 count, and 30 count).

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<tr>
<th>Variety</th>
<th>Avg. Fruit Weight (total)</th>
<th>Avg. Fruit Weight (Harvest 1)</th>
<th>Avg. Fruit Weight (Harvest 2)</th>
<th>Avg. Fruit Weight (Harvest 3)</th>
<th>60 Count</th>
<th>45 Count</th>
<th>36 Count</th>
<th>30 Count</th>
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<tr>
<td></td>
<td>(lb/fruit)</td>
<td>(lb/fruit)</td>
<td>(lb/fruit)</td>
<td>(lb/fruit)</td>
<td>(%)</td>
<td>(%)</td>
<td>(%)</td>
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<td>44.5</td>
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*Percent of fruit in each category determined by dividing the yield of a given size class by the total yield for that variety.*
Table 7. Quality data including firmness, sugars (brix), hollow heart incidence, hard seed incidence, length, and width of four harvested fruit from each variety from the second (2 July) harvest.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Sugars (Brix) (%)</th>
<th>Firmness (lb force)</th>
<th>Avg. Hollow Heart (1-4)</th>
<th>Hard Seed* seed/melon</th>
<th>Length (in)</th>
<th>Width (in)</th>
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<td>10.3</td>
<td>9.3</td>
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<td>3.9 b-g</td>
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<td>0.9</td>
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<td>8.3</td>
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<td>3.8 c-g</td>
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<td>0.4</td>
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<td>3.8 d-g</td>
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<td>0.0</td>
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<td>0.6</td>
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* Means within the same column followed by the same letters are not significantly different according to Fisher’s least significant difference test, P < 0.05.
* Hard seed counted in quartered melons (four melons quartered) and then divided by number of quarters counted to determine average seed per melon.
Evaluation of Slow-Release Nitrogen Fertilizers in Seedless Watermelon
Juan Carlos Diaz-Perez
Department of Horticulture, UGA-Tifton Campus, Tifton, GA 31793-0748

Introduction
Slow release fertilizers are a possible alternative to increase nitrogen use efficiency in vegetable production. The objective was to evaluate the effects of various slow release fertilizers on seedless watermelon fruit yield.

Materials and Methods
The experimental protocol was as requested by Georgia Pacific. The trial was conducted at the Horticulture Farm, Tifton Campus, University of Georgia, during the spring of 2007. The soil was a Tifton Sandy Loam (a fine loamy, siliceous thermic Plinthic Paleudults) with a pH of 6.5.

The design was a randomized, complete block with five replications and a split plot arrangement. The subplot used gypsum (0 or 1,000 lb/a) and the main plot used various sources of nitrogen fertilizer. The N fertilizers were: Ammonium nitrate (grower’s standard), Nitamin 30L, GP-G30, and GP-G31. The experimental plot consisted of one 40-ft long bed. In all treatments, the total amount of N applied over the season was 150 lb/a, with 50 lb/a N being applied as ammonium nitrate prior to planting. The remainder of the N was applied over the first three weeks after transplanting (GP-G31), six weeks after transplanting (Nitamin 30L, GP-G30), or twelve weeks after transplanting (ammonium nitrate). All treatments received weekly applications of K, alternating potassium chloride and potassium thiosulfate, for a total of 100 lb/a K.

Watermelon (Sakata ‘SSX-7401’ as female and ‘8662’ as a pollenizer) transplants were planted on 12 April 2007 in a single row of plants per bed, with a distance between plants of 2 ft, placing one pollinator plant every two female plants. At the time of transplanting, each seedling received about 250 mL of a 2,000 ppm N solution as a starter fertilizer (10-34-00). Plants were grown on raised beds (6 ft from center to center of each bed) with black plastic mulch and drip irrigation. Plants were irrigated based on cumulative evapotranspiration and appropriate crop coefficients, depending on the stage of crop development. The leaf nitrogen level was estimated by determining the chlorophyll content (SPAD-502, Minolta) 26, 33, and 53 days after transplanting (DAT). Leaf petioles were sampled 46, 67, and 98 DAT to determine their mineral nutrient concentration. Pesticides were applied as necessary. Harvest was conducted on 5, 12, and 19 July. Watermelon fruit were graded as marketable or cull, according to the USDA grading standards, and fruit number (quantity) and weight were determined.

Data were analyzed using the General Linear Model Procedure of SAS (SAS Institute Inc., 2000), using the LSD test (at both P = 0.05 and P = 0.1 levels) to separate the treatment means. Plants in the first replication were accidentally damaged by herbicide (paraquat); thus, data from this replication were not included in the statistical analysis.

Results and Discussion
Weather. Over the growing season, the cumulative rainfall was 7.8 in and the cumulative evapotranspiration was 18.5 in. The mean air and soil (4-in deep) temperatures were 75.1 F and 76.4 F, respectively (Figure 1).

Soil mineral nutrients. A soil analysis prior to planting (28 March), before any N fertilizer application, showed the following mineral nutrient concentrations (lb/a): Ca (991), K (137), Mg (137), Mn (30), NH₄-N (19), NO₃-N (8), P (229), and Zn (44). A soil analysis 63 days after transplanting showed that Mn was lowest in GP-30, NH₄-N was lowest in ammonium nitrate and highest in GP-G31, and Zn was highest in GP-G31, while the rest of the nutrients were unaffected by the N fertilizer sources.

Leaf mineral nutrients. Leaves were sampled on 28 May (46 DAT), 18 June (67 DAT), and 19 July (98 DAT). Leaves sampled 46 DAT showed that Ca was lowest in GP-G31, NO₃ was lowest in GP-G31, and P was highest in GP-G31. In leaves sampled 67 DAT, P was lowest in Nitamin 30L and highest in GP-G31, and Zn was lowest in Nitamin 30L and highest in ammonium nitrate. Leaves sampled 98 DAT showed that NO₃ was lowest in ammonium nitrate and highest in GP-G31, P was lowest in Nitamin 30L and highest in ammonium nitrate, and Zn was lowest in GP-G31 and highest in GP-G30.
Chlorophyll content. Over the season, leaf chlorophyll content was little affected by nitrogen fertilizer or gypsum application. The lowest chlorophyll readings occurred 53 DAT, which is consistent with reports that show a reduction in leaf N late in the season.

 Marketable and total yields of plants fertilized with Nitamin 30L and GP-G30 were highest, although not significantly different (P = 0.05) compared to those of plants receiving ammonium nitrate (Table 1). Cull yields and weight of individual fruits were not affected by nitrogen fertilizer. Gypsum had no effect on yields or fruit weight. There was no nitrogen fertilizer x gypsum interaction.

Conclusions

Nitamin 30L and GP-G30 produced the highest watermelon yields. However, since results come from a single trial only, no definite conclusions can be drawn yet about the apparent yield increase obtained by the use of these fertilizers.

Figure 1: Mean Daily Air and Soil Temperature (at 4 in deep) During the Growing Season, Tifton, GA, Spring of 2007

Acknowledgements

My sincere gratitude to Jesús Bautista and Nélida Bautista for their invaluable technical support. Thanks also to Jason Brock of the Plant Disease Clinic, University of Georgia, Tifton Campus, for identification of plant diseases. Financial support provided by the Georgia agricultural experiment stations and Georgia Pacific is highly appreciated.

Continued on next page.
Table 1. Yield of seedless watermelon (Sakata ‘SSX-7401’) as affected by nitrogen fertilizer and gypsum. Tifton, GA, spring of 2007.

<table>
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<th>Main Factors</th>
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* Means separated within columns (by main factor) by Fisher’s protected LSD test [P ≤ 0.05 or P ≤ 0.1 (letters in parenthesis)].
Evaluation of Pepper Varieties for Production in Georgia

George Boyhan¹, Timothy Coolong², and Cecilia McGregor¹
¹Department of Horticulture, University of Georgia, Athens, GA 30602
²Department of Horticulture, University of Georgia, Tifton, GA 31793

Introduction

In 2013 bell peppers were second only to watermelon in vegetable farm gate value with a value over $138 million (Wolfe and Stubbs, 2014). Other peppers such as banana and jalapeno peppers also have a significant value in Georgia production. Pepper production in Georgia has grown over 25% in the past year. In addition to bell peppers, over $13 million of other pepper types are grown in Georgia. The purpose of this trial was to evaluate pepper varieties for south Georgia production.

Materials and Methods

Seed were sown in the greenhouse at the Durham Horticulture Farm in Watkinsville, GA, on 19 and 27 June 2014. The media used was Fafard 3B (Conrad Fafard, Inc., Agawam, MA) and there were 36 cells per flat. Seedlings were fertilized twice with 20-20-20 (J.R. Peter, Inc.) at 781 ppm. Seedlings were drenched once with Subdue fungicide at the label recommended rate.

There were 20 entries in the trial, which was arranged as a randomized complete block design with three replications. Each plot or experimental unit consisted of 40 plants arranged in two rows in a 20 ft plot (1 ft in-row spacing). Plots consisted of white plastic covered beds that had been prepared according to University of Georgia Extension recommendations.

Diseases and insects were also controlled according to UGA Extension recommendations.

Plants were transplanted on 22 Aug. 2014. Since there were not sufficient transplants of some entries, a stand count was taken shortly after transplanting. Plants were fertigated according to UGA Extension recommendations.

Harvests began on 15 Oct. 2014. There were two additional harvests on 24 Oct. and 6 Nov. 2014. The total weight and count of each plot was recorded. Bell peppers were further graded into three size classes: Fancy (width ≥ 3”, length ≥ 3.5”), Number 1s (width and length ≥ 2.5”), and Choppers (width and length < 2.5”). All other pepper types were not graded.

Data were analyzed with an analysis of covariance with weights transformed with a square root transformation before analysis, and then means were back transformed to their original units. Pepper counts were also transformed, but the natural log transformation was used instead.

Results and Discussion

The total yield (Fancy, No. 1s, and Choppers) ranged from 2,067 to 26,498 lb/a. The highest yielding bell pepper was PS 09954288 from Seminis, and the highest yielding jalapeno or specialty pepper was ACR 127 from Abbott and Cobb. Aristotle X3R had the highest yield of Fancy fruit at 10,615 lb/a. The greatest yield of No. 1 fruit was with PS 09954288, which had 13,143 lb/a. This was better than all other entries. The highest yield of Chopper grade was with Gridiron.

There were three entries from DP Seeds, which we categorized as specialty peppers. They were miniature bell peppers. All had relatively low yields compared to the other entries, however, among these entries Inky had the greatest yield.

In conclusion, data such as this allows growers, breeders, and other interested parties to make informed choices when selecting pepper varieties.

Literature Cited

Pepper variety trial results, fall 2014.

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</table>

\(^{1}\text{Fancy: width ≥ 3", length ≥ 3.5"; No. 1s: width & length ≥ 2.5"; Choppers < 2.5".}\)

\(^{2}\text{Boxes: 1 1/9 bushel (28 lb).}\)
Introduction

Slow release fertilizers are a possible alternative to increase nitrogen use efficiency in vegetable production. The objective was to evaluate the effect of Nfusion (a slow-release nitrogen fertilizer; Georgia Pacific) on soil nutrients, nitrogen leaching, plant nutrition, and fruit yield of bell pepper plants.

Materials and Methods

The trial was conducted at the Horticulture Farm, Tifton Campus, University of Georgia, during the spring of 2008. The soil was a Tifton Sandy Loam (a fine loamy, siliceous thermic Plinthic Paleudults) with a pH of about 6.5.

The design was a randomized complete block with a factorial arrangement. There were four treatments [two N fertilizers x two rates (175 lb N/a and 250 lb N/a)] and four replications. The N fertilizers were: Nfusion (controlled release N fertilizer) and a control (calcium nitrate, grower’s standard N fertilizer).

The experimental plot consisted of a 30-ft long bed section. There was a 10 ft separation between plots in the same bed. Plants were grown on raised beds (6 ft from center to center of each bed) with black plastic mulch and drip irrigation. Bell pepper 'Heritage' transplants were planted on 10 April 2008 in two rows of plants per bed, with a distance between plants of 1 ft. At the time of transplanting, each seedling received about 250 mL of a 10,000 ppm N solution as a starter fertilizer (10-34-00).

Nitrogen and potassium fertilization after planting was made through the drip irrigation system. Nitrogen was applied either as a mixture of Nfusion and Ca(NO₃)₂ (30% N derived from Nfusion and 70% from Ca(NO₃)₂) or as Ca(NO₃)₂ alone as the standard fertilizer. Potassium was supplied as potassium thiosulfate or KCl for all treatments. The amount of N ingredient and K solution for each treatment was weighed immediately prior to application, mixed while being diluted to an approximate 10 gal total volume, and then pumped into its respective plots along with approximately 20 gal of additional irrigation water.

Fertilizers in the standard fertilization treatments were injected 12 times during the season on seven-day intervals (18 April, 25 April, 2 May, 9 May, 16 May, 23 May, 30 May, 6 June, 13 June, 20 June, 27 June, and 3 July), while Nfusion treatments received eight fertilizer applications (18 April, 25 April, 2 May, 9 May, 16 May, 23 May, 30 May, 6 June). In weeks eight through 12, potassium continued to be applied to the Nfusion plots at the same rate as in the respective calcium nitrate treatment plots.

Soil samples were collected 47 (27 May), 69 (18 June), and 99 (18 July) days after transplanting (DAT) at 12 and 24 inches deep. Soil samples were analyzed for pH and macro and micro elements at the UGA Soil, Plant and Water Analysis Lab (Athens, GA).

Plants were irrigated based on cumulative evapotranspiration and appropriate crop coefficients, depending on the stage of crop development. The leaf nitrogen level was estimated by determining the chlorophyll content (SPAD-502, Minolta) 26, 33, and 53 days after transplanting. Leaf samples were collected 40 days after transplanting (DAT), 68 DAT, and 99 DAT to determine the mineral nutrient concentration in the leaves. Pesticides were applied as necessary.

Harvest was conducted on 6 June (57 DAT), 12 June (63 DAT), 20 June (71 DAT), 27 June (78 DAT), 16 July (97 DAT), and 28 July (109 DAT). Bell pepper fruit were graded as marketable or cull, according to the USDA grading standards, and fruit numbers and weights were determined.

Data were analyzed using the General Linear Model Procedure of SAS (SAS Institute Inc., 2000), using the LSD test to separate the treatment means. In one plot of replication, three plants showed high incidences of a soil borne disease (caused by Rhyzoctonia spp.), which reduced plant vigor and even resulted in mortality of some plants. Data from this plot were not included in the statistical analysis.

Results and Discussion

Weather. Over the growing season, the cumulative rainfall was 7.8 inches (Figure 1), and the average maximum, minimal, and mean temperatures were 85.5°F, 64.9°F, and 75.2°F, respectively (Figure 2).

Soil mineral nutrients. Soil analyses showed that NH₄ and NO₃ concentrations were higher and pH was lower in soils fertilized with Nfusion than those fertilized with calcium nitrate. Presence of greater N concentrations in both the 0-12 and 12-24 inch depths would be expected earlier in the season because during the first eight weeks the amount of Ca(NO₃)₂ applied with the Nfusion treatments was greater than that applied to the control, even though over the entire season, the total amount of N applied was the same between fertilizer treatments. Differences in total N between the Nfusion and the standard treatment became smaller as the season progressed. By 99 DAT, no differences
in soil N concentrations existed, even though there was no N fertilizer being applied in the Nfusion plots for 42 days.

Soils in Tifton and the Coastal Plain are typically low in CEC and therefore do not retain cations well. Anions (such as NO₃⁻) are retained even less than cations because of the net negative soil charge, and therefore, they would be expected to leach more rapidly. Soil samples prior to application of the fertilizer regimes were not taken, so we have no evidence for the native concentrations of these nutrients with which to compare later values. However, because of the low soil CEC, it is expected that the concentrations of NO₃ and NH₄ were low.

NO₃ concentration in the soil was higher while pH and Mg and Ca concentrations were lower with the nitrogen fertilization rate of 250 lb/a compared to 175 lb N/a. Soil pH, Ca, Mn, P, and Zn were higher and Mg was lower at the 12-inch depth compared to the 24-inch depth.

Leaf mineral nutrients. Leaves were sampled on 40 DAT, 68 DAT, and 98 DAT (Table 2). In the first two sampling dates (40 DAT and 68 DAT), leaf N concentration was higher in plants fertilized with Nfusion compared to the control, while there was no difference in N concentration for 98 DAT. In all the sampling dates, the other nutrients were in general little affected by the type of fertilizer or the rate of N fertilizer, although leaf N concentration tended to be higher with a higher rate of N fertilization.

Chlorophyll index. Over the season, leaf chlorophyll index was little affected by N fertilizer. Chlorophyll content was higher at the higher N fertilization rate (250 lb N/a), but the difference was not significant at the last sampling date (17 July).

Yield. There was a fertilizer x rate interaction for marketable and total yields (Table 1) but not for individual fruit weight. Marketable and total yields were highest with calcium nitrate at 250 lb/a and Nfusion at 175lb/a and lowest with Nfusion at 250 lb/a. Marketable and total yields were little affected by rate of fertilizer calcium nitrate but decreased with increasing rates of Nfusion. Fertilizer nor rate did not affect the weight of individual fruit.

Acknowledgements
My sincere gratitude to Jesús Bautista and Nélida Bautista for their invaluable technical support. Thanks also to Jason Brock of the Plant Disease Clinic, University of Georgia, Tifton Campus, for identification of plant diseases. Financial support provided by the Georgia agricultural experiment stations and Georgia Pacific is highly appreciated.

<table>
<thead>
<tr>
<th>Table 1. Yield of bell pepper as affected by nitrogen fertilizer and rate of application.</th>
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<td>CaNO₃</td>
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<tr>
<td>250 lb/a</td>
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<td><strong>Significance</strong></td>
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<td>Rate (R)</td>
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<td>F*R</td>
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<tr>
<td>LSD 0.05</td>
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<td><strong>Treatments</strong></td>
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<td>Nfusion at 250 lb/a</td>
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<td>Nfusion at 175 lb/a</td>
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<tr>
<td>CaNO₃ at 175 lb/a</td>
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<tr>
<td>CaNO₃ at 250 lb/a</td>
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* Means separated within columns (by main factor and by treatment) by Duncan test (P ≤ 0.05).
Figure 1: Cumulative Rainfall During the Growing Season
Transplanting Date was 10 April 2008.

Figure 2: Mean Daily Air Temperatures During the Growing Season
Bell Pepper Plant Growth, Gas Exchange, and Fruit Yield as Affected by the Plant Biostimulants Biozyme, Fitobolic, Foltron, and Balance

Juan Carlos Díaz-Pérez
Department of Horticulture, University of Georgia, Tifton, GA 31793

Introduction

Bell pepper is an important vegetable crop in Georgia and has a farm gate value of $109 million. Bell pepper is exposed to heat stress conditions that affect fruit quality and fruit yield. Crop biostimulants have been shown to increase crop yield and quality under adverse environmental conditions (Kauffman et al., 2007; Srivastava et al., 2008; and Yvin, 1997). Biozyme is a plant extract based biostimulant (Arysta LifeScience); Foltron helps plants manage stress and is based on the association of macro and micro nutrients with folcystein. The objective of this research was to determine the effects of the plant biostimulants Balance, Biozyme, Fitobolic, and Foltron on leaf gas exchange, leaf fluorescence, and fruit yield in bell pepper.

Materials and Methods

The trial was conducted at the Horticulture Farm (Tifton, GA), University of Georgia, during the spring season of 2010. The soil of the experimental area is loamy sand, with a pH of about 6.5. The experimental design used a randomized complete block with six replications and nine treatments. The nine treatments [eight biostimulant/rate combinations applied three times during the season(four plant biostimulants x two rates = eight), and one untreated control (UTC)] were as follows:

1. Untreated Control
2. Biozyme at 14 oz/a (1 L/Ha)
3. Biozyme at 28 oz/a (2 L/Ha)
4. Fitbolic at 14 oz/a (1 L/Ha)
5. Fitbolic at 28 oz/a (2 L/Ha)
6. Foltron at 28 oz/a (2 L/Ha)
7. Foltron at 40 oz/a (3 L/Ha)
8. Balance at 14 oz/a (1 L/Ha)
9. Balance at 28 oz/a (2 L/Ha)

Bell pepper (‘Aristotle’; Seminis, Oxnard, CA) was planted on 16 April 2010 on raised beds (on 1.8 m centers). Plants were established using two rows per bed (36 cm apart) with a distance of 30 cm between plants within the row. The beds were covered with silver reflective plastic mulch (RepelGro; ReflecTek Foils, Inc, Lake Zurich, IL) One drip tape line (Rob-Drip; Roberts Irrigation Products, Inc., San Marcos, CA) was placed 1 inch deep into the soil in the center of the bed. Plant biostimulants were applied with a backpack sprayer, providing full coverage of the plant canopy. For biostimulant application, water pH was about 6-7 and a surfactant (e.g., Latron® B-1956) was used. The experimental plot consisted of a 5 m long bed section, leaving a 3 m separation between plots within the same bed. Plants were irrigated with an amount of water equivalent to 100% crop evapotranspiration (ETc). Crop evapotranspiration was calculated by multiplying the reference evapotranspiration (ETo) by the crop factor (dependent on the crop stage of development). Water was applied when cumulative ETc was 1.2 mm, which corresponded to about every 2-3 days in mature plants (mean ETo was about 5-6 mm/day). Weather data (air temperature and ETo) were obtained from a nearby University of Georgia weather station (< 300 m).

Leaf chlorophyll. Leaf chlorophyll was estimated by means of a chlorophyll meter (SPAD-502, Minolta) in five mature, well exposed leaves per plot. Leaf chlorophyll was measured every seven days during the growing season.

Plant growth. Stem diameter was measured weekly with a micrometer in three plants per plot. Measurements were initiated 30 days after planting. Plant height was measured in two well developed plants per plot on 2 June and 10 June. Plant fresh weight was measured after the last harvest by excising the tops of three plants and determining the average weight per plant.

Leaf gas exchange and fluorescence. Plant gas exchange (leaf net photosynthesis and stomatal conductance) was measured with a gas exchange system (LI-1600, LI-COR) several times after the applications of the biostimulants. Leaf fluorescence (photosystem II efficiency) was measured in light-adapted leaves with a leaf chamber fluorometer (LI-6400-40, LI-COR) attached to the gas exchange system. Water use efficiency was calculated as the ratio between net photosynthesis and transpiration, as measured with the gas exchange system.
Phytotoxicity. Phytotoxicity symptoms were evaluated one to two days after the application of biostimulants using a 1-5 visual rating scale (1 = no symptoms; 2 = mild; 3 = moderate; 4 = large; 5 = severe) to grade the entire plot.

Fruit yield. Fruit were harvested on 11 June, 18 June, 25 June, 2 July, and 16 July and then graded as marketable and culls, according to the U.S. Grading Standards (USDA, 2005). The number and weight of fruit in each grading category was determined.

Statistical analysis. Data were analyzed using the GLM procedure of SAS (SAS 9.1; SAS Inst. Inc.).

Results

Weather. Air temperature and rainfall during the growing season are shown in Table 1. Temperatures during June and July were high, resulting in plant heat stress (plant wilting), despite having soil moisture levels close to field capacity.

Leaf chlorophyll and plant growth. The use of biostimulants had no significant effect on chlorophyll index or bell pepper plant growth measured as stem diameter and top fresh weight, although plants treated with Balance at 2 L/ha were the shortest (Table 2).

Gas exchange and fluorescence. Biostimulants also had no detectable effect on net photosynthesis, stomatal conductance, water use efficiency, or fluorescence (photosystem II efficiency) of bell pepper plants (Table 3).

Phytotoxicity. There were no significant differences in phytotoxicity rating (mean = 1.7) among biostimulants.

Fruit yield. The effects of biostimulants on bell pepper yields are shown in Table 4. Marketable fruit weight was highest in the control and in plants treated with Balance at 1 L/ha, and weight was lowest in plants treated with Fitobolic at 2 L/ha. The fruit weight of culls, the total fruit weight, and the number of marketable fruit, culls, or total number of fruit were not significantly affected by the biostimulants. The weight of individual fruit was also not significantly affected by the biostimulants. Fruit sunscald, due to presence of high temperatures and high solar radiation, was the most common physiological disorder in culled fruit.

Conclusions

The biostimulants Balance, Biozyme, Fitobolic, and Foltron had no significant effect on plant growth, gas exchange, fluorescence, or fruit yield in bell pepper.

Literature Cited


Acknowledgements

My sincere gratitude to Jesús Bautista and Nélida Bautista for their invaluable technical support. Thanks also to Jason Brock of the Plant Disease Clinic, University of Georgia, Tifton Campus, for identification of plant diseases. Financial support provided by the Georgia agricultural experiment stations and Arysta LifeScience is highly appreciated.

Continued on next page.

Table 1. Air temperature and rainfall during the growing season of bell pepper, Tifton GA, spring of 2010.

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<th>Air Temperature</th>
<th>Rainfall</th>
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<td>19.2 C (66.5 F)</td>
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<td>May (1-31)</td>
<td>24.5 C (76.1 F)</td>
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<td>27.8 C (82.0 F)</td>
<td>129 mm (5.10 inch)</td>
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<td>July (1-16)</td>
<td>27.4 C (81.3 F)</td>
<td>027 mm (1.08 inch)</td>
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<td>Mean</td>
<td>25.2 C (77.4 F)</td>
<td>372 mm (14.6 inch)</td>
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Continued on next page.
### Table 2. Chlorophyll and growth variables in bell pepper as affected by various plant biostimulants, Tifton, GA, spring 2010.\(^1\)

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<thead>
<tr>
<th>Biostimulant</th>
<th>Chlorophyll (SPAD)</th>
<th>Stem Diameter (mm)</th>
<th>Plant Height (cm)</th>
<th>Top Fresh Wt. (g/plant)</th>
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</table>

\(^1\) Means followed by the same letter are not significantly different based on Fisher’s protected least significant test at 95% confidence.

### Table 3. Gas exchange variables of bell pepper as affected by various plant biostimulants. Tifton, GA, spring 2010.\(^2\)

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<thead>
<tr>
<th>Biostimulant</th>
<th>Net Photosynthesis (µmol m(^{-2}) s(^{-1}))</th>
<th>Stomatal Conductance (mol m(^{-2}) s(^{-1}))</th>
<th>Water Use Efficiency (µmol/mmol)</th>
<th>PSII Efficiency (^y) (µmol/mmol)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>33.8</td>
<td>0.76</td>
<td>2.14</td>
<td>0.18</td>
</tr>
<tr>
<td>Balance_1L</td>
<td>35.0</td>
<td>0.79</td>
<td>2.20</td>
<td>0.18</td>
</tr>
<tr>
<td>Balance_2L</td>
<td>33.3</td>
<td>0.76</td>
<td>2.17</td>
<td>0.20</td>
</tr>
<tr>
<td>Biozyme_1L</td>
<td>33.1</td>
<td>0.70</td>
<td>2.25</td>
<td>0.18</td>
</tr>
<tr>
<td>Biozyme_2L</td>
<td>33.2</td>
<td>0.73</td>
<td>2.26</td>
<td>0.18</td>
</tr>
<tr>
<td>Foltron_2L</td>
<td>33.2</td>
<td>0.76</td>
<td>2.20</td>
<td>0.16</td>
</tr>
<tr>
<td>Foltron_3L</td>
<td>33.8</td>
<td>0.73</td>
<td>2.20</td>
<td>0.18</td>
</tr>
<tr>
<td>Fitobolic_1L</td>
<td>34.9</td>
<td>0.76</td>
<td>2.27</td>
<td>0.17</td>
</tr>
<tr>
<td>Fitobolic_2L</td>
<td>31.8</td>
<td>0.71</td>
<td>2.10</td>
<td>0.18</td>
</tr>
<tr>
<td>(P)</td>
<td>0.0835</td>
<td>0.933</td>
<td>0.305</td>
<td>0.107</td>
</tr>
</tbody>
</table>

\(^1\) Means followed by the same letter are not significantly different based on Fisher’s protected least significant test at 95% confidence.

\(^y\) Photosystem II (PSII) efficiency. It is the fraction of absorbed PSII photons that are used in photochemistry.

### Table 4. Fruit yields of bell pepper as affected by various plant biostimulants, Tifton, GA, spring 2010.\(^2\)

<table>
<thead>
<tr>
<th>Biostimulant</th>
<th>Marketable</th>
<th>Cull</th>
<th>Total</th>
<th>Fruit wt.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1000/ha</td>
<td>t/ha</td>
<td>1000/ha</td>
<td>t/ha</td>
</tr>
<tr>
<td>Control</td>
<td>202.6</td>
<td>28.1 a</td>
<td>279.1</td>
<td>16.2</td>
</tr>
<tr>
<td>Balance_1L</td>
<td>232.5</td>
<td>28.8 a</td>
<td>214.6</td>
<td>13.6</td>
</tr>
<tr>
<td>Balance_2L</td>
<td>199.7</td>
<td>23.1 abc</td>
<td>294.7</td>
<td>16.7</td>
</tr>
<tr>
<td>Biozyme_1L</td>
<td>189.5</td>
<td>24.2 abc</td>
<td>230.7</td>
<td>14.4</td>
</tr>
<tr>
<td>Biozyme_2L</td>
<td>165.0</td>
<td>19.1 bc</td>
<td>266.6</td>
<td>15.6</td>
</tr>
<tr>
<td>Foltron_2L</td>
<td>210.4</td>
<td>25.1 abc</td>
<td>264.8</td>
<td>16.9</td>
</tr>
<tr>
<td>Foltron_3L</td>
<td>220.0</td>
<td>26.8 ab</td>
<td>256.4</td>
<td>15.1</td>
</tr>
<tr>
<td>Fitobolic_1L</td>
<td>173.9</td>
<td>21.1 abc</td>
<td>297.7</td>
<td>17.2</td>
</tr>
<tr>
<td>Fitobolic_2L</td>
<td>160.2</td>
<td>18.5 c</td>
<td>276.8</td>
<td>16.5</td>
</tr>
<tr>
<td>(P)</td>
<td>0.104</td>
<td>0.036</td>
<td>0.351</td>
<td>0.460</td>
</tr>
</tbody>
</table>

\(^2\) Means followed by the same letter are not significantly different based on Fisher’s protected least significant test at 95% confidence.
Bell Pepper Plant Physiology and Fruit Yield as Affected by the Plant Biostimulant MaxCel® and Magnesium Sulfate Fertilizer
Juan Carlos Díaz-Pérez
Department of Horticulture, University of Georgia, Tifton, GA 31793

Introduction
Bell pepper is exposed to heat stress conditions that affect fruit quality and fruit yield. Crop biostimulants have been shown to increase crop yield and quality under adverse environmental conditions (Kauffman et al., 2007; Srivastava et al., 2008; and Yvin, 1997). Plant biostimulant MaxCel® (6-benzyladenine) is used for fruit thinning in apples and other fruit trees. The objective of this research was to determine the effects of the plant biostimulant MaxCel® (Valent Biosciences) applied alone or in combination with magnesium sulfate fertilizer on bell pepper fruit yields.

Materials and Methods
The experiment was conducted at the Horticulture Farm (Tifton, GA), University of Georgia, during the spring season of 2011. The soil of the experimental area is loamy sand, with a pH of about 6.5. The experimental design was a randomized complete block with six replications and seven treatments (Table 1). The experimental plot consisted of a 5 m long bed section, leaving a 1.6 m separation between plots within the same bed.

Crop management. Bell pepper (‘TomCat’) was planted to the field on 15 April 2011 on raised beds (on 1.8 m centers). Plants were established using two rows per bed (36 cm apart) with a distance of 30 cm between plants within the row. The beds were covered with 1.5-m-wide, low-density polyethylene, black plastic mulch. One drip tape line (John Deere, 10-cm separation between emitters) was placed 2-3 cm deep into the soil in the center of the bed.

The field was fertilized before planting with 672 kg/ha of 10N-10P2O5-10K2O fertilizer. After planting, N and K2O were applied weekly through the drip tape line. Total amount of N and K2O applied were 169 kg/ha. Magnesium chloride (Epsom salt) was applied at 6 kg/ha.

Plants were irrigated with an amount of water equivalent to 100% crop evapotranspiration (ETc). Crop evapotranspiration was calculated by multiplying the reference evapotranspiration (ETo) by the crop factor (dependent on the crop stage of development). Water was applied when cumulative ETc was 1.2 mm, which corresponded to about every two to three days in mature plants (mean ET0 was about 6 mm/day). Weather data (air temperature and ET0) were obtained from a nearby University of Georgia weather station (< 300 m).

Biostimulant application. Plant biostimulant MaxCel® (6-benzyladenine) (Valent Biosciences) was applied with a backpack sprayer, providing full coverage of the plant canopy. For biostimulant application, water pH was about 6-7 and a non-ionic surfactant (80-20 surfactant; UCPA LLC, Eagan, MN) was used at 0.05%. MaxCel® was sprayed five times during the growing season, about every 10 days, at either 1 mL/L MaxCel® (20 ppm 6-benzyladenine) or 3 mL/L MaxCel® (60 ppm 6-benzyladenine), using sufficient volume to ensure full canopy coverage. MaxCel® was applied the same day that magnesium sulfate was injected through the drip system.

Fruit yield. Fruit were harvested six times from 21 June to 15 Aug. and graded as marketable or culls, according to the U.S. Grading Standards. The number and weight of fruit in each grading category was also determined.

Statistical analysis. Data were analyzed using the GLM procedure of SAS (SAS 9.1; SAS Inst. Inc., Cary, NC).

Results and Discussion
There were no differences in both marketable and total yields among treatments, indicating that MaxCel® at any of the rates applied alone or combined with magnesium chloride did not have any effects on marketable and total fruit yields. Individual fruit weight and the incidences of blossom-end rot (mean = 1%) and sunscald (mean = 2%) were also unaffected by treatments. Thus, MaxCel® provided no significant improvement in bell pepper fruit yield or quality.

Continued on next page.
Literature Cited


Acknowledgements
My sincere gratitude to Jesús Bautista and Nélida Bautista for their invaluable technical support. Thanks also to Jason Brock of the Plant Disease Clinic, University of Georgia, Tifton Campus, for identification of plant diseases. Financial support provided by the Georgia agricultural experiment stations and Valent Biosciences is highly appreciated.

Table 1. Bell pepper fruit yields as affected by the biostimulant MaxCel® alone or combined with micronutrients (magnesium chloride). Tifton, GA, spring of 2011. *

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Marketable 1000/ha</th>
<th>Marketable t/ha</th>
<th>Cull 1000/ha</th>
<th>Cull t/ha</th>
<th>Total 1000/ha</th>
<th>Total t/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>UTC + MN y</td>
<td>607</td>
<td>46.8</td>
<td>322</td>
<td>12.9</td>
<td>928</td>
<td>59.7</td>
</tr>
<tr>
<td>MaxCel® 0.5 m/L</td>
<td>454</td>
<td>32.6</td>
<td>308</td>
<td>10.8</td>
<td>762</td>
<td>43.4</td>
</tr>
<tr>
<td>MaxCel® 0.5 m/L + MN</td>
<td>438</td>
<td>37.6</td>
<td>319</td>
<td>11.5</td>
<td>757</td>
<td>49.1</td>
</tr>
<tr>
<td>MaxCel® 1 m/L</td>
<td>523</td>
<td>40.0</td>
<td>314</td>
<td>13.4</td>
<td>837</td>
<td>53.4</td>
</tr>
<tr>
<td>MaxCel® 1 m/L + MN</td>
<td>556</td>
<td>39.0</td>
<td>310</td>
<td>11.8</td>
<td>866</td>
<td>50.8</td>
</tr>
<tr>
<td>MaxCel® 3 m/L</td>
<td>475</td>
<td>34.3</td>
<td>276</td>
<td>10.2</td>
<td>751</td>
<td>44.5</td>
</tr>
<tr>
<td>MaxCel® 3 m/L + MN</td>
<td>573</td>
<td>41.6</td>
<td>328</td>
<td>12.9</td>
<td>901</td>
<td>54.5</td>
</tr>
<tr>
<td>P</td>
<td>0.380</td>
<td>0.411</td>
<td>0.923</td>
<td>0.257</td>
<td>0.526</td>
<td>0.291</td>
</tr>
</tbody>
</table>

* Means followed by the same letter are not significantly different based on Fisher’s protected least significant test at 95% confidence.

y UTC: untreated control; MN: micronutrients, applied as magnesium chloride at 6 kg/ha.
Amelioration of Crop Heat Stress and Fruit Disorders in Bell Pepper with Biostimulants

Juan Carlos Díaz-Pérez
Department of Horticulture, University of Georgia, Tifton, GA 31793

Introduction
Bell pepper is an important vegetable crop in Georgia and had a farm gate value of nearly $138 million in 2013. Bell pepper is exposed to heat stress conditions that affect fruit quality and fruit yield. Crop biostimulants have been shown to increase crop yield and quality under adverse environmental conditions (Kauffman et al., 2007; Srivastava et al., 2008; and Yvin, 1997). The objectives of this trial were to determine the effects of plant biostimulants on plant physiology, plant growth, incidence/severity of plant diseases, fruit yield, and incidence of physiological disorders.

Materials and Methods
The study was carried out at the University of Georgia, Tifton Campus, in the spring season of 2013. The experimental design consisted of a randomized complete block with five treatments (biostimulants) and four replications.

Biostimulants were: Untreated control, ABA (1,000 ppm), MaxCel® (1 mL/L), Screen Duo (aluminum silicate 8 lb/a, 15 g/L), and Seaweed (5 g/L).

- Abscisic acid (ABA) was applied to plugs at 1,000 ppm two days before planting.
- MaxCel® (1.9% or 20 ppm 6-benzyladenine; Valent BioSciences Corporation, Libertyville, IL) was applied with a CO2 sprayer, providing full coverage of the plant canopy. Water pH was about 6-7 and a non-ionic surfactant was used at 0.05%. First application was seven to 10 days after transplanting; second application was at first fruit set; and third through fifth applications were made once harvest had started, one application after each harvest but not closer than 10 days after previous application with a maximum of five applications.
- ScreenDuo (97.4% aluminum silicate; Certis, Columbia, MD) was applied at 15 g/L and was sprayed every 14 days, starting after transplanting. Applications were made using sufficient volume to ensure full canopy coverage, and was reapplied if heavy rain occurred before the 14-day time frame between applications.
- Extract of brown alga, Ascophyllum nodosum (Phaeophyceae) (5 mL/L) was applied every two weeks at 0.5% (5 g per 1,000 mL water). (StimplexTM; Acadia Seaplants Limited, Darmouth, Nova Scotia, Canada).

Plants were grown on raised beds (6 ft from center to center of each bed) with silver plastic (or white plastic) mulch and drip irrigation. Plot size was 4.6 m. Plants were planted in two rows per bed, with a distance between plants of 30 cm. At the time of transplanting, each seedling received about 250 mL of a 2,000 ppm N solution as a starter fertilizer (10-34-00).

The drip line was buried 3 cm under the soil surface. Fertilization (N-P-K) was in accordance to the recommendations of University of Georgia Cooperative Extension. Crop evapotranspiration was calculated from evapotranspiration data from a nearby weather station and the crop coefficients for bell pepper (University of Florida).

Phytotoxicity. Phytotoxicity symptoms were evaluated one to two days after the application of biostimulants using a 1-5 visual rating scale (1 = no symptoms; 2 = mild; 3 = moderate; 4 = large; 5 = severe) to grade the entire plot.

Harvest. Fruit was graded according to USDA standards and weighed to determine yields. The percent of fruit with BER and decay symptoms was determined.

Results
Number and weight of total, marketable, and cull fruit were unaffected (P < 0.05) by biostimulant treatments. Mean total and marketable yields were 21.0 t/ha (9.4 t/a) and 19.6 t/ha (8.7 t/a), respectively. Individual fruit weight (mean = 170 g/fruit) and the incidences of blossom-end rot (mean = 6.5%) and sunscald (mean = 3.2%) were also unaffected by biostimulant treatments. Thus, biostimulant treatments provided no significant improvement in bell pepper fruit yield or quality.
Bell Pepper Plant Growth and Fruit Yield as Affected by S-ABA Concentration and Water Application Rate
Juan Carlos Díaz-Pérez
Department of Horticulture, University of Georgia, Tifton, GA 31793

Introduction
In 2013 bell peppers had a farm gate value over $138 million. Bell pepper is exposed to heat stress conditions that affect fruit quality and fruit yield. Crop biostimulants have been shown to increase crop yield and quality under adverse environmental conditions (Kauffman et al., 2007; Srivastava et al., 2008; and Yvin, 1997). Abscisic acid has many roles in plants, but it is primarily associated with stress responses. The objectives of this research were to determine the effects of S-ABA concentration and water application rate on bell pepper transplants treated three days before planting, including the effects on plant physiology and growth and fruit yield in field-grown plants.

Materials and Methods
The experiment was conducted at the Horticulture Farm (Tifton, GA), University of Georgia, during the spring season of 2012. The soil of the experimental area was loamy sand, with a pH of about 6.5. The experimental design was a randomized complete block with six replications and four treatments. The experimental plot consisted of a 5 m long bed section, leaving a 1.6 m separation between plots within the same bed.

Biostimulant application. VBC-30151 (10% a.i. of S-ABA; Valent BioSciences) was applied to transplants before planting with a CO2 sprayer. Transplants were grown on peat-based substrate in 200-cell trays (cell size = 1.9 cm x 1.9 cm). Tray surface was 0.231 m² (34.3 cm wide x 67.3 cm long). Water pH was about 6-7 and a non-ionic surfactant (Latron B-1956) was used at 0.05%. The experimental design was a randomized complete block with a factorial arrangement and eight treatment combinations [four S-ABA levels (0, 250, 500, and 1,000) x two water application volumes (250 and 1000 mL/m² of tray)].

Crop management. Bell pepper (‘Colossal’) was planted to the field on 9 April 2012 on raised beds (on 1.8 m centers). Plants were established using two rows per bed (36 cm apart) with a distance of 30 cm between plants within the row. The beds were covered with 1.5-m-wide, low-density polyethylene, black plastic mulch. One drip tape line (John Deere, 10-cm separation between emitters, 0.20 mm thick, 4.97 L/m per hour) was placed 2-3 cm deep into the soil in the center of the bed. The field was fertilized before planting with 672 kg/ha of 10N-10P₂O₅-10K₂O fertilizer. After planting, N and K₂O were applied weekly through the drip tape. Total amount of N and K₂O applied were 261 and 304 kg/ha, respectively. Plants were irrigated with an amount of water equivalent to 100% crop evapotranspiration (ETc). Crop evapotranspiration was calculated by multiplying the reference evapotranspiration (ET0) by the crop factor (dependent on the crop stage of development). Water was applied when cumulative ETc was 1.2 mm, which corresponded to about every two to three days in mature plants (mean ET0 was about 6 mm/day). Weather data (air temperature and ET0) were obtained from a nearby University of Georgia weather station (< 300 m).

Leaf chlorophyll index. Leaf chlorophyll index was measured twice per week with a chlorophyll meter (SPAD-502, Minolta) in five mature, well exposed leaves per plot.

Soil water content. Soil water content was measured twice a week during the entire season with a portable time domain reflectometer sensor.

Plant growth. Stem diameter and plant height were measured twice per week during the entire season on three plants per plot.

Root zone temperature. Root zone temperature (RZT) at a depth of 10 cm was measured twice a week during the entire season with an electronic thermometer.

Canopy temperature. Canopy temperature was measured at midday on three plants per plot on clear days: 30 May, 5 June, and 22 June.

Gas exchange and fluorescence. Leaf gas exchange (net photosynthesis and stomatal conductance) and leaf fluorescence (PSII efficiency) were measured with a gas exchange system (LI-6400) coupled with a fluorescence chamber. Measurements were conducted...
on well exposed leaves in mature plants on clear days (21 June and 28 June), from 11:00 to 13:00 HR EST.

Phytotoxicity. Phytotoxicity symptoms were evaluated one to two days after the application of biostimulants using a 1-5 visual rating scale (1 = no symptoms; 2 = mild; 3 = moderate; 4 = large; 5 = severe) to grade the entire plot.

Fruit yield. Fruit were harvested five times from 22 June to 30 Jul. and then graded as marketable or culls, according to the U.S. Grading Standards. The number and weight of fruit in each grading category was also determined.

Statistical analysis. Data were analyzed using the GLM procedure of SAS (SAS 9.3; SAS Inst. Inc., Cary, NC).

Results
Weather. Maximal, minimal, and mean air temperatures during the growing season are shown in Figure 1. The mean seasonal air temperature was 24.3°C and the cumulative rainfall was 277 mm. The mean temperature during the plant establishment (first four weeks after transplanting) was 24.4°C.

Leaf chlorophyll index. Leaf chlorophyll index is an indirect indicator of leaf nitrogen concentration. Chlorophyll index did not consistently change with increases in S-ABA concentration or water application rate (Tables 1A and 1B).

Soil water content. Soil water content increased with S-ABA concentration and application water rate, suggesting that increasing S-ABA resulted in reduced plant water use. Soil water content (SWC) may be an indicator of plant water use since all treatments received the same amount of irrigation water.

Stem diameter and plant height. Stem diameter and plant height decreased with both increasing S-ABA concentration and application water rates.

Root zone temperature. Root zone temperature was highest in plants treated with 1,000 ppm S-ABA + 1000 mL/m² water application rate, while there were little differences in RZT among the other treatments.

Canopy temperature. Canopy temperature was similar among treatments.

Gas exchange and fluorescence. Leaf net photosynthesis and stomatal conductance were both unaffected by S-ABA concentration (although both tended to increase with increasing S-ABA concentration), while they were both higher at 1,000 mL/m² than at 250 mL/m² water application rate (Table 2A and 2B). Fluorescence (measured as PSII efficiency) was unaffected by either S-ABA concentration or application water volume. Water use efficiency was highest at 0 ppm S-ABA and with 250 mL/m² application water rate.

Fruit yield. Neither S-ABA concentration or application water rate had any significant effects on number of fruit or fruit yields (marketable and total), incidence of fruit scald, or fruit weight (Table 3).

Phytotoxicity. There were no visual phytotoxicity symptoms in any of the treatments.

Conclusions
Bell pepper plant growth, measured as stem diameter and plant height decreased with increasing concentrations of S-ABA and increased water application rate. Leaf net photosynthesis and stomatal conductance of mature plants were not significantly affected by S-ABA concentration; they were increased when treated with the high water application rate. Despite the effects on plant growth, no significant effects of S-ABA concentration or water application rate on fruit number or fruit yield were found.

Literature Cited


Acknowledgements
My sincere gratitude to Jesús Bautista and Nélida Bautista for their invaluable technical support. Thanks also to Jason Brock of the Plant Disease Clinic, UGA, Tifton Campus, for identification of plant diseases. Financial support provided by the Georgia agricultural experiment stations and Valent BioSciences is highly appreciated.
Table 1A. Chlorophyll index, soil water content (SWC), stem diameter, plant height, root zone temperature (RZT), and canopy temperature in bell pepper as affected by S-ABA concentration and water application rate. Tifton, GA, spring 2012.1

<table>
<thead>
<tr>
<th>Biostimulant</th>
<th>Chlorophyll Index (SPAD)</th>
<th>SWC (%)</th>
<th>Stem Diameter (mm)</th>
<th>Plant Height (cm)</th>
<th>RZT (ºC)</th>
<th>Canopy Temp. (ºC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-ABA rate (ppm)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>67.5 a</td>
<td>4.36 d</td>
<td>13.64 a</td>
<td>43.33 a</td>
<td>36.02 b</td>
<td>29.59</td>
</tr>
<tr>
<td>250</td>
<td>66.7 b</td>
<td>4.96 b</td>
<td>14.01 a</td>
<td>41.33 b</td>
<td>36.03 b</td>
<td>29.21</td>
</tr>
<tr>
<td>500</td>
<td>67.0 b</td>
<td>4.73 c</td>
<td>13.98 a</td>
<td>42.46 a</td>
<td>36.15 b</td>
<td>29.73</td>
</tr>
<tr>
<td>1000</td>
<td>67.1 ab</td>
<td>5.23 a</td>
<td>12.80 b</td>
<td>39.03 c</td>
<td>36.73 a</td>
<td>29.89</td>
</tr>
<tr>
<td>Water (mL/m²)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>250</td>
<td>67.09</td>
<td>4.62 b</td>
<td>13.77 a</td>
<td>42.17 a</td>
<td>36.16</td>
<td>29.63</td>
</tr>
<tr>
<td>1000</td>
<td>67.06</td>
<td>5.01 a</td>
<td>13.44 b</td>
<td>40.91 b</td>
<td>36.30</td>
<td>29.58</td>
</tr>
</tbody>
</table>

Significance

- S-ABA: 0.013 < 0.0001 < 0.0001 < 0.0001 0.001 0.322
- Water (W): 0.833 < 0.0001 0.013 0.0001 0.316 0.838
- S-ABA x W: 0.033 < 0.0001 0.006 0.0002 0.035 0.342

1 Means followed by the same letter are not significantly different based on Fisher's protected least significant test at 95% confidence.

Table 1B. Chlorophyll index, soil water content (SWC), stem diameter, plant height, root zone temperature (RZT), and canopy temperature in bell pepper as affected by S-ABA concentration and water application rate. Tifton, GA, spring 2012.1

<table>
<thead>
<tr>
<th>Treatment</th>
<th>S-ABA (ppm)</th>
<th>Water (mL/m²)</th>
<th>Chlorophyll Index</th>
<th>SWC (%)</th>
<th>Stem Diameter (mm)</th>
<th>Plant Height (cm)</th>
<th>RZT (ºC)</th>
<th>Canopy Temp. (ºC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>250</td>
<td>67.2 ab</td>
<td>4.05 d</td>
<td>13.97 a</td>
<td>44.7 a</td>
<td>35.80 b</td>
<td>29.8</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
<td>1000</td>
<td>67.8 a</td>
<td>4.68 c</td>
<td>13.30 bc</td>
<td>42.0 bc</td>
<td>36.24 b</td>
<td>29.3</td>
</tr>
<tr>
<td>3</td>
<td>250</td>
<td>250</td>
<td>67.0 abc</td>
<td>4.83 bc</td>
<td>13.78 ab</td>
<td>41.1 cd</td>
<td>36.19 b</td>
<td>29.2</td>
</tr>
<tr>
<td>4</td>
<td>500</td>
<td>250</td>
<td>66.8 bc</td>
<td>4.79 bc</td>
<td>14.22 a</td>
<td>42.6 b</td>
<td>36.25 b</td>
<td>29.4</td>
</tr>
<tr>
<td>5</td>
<td>1000</td>
<td>250</td>
<td>67.2 ab</td>
<td>4.66 c</td>
<td>13.74 ab</td>
<td>42.3 bc</td>
<td>36.05 b</td>
<td>30.1</td>
</tr>
<tr>
<td>6</td>
<td>1000</td>
<td>1000</td>
<td>67.3 ab</td>
<td>4.83 bc</td>
<td>13.09 c</td>
<td>40.3 d</td>
<td>36.40 b</td>
<td>30.1</td>
</tr>
<tr>
<td>7</td>
<td>500</td>
<td>1000</td>
<td>66.9 bc</td>
<td>5.62 a</td>
<td>12.50 d</td>
<td>37.7 e</td>
<td>37.06 a</td>
<td>29.7</td>
</tr>
<tr>
<td>P</td>
<td></td>
<td></td>
<td>0.007</td>
<td>&lt;0.0001</td>
<td>&lt;0.0001</td>
<td>&lt;0.0001</td>
<td>0.0005</td>
<td>0.441</td>
</tr>
</tbody>
</table>

1 Means followed by the same letter are not significantly different based on Fisher’s protected least significant test at 95% confidence.

Table 2A. Gas exchange and fluorescence of bell pepper leaves as affected by S-ABA concentration and water application rate. Tifton, GA, spring 2012.2

<table>
<thead>
<tr>
<th>Treatment</th>
<th>S-ABA (ppm)</th>
<th>Water (mL/m²)</th>
<th>Net Photosynthesis (µmol m⁻² s⁻¹)</th>
<th>Stomatal Conductance (mol m⁻² s⁻¹)</th>
<th>PSII Efficiency</th>
<th>Water Use Efficiency (µmol/mmol)</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-ABA rate (ppm)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>26.5</td>
<td></td>
<td>0.260 b</td>
<td>0.158</td>
<td>2.94 a</td>
<td></td>
</tr>
<tr>
<td>250</td>
<td>27.5</td>
<td></td>
<td>0.314 ab</td>
<td>0.149</td>
<td>2.73 b</td>
<td></td>
</tr>
<tr>
<td>500</td>
<td>27.8</td>
<td></td>
<td>0.314 ab</td>
<td>0.154</td>
<td>2.80 ab</td>
<td></td>
</tr>
<tr>
<td>1000</td>
<td>29.6</td>
<td></td>
<td>0.346 a</td>
<td>0.156</td>
<td>2.80 ab</td>
<td></td>
</tr>
<tr>
<td>Water (mL/m²)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>250</td>
<td>26.3 b</td>
<td></td>
<td>0.274 b</td>
<td>0.151</td>
<td>2.89 a</td>
<td></td>
</tr>
<tr>
<td>1000</td>
<td>29.4 a</td>
<td></td>
<td>0.342 a</td>
<td>0.158</td>
<td>2.75 b</td>
<td></td>
</tr>
</tbody>
</table>

Significance

- S-ABA: 0.213 0.062 0.613 0.556
- Water (W): 0.005 0.003 0.162 0.016
- S-ABA x W: 0.117 0.017 0.902 0.054

1 Means followed by the same letter are not significantly different based on Fisher’s protected least significant test at 95% confidence.

2 Photosystem II (PSII) efficiency. It is the fraction of absorbed PSII photons that are used in photochemistry.
Table 2B. Gas exchange and fluorescence of bell pepper leaves as affected by S-ABA concentration and water application rate. Tifton, GA, spring 2012.?

<table>
<thead>
<tr>
<th>Treatment</th>
<th>S-ABA (ppm)</th>
<th>Water (mL/m²)</th>
<th>Net Photosynthesis (µmol m⁻² s⁻¹)</th>
<th>Stomatal Conductance (mol m⁻² s⁻¹)</th>
<th>PSII Efficiency</th>
<th>Water Use Efficiency (µmol/mmol)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>250</td>
<td>25.9 c</td>
<td>0.249 c</td>
<td>0.152</td>
<td>2.96 a</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
<td>1000</td>
<td>27.0 bc</td>
<td>0.271 c</td>
<td>0.164</td>
<td>2.92 a</td>
</tr>
<tr>
<td>3</td>
<td>250</td>
<td>250</td>
<td>24.3 c</td>
<td>0.254 c</td>
<td>0.148</td>
<td>2.80 ab</td>
</tr>
<tr>
<td>6</td>
<td>250</td>
<td>1000</td>
<td>30.7 ab</td>
<td>0.373 ab</td>
<td>0.150</td>
<td>2.66 b</td>
</tr>
<tr>
<td>4</td>
<td>500</td>
<td>250</td>
<td>27.8 abc</td>
<td>0.327 bc</td>
<td>0.149</td>
<td>2.79 ab</td>
</tr>
<tr>
<td>7</td>
<td>500</td>
<td>1000</td>
<td>27.8 abc</td>
<td>0.300 bc</td>
<td>0.159</td>
<td>2.81 ab</td>
</tr>
<tr>
<td>5</td>
<td>1000</td>
<td>250</td>
<td>27.3 abc</td>
<td>0.267 c</td>
<td>0.154</td>
<td>2.99 a</td>
</tr>
<tr>
<td>8</td>
<td>1000</td>
<td>1000</td>
<td>31.9 a</td>
<td>0.424 a</td>
<td>0.158</td>
<td>2.61 b</td>
</tr>
<tr>
<td>P</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.015 0.001 0.732 0.006</td>
</tr>
</tbody>
</table>

Means followed by the same letter are not significantly different based on Fisher’s protected least significant test at 95% confidence.

Table 3. Cumulative fruit yields of bell pepper as affected by S-ABA concentration and water application rate. Tifton, GA, spring 2012.?

<table>
<thead>
<tr>
<th>Biostimulant</th>
<th>Marketable 1000/ha t/ha</th>
<th>Cull 1000/ha t/ha</th>
<th>Total 1000/ha t/ha</th>
<th>Scald (%)</th>
<th>Fruit Wt. g/fruit</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-ABA rate (ppm)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>321.3 33.7</td>
<td>42.7 2.1</td>
<td>364.0 35.8</td>
<td>9.9</td>
<td>104.3</td>
</tr>
<tr>
<td>250</td>
<td>331.1 35.8</td>
<td>43.9 2.6</td>
<td>375.1 38.3</td>
<td>10.3</td>
<td>108.6</td>
</tr>
<tr>
<td>500</td>
<td>322.2 33.9</td>
<td>53.2 3.1</td>
<td>375.4 37.1</td>
<td>12.3</td>
<td>106.0</td>
</tr>
<tr>
<td>1000</td>
<td>360.7 37.3</td>
<td>44.2 2.3</td>
<td>405.0 39.5</td>
<td>10.8</td>
<td>103.9</td>
</tr>
<tr>
<td>Water (mL/m²)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>250</td>
<td>327.0 34.9</td>
<td>46.6 2.3</td>
<td>373.6 37.4</td>
<td>10.7</td>
<td>106.9</td>
</tr>
<tr>
<td>1000</td>
<td>340.7 35.4</td>
<td>45.4 2.3</td>
<td>386.1 38.0</td>
<td>10.9</td>
<td>104.5</td>
</tr>
</tbody>
</table>

| Significance |                         |                  |                    |           |                  |
|--------------|-------------------------|------------------|--------------------|-----------|                  |
| S-ABA        | 0.442 0.648 0.651 0.102 0.367 0.661 0.81 0.561 | | | | |
| Water (W)    | 0.481 0.823 0.855 0.904 0.461 0.806 0.91 0.355 | | | | |
| S-ABA x W    | 0.195 0.359 0.932 0.841 0.111 0.297 0.68 0.505 | | | | |

Means followed by the same letter are not significantly different based on Fisher’s protected least significant test at 95% confidence.

Figure 1: Max, Mean, and Min Air Temperatures in Bell Peppers From Planting to the Last Harvest, Tifton, GA, Spring of 2012
Bell Pepper Plant Physiology and Fruit Yield as Affected by the Plant Biostimulants MaxCel® and VBC-30197

Juan Carlos Díaz-Pérez
Department of Horticulture, University of Georgia, Tifton, GA 31793

Introduction

Bell pepper is an important vegetable crop in Georgia. Bell pepper is exposed to heat stress conditions that affect fruit quality and fruit yield. Crop biostimulants have been shown to increase crop yield and quality under adverse environmental conditions (Kauffman et al., 2007; Srivastava et al., 2008; and Yvin, 1997). Plant biostimulant MaxCel® (6-benzyladenine) is used for fruit thinning in apples and other fruit trees. The objectives of this research were to determine the effects of the plant biostimulants MaxCel® and VBC-7003 (both from Valent) on plant physiology, plant growth, and fruit yield in bell pepper grown in the field.

Materials and Methods

The experiment was conducted at the Horticulture Farm (Tifton, GA), University of Georgia, during the spring season of 2012. The soil of the experimental area was loamy sand, with a pH of about 6.5. The experimental design was a randomized complete block with six replications and four treatments. The experimental plot consisted of a 5 m long bed section, leaving a 1.6 m separation between plots within the same bed.

Crop management. Bell pepper (‘Colossal’) was planted to the field on 26 April 2012 on raised beds (on 1.8 m centers). Plants were established using two rows per bed (36 cm apart) with a distance of 30 cm between plants within the row. The beds were covered with 1.5-m-wide, low-density polyethylene, black plastic mulch. One drip tape line (John Deere, 10-cm separation between emitters, 0.20 mm thick, 4.97 L/m per hour) was placed 2-3 cm deep into the soil in the center of the bed.

The field was fertilized before planting with 672 kg/ha of 10N-10P₂O₅-10K₂O fertilizer. After planting, N and K₂O were applied weekly through the drip tape. Total amount of N and K₂O applied were 245 and 284 kg/ha, respectively.

Plants were irrigated with an amount of water equivalent to 100% crop evapotranspiration (ETc). Crop evapotranspiration was calculated by multiplying the reference evapotranspiration (ETo) by the crop factor (dependent on the crop stage of development). Water was applied when cumulative ETc was 1.2 mm, which corresponded to about every two to three days in mature plants (mean ETo was about 6 mm/day). Weather data (air temperature and ETo) were obtained from a nearby University of Georgia weather station (< 300 m).

Biostimulant application. MaxCel® (1.9% 6-benzyladenine) and VBC-30197 (1% a.i.) were applied with a CO₂ sprayer, providing full coverage of the plant canopy. Water pH was about 6-7 and a non-ionic surfactant was used at 0.05%. MaxCel® was applied at either 0.5 mL/L (10 ppm 6-BA) or 1 mL/L MaxCel® (20 ppm 6-BA), using sufficient volume to ensure full canopy coverage. VBC-30197 was applied at 2.0 mL/L (20 ppm a.i.). Biostimulants were sprayed the following times: a) seven days after transplanting (20 gal/a); b) at first fruit set (30 gal/a); and c) after harvest started, once after each harvest but not closer than 10 days after previous application (40 gal/a), applied three times.

Leaf chlorophyll index. Leaf chlorophyll index was measured twice per week with a chlorophyll meter (SPAD-502, Minolta) in five mature, well exposed leaves per plot.

Soil water content. Soil water content was measured twice a week during the entire season with a portable time domain reflectometer sensor.

Plant growth. Stem diameter and plant height were measured twice per week during the entire season on three plants per plot.

Root zone temperature. Root zone temperature (RZT) at 10 cm depth was measured twice a week during the entire season with an electronic thermometer.

Canopy temperature. Canopy temperature was measured at midday on three plants per plot on clear days: 30 May, 5 June, and 22 June.

Gas exchange and fluorescence. Leaf gas exchange (net photosynthesis and stomatal conductance) and leaf fluorescence (PSII efficiency) were measured with a gas exchange system (LI-6400) coupled with a fluorescence chamber. Measurements were conducted on well exposed leaves in mature plants, on clear days (21 June and 28 June), between 11:00 and 13:00 HR EST.

Phytotoxicity. Phytotoxicity symptoms were evaluated one to two days after the application of biostimulants using a 1-5 visual rating scale (1 = no symptoms; 2 = mild; 3 = moderate; 4 = large; 5 = severe) to grade the entire plot.

Fruit yield. Fruit were harvested five times from 22 June to 30 July and graded as marketable or culls, according to the U.S. Grading Standards. The number and weight of fruit in each grading category was also determined.

Statistical analysis. Data were analyzed using the GLM Procedure of SAS (SAS 9.3; SAS Inst. Inc., Cary, NC).
Results

Weather. Maximal, minimal, and mean temperatures during the growing season are shown in Figure 1. The mean temperature was 25.2°C and the cumulative rainfall was 390 mm.

Leaf chlorophyll index. Leaf chlorophyll index is an indirect indicator of leaf nitrogen concentration. Chlorophyll index was unaffected by either MaxCel® or VBC-30197 compared to the untreated control (UTC) (Table 1).

Soil water content. Soil water content (SWC) may be an indicator of plant water use since all treatments received the same amount of irrigation water. Soil water content was highest with the UTC and lowest with MaxCel® at 1.0 mL/L, suggesting that plants treated with MaxCel® at 1.0 mL/L had reduced soil water use. This result could be due to reduced plant growth compared to the other treatments.

Stem diameter and plant height. Stem diameter was highest and plants were tallest when treated with VBC-30197, suggesting that VBC-30197 increased growth of the aerial portion of the plant.

Root zone temperature. Root zone temperature (RZT) may be affected by plant canopy growth (higher canopy growth values are associated with reduced RZT). Root zone temperature was highest in the UTC and lowest in VBC-30197, suggesting that plants treated with VBC-30197 had increased canopy growth compared to plants from the other treatments.

Canopy temperature. Canopy temperature was highest in plants treated with MaxCel® at 1.0 mL/L.

Gas exchange and fluorescence. Leaf net photosynthesis (P = 0.060) and stomatal conductance (P = 0.0496) were lowest in plants treated with MaxCel® at 1.0 mL/L (Table 2). Reduced values of stomatal conductance are consistent with the increased canopy temperatures in plants treated with MaxCel® at 1.0 mL/L. There were no differences in photosystem II efficiency or water use efficiency among biostimulant treatments and the control.

Fruit yield. Neither MaxCel® (at both rates) nor VBC-30197 had any significant effects on number of fruit or fruit yields (marketable and total), incidence of fruit scald, or fruit weight (Table 3).

Phytotoxicity. There were no visual phytotoxicity symptoms in any of the treatments.

Conclusions

The biostimulant VBC-30197 was associated with increased vegetative growth compared to MaxCel® and the untreated control, although it had no significant effects on either marketable or total fruit yields. MaxCel® at 1.0 mL/L had reduced rates of both leaf net photosynthesis and stomatal conductance, possibly due to toxicity effects. Fruit number, fruit yield, and fruit size of bell pepper plants treated with VBC-30197 and MaxCel® were similar compared to those of the control.

Literature Cited


Acknowledgements

My sincere gratitude to Jesús Bautista and Nélida Bautista for their invaluable technical support. Thanks also to Jason Brock of the Plant Disease Clinic, University of Georgia, Tifton Campus, for identification of plant diseases. Financial support provided by the Georgia agricultural experiment stations and Valent BioSciences is highly appreciated.

Continued on next page.

Table 1. Chlorophyll index, soil water content (SWC), stem diameter, plant height, root zone temperature (RZT) and canopy temperature in bell pepper as affected by the biostimulants MaxCel® and VBC-30197. Tifton, GA, spring 2012.

<table>
<thead>
<tr>
<th>Biostimulant</th>
<th>Chlorophyll Index (SPAD)</th>
<th>SWC (%)</th>
<th>Stem Diameter (mm)</th>
<th>Plant Height (cm)</th>
<th>RZT (ºC)</th>
<th>Canopy Temp. (ºC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>UTC y</td>
<td>67.3</td>
<td>6.20 a</td>
<td>11.6 b</td>
<td>36.2 b</td>
<td>39.25 a</td>
<td>28.71 b</td>
</tr>
<tr>
<td>MaxCel® at 0.5 mL</td>
<td>66.9</td>
<td>5.67 bc</td>
<td>11.6 b</td>
<td>38.0 b</td>
<td>38.97 ab</td>
<td>29.13 ab</td>
</tr>
<tr>
<td>MaxCel® at 1.0 mL</td>
<td>66.7</td>
<td>5.56 c</td>
<td>11.5 b</td>
<td>37.6 b</td>
<td>38.48 bc</td>
<td>30.02 a</td>
</tr>
<tr>
<td>VBC-30197 at 2 mL/L</td>
<td>66.3</td>
<td>5.92 ab</td>
<td>12.7 a</td>
<td>41.1 a</td>
<td>38.09 c</td>
<td>28.25 b</td>
</tr>
<tr>
<td>P</td>
<td>0.378</td>
<td>0.002</td>
<td>&lt; 0.0001</td>
<td>0.002</td>
<td>0.002</td>
<td>0.016</td>
</tr>
</tbody>
</table>

* Means followed by the same letter are not significantly different based on Fisher’s protected least significant test at 95% confidence.

y UTC: untreated control.
Table 2. Gas exchange and fluorescence of bell pepper leaves as affected by the biostimulants MaxCel® and VBC-30197. Tifton, GA, spring 2012.\textsuperscript{z}

<table>
<thead>
<tr>
<th>Biostimulant</th>
<th>Net Photosynthesis (µmol m\textsuperscript{-2} s\textsuperscript{-1})</th>
<th>Stomatal Conductance (mol m\textsuperscript{-2} s\textsuperscript{-1})</th>
<th>PSII Efficiency \textsuperscript{x}</th>
<th>Water Use Efficiency (µmol/mmol)</th>
</tr>
</thead>
<tbody>
<tr>
<td>UTC\textsuperscript{y}</td>
<td>32.0 a</td>
<td>0.392 a</td>
<td>0.159</td>
<td>2.51</td>
</tr>
<tr>
<td>MaxCel\textsuperscript{®} at 0.5 mL</td>
<td>27.2 ab</td>
<td>0.313 ab</td>
<td>0.140</td>
<td>2.44</td>
</tr>
<tr>
<td>MaxCel\textsuperscript{®} at 1.0 mL</td>
<td>24.2 b</td>
<td>0.251 b</td>
<td>0.144</td>
<td>2.49</td>
</tr>
<tr>
<td>VBC-30197 at 2 mL/L</td>
<td>28.6 ab</td>
<td>0.300 ab</td>
<td>0.150</td>
<td>2.67</td>
</tr>
<tr>
<td>\textbf{P}</td>
<td>\textbf{0.060}</td>
<td>\textbf{0.0496}</td>
<td>\textbf{0.410}</td>
<td>\textbf{0.501}</td>
</tr>
</tbody>
</table>

\textsuperscript{z} Means followed by the same letter are not significantly different based on Fisher’s protected least significant test at 95% confidence.

\textsuperscript{y} UTC: untreated control.

\textsuperscript{x} Photosystem II (PSII) efficiency. It is the fraction of absorbed PSII photons that are used in photochemistry.

Table 3. Cumulative fruit yields of bell pepper as affected by S-ABA concentration and water application rate. Tifton, GA, spring 2012.\textsuperscript{z}

<table>
<thead>
<tr>
<th>Biostimulant</th>
<th>Marketable</th>
<th>Cull</th>
<th>Total</th>
<th>Scald (%)</th>
<th>Fruit Wt. g/fruit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1000/ha</td>
<td>t/ha</td>
<td>1000/ha</td>
<td>t/ha</td>
<td>1000/ha</td>
</tr>
<tr>
<td>UTC\textsuperscript{y}</td>
<td>294</td>
<td>24.8</td>
<td>32.3</td>
<td>1.6</td>
<td>326</td>
</tr>
<tr>
<td>MaxCel\textsuperscript{®} at 0.5 mL</td>
<td>277</td>
<td>26.7</td>
<td>31.7</td>
<td>1.7</td>
<td>309</td>
</tr>
<tr>
<td>MaxCel\textsuperscript{®} at 1.0 mL</td>
<td>243</td>
<td>23.2</td>
<td>26.3</td>
<td>1.3</td>
<td>269</td>
</tr>
<tr>
<td>VBC-30197 at 2 mL/L</td>
<td>306</td>
<td>29.1</td>
<td>25.1</td>
<td>1.1</td>
<td>331</td>
</tr>
<tr>
<td>\textbf{P}</td>
<td>\textbf{0.653}</td>
<td>\textbf{0.715}</td>
<td>\textbf{0.753}</td>
<td>\textbf{0.687}</td>
<td>\textbf{0.696}</td>
</tr>
</tbody>
</table>

\textsuperscript{z} Means followed by the same letter are not significantly different based on Fisher’s protected least significant test at 95% confidence.

\textsuperscript{y} UTC: untreated control.

Figure 1: Max, Mean, and Min Air Temperatures in Bell Peppers From Planting to the Last Harvest, Tifton, GA, Spring of 2012.
Bell Pepper Plant Growth as Affected by the Biostimulants CX-11020 and Screen Duo

Juan Carlos Díaz-Pérez
Department of Horticulture, University of Georgia, Tifton, GA 31793

Introduction

Bell pepper is an important vegetable crop in Georgia, with a surface of 6,000 acres and a farm gate value of $78 million in 2010. Bell pepper is exposed to heat stress conditions that affect fruit quality and fruit yield. Crop biostimulants have been shown to increase crop yield and quality under adverse environmental conditions (Kauffman et al., 2007; Srivastava et al., 2008; and Yvin, 1997).

Screen-Duo (aluminium silicate) is a biostimulant used for heat stress and sunburn management (CERTIS USA). Biostimulant CX-11020 is expected to provide improved tolerance to heat and drought stress conditions, according to the manufacturer (CERTIS USA). The objectives of this research were to determine the effects of the plant biostimulants CX-11020 and Screen Duo on the plant growth of bell peppers grown under heat stress conditions.

Materials and Methods

The experiment was conducted at the Horticulture Farm (Tifton, GA), University of Georgia, during the spring season of 2011. The soil of the experimental area was loamy sand, with a pH of about 6.5. The experimental design was a randomized complete and six replications (Table 1). The biostimulant treatments were: a) CX-11020 at 6.5 gal/a, b) CX-11020 at 13 gal/a, c) Screen Duo at 8 lb/a, and d) untreated control (UTC).

Crop management. 'Colossal' bell pepper was planted to the field on 7 June 2012 on raised beds (on 1.8 m centers). Plants were established on two rows per bed with a distance of 30 cm between plants within the row. The beds were covered with 1.5-m-wide, low-density polyethylene, white plastic mulch. One drip tape line (John Deere, 10-cm separation between emitters) was placed 2-3 cm deep into the soil in the center of the bed.

The field was fertilized before planting with 672 kg/ha of 10N-10P₂O₅-10K₂O fertilizer. After planting, N and K₂O were applied weekly through the drip tape. Total amount of N, P₂O₅, and K₂O applied were 205, 67, and 236 kg/ha, respectively. The experimental plot consisted of a 5 m long bed section, leaving a 1.6 m separation between plots within the same bed. The irrigation rate was 100% the rate of crop evapotranspiration (ETc). Crop evapotranspiration (ETc) was calculated by multiplying the reference evapotranspiration (ETo) by the crop factor (dependent on the crop stage of development). Irrigation water was applied when cumulative ETc was 12 mm, which corresponded to about every two to three days in mature plants (mean ETo was about 6 mm/day). Weather data (air temperature and ETo) were obtained from a nearby University of Georgia weather station (< 300 m).

Biostimulant application. The biostimulants CX-11020 and Screen Duo were applied with a CO₂-backpack sprayer, providing full coverage of the plant canopy, as recommended by Certis. Water pH was about 6-7, and a non-ionic surfactant (80-20 surfactant; UCPA LLC, Eagan, MN) was used at 0.05%. The biostimulants were sprayed every 14 days, starting after transplanting, using sufficient volume to ensure full canopy coverage. Biostimulants were reapplied if heavy rain occurred before the 14-day time frame between applications.

Leaf chlorophyll. Leaf chlorophyll index (SPAD) was measured with a chlorophyll meter (SPAD-502, Minolta) in five mature, well exposed leaves per plot. Chlorophyll measurements were conducted twice per week for the entire season.

Root zone temperature. Root zone temperature (RZT) was measured at 10 cm deep (within the row, between two plants) with a portable electronic thermometer.

Soil water content. Soil water content (SWC) was measured at 12 cm deep (within the row, between two plants) with a portable Time Domain Reflectometry (TDR) sensor (Campbell Sci.).

Plant growth. Plant height and stem diameter were measured twice a week over the entire season.

Continued on next page.
Statistical analysis. Data were analyzed using the GLM procedure of SAS (SAS 9.3; SAS Inst. Inc., Cary, NC).

Results

Weather. Maximal, minimal, and mean daily temperatures during the growing season are shown in Figure 1. The average temperatures for the season were 31.4°C (maximal), 20.4°C (minimal), and 25.9°C (mean), and the cumulative rainfall was 559 mm.

Plant growth. Chlorophyll index was lowest in the untreated control (Table 1). Chlorophyll index is an indirect estimate of leaf nitrogen concentration. Stem diameter and plant height were similar among biostimulant treatments. Root zone temperature (RZT) and soil water content (SWC) were unaffected by biostimulant treatments. Both RZT and SWC are negatively related to plant growth (reduced RZT and reduced SWC are associated with increased plant growth).

Phytotoxicity. There were no phytotoxicity symptoms in any of the treatments.

Tomato spotted wilt virus. There was a 100% incidence of TSWV disease in all the treatments. Plants had reduced growth during July, August, and the first three weeks of September. In the last week of September, plants started to form new leaves and increase in vigor, recovering from the TSWV symptoms. This plant recovery was probably a result of the decreasing air temperatures.

Conclusions

Neither CX-11020 (both rates) or Screen Duo provided any amelioration of heat stress effects on bell pepper plant growth or function. Heat stress conditions during the transplant establishment period resulted in reduced plant vigor and, possibly, were associated with the 100% incidence of tomato spotted wilt virus. Planting in this study was done six to eight weeks later than in commercial production with the goal of exposing the crop to heat stress. In previous studies, we have found that heat stress increases the incidence and severity of TSWV (Díaz-Perez et al., 2007).

Literature Cited


Acknowledgements

My sincere gratitude to Jesús Bautista and Nélida Bautista for their invaluable technical support. Thanks also to Jason Brock of the Plant Disease Clinic, University of Georgia, Tifton Campus, for identification of plant diseases. Financial support provided by the Georgia agricultural experiment stations and CERTIS USA is highly appreciated.

Table 1. Chlorophyll index (SPAD values), plant growth, canopy temperature, and soil water content (SWC) in tomato as affected by biostimulant (CX-11020) rate and irrigation rate. Tifton, GA, Spring 2011.

<table>
<thead>
<tr>
<th>Biostimulant</th>
<th>Chlorophyll Index (SPAD)</th>
<th>Stem Diameter (mm)</th>
<th>Plant Height (cm)</th>
<th>Canopy Temp. (°C)</th>
<th>SWC (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CX-11020 at 6.5 g/a</td>
<td>52.2 a</td>
<td>11.0</td>
<td>28.7</td>
<td>35.66</td>
<td>5.6</td>
</tr>
<tr>
<td>CX-11020 at 13 g/a</td>
<td>51.4 ab</td>
<td>10.8</td>
<td>28.2</td>
<td>35.72</td>
<td>5.7</td>
</tr>
<tr>
<td>Screen Duo 8 at lb/a</td>
<td>52.1 a</td>
<td>11.0</td>
<td>29.9</td>
<td>35.53</td>
<td>5.7</td>
</tr>
<tr>
<td>UTC†</td>
<td>50.7 b</td>
<td>10.6</td>
<td>28.6</td>
<td>35.63</td>
<td>5.9</td>
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<tr>
<td>Significance</td>
<td>0.005</td>
<td>0.372</td>
<td>0.183</td>
<td>0.780</td>
<td>0.202</td>
</tr>
</tbody>
</table>

† Means followed by the same letter are not significantly different based on Fisher’s protected least significant test at 95% confidence.

† UTC: untreated control.
Figure 1: Air Temperature (Mean = 25.9°C) and Rainfall (Total = 559 mm) in Bell Peppers From June to Sept. 2012; Planting Date was 7 June 2012; Tifton, GA, Spring of 2011
The Role of Soil Fertility on the Efficacy of Acibenzolar-S-Methyl (Actigard) for Control of Bacterial Leaf Spot of Pepper
Bhabesh Dutta, Ron Gitaitis, David Langston, and Hunt Sanders
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Introduction
Pepper is an important vegetable crop in the U.S. for both processing and fresh-market consumption. Georgia ranks in the top four states in the nation in pepper production. In terms of dollar value to Georgia, pepper ranks second, behind only Vidalia onions. Pepper production has been negatively impacted by pests and diseases such as bacterial leaf spot of pepper (BLS), caused by the bacterium Xanthomonas campestris pv. vesicatoria.

Bacterial leaf spot has caused millions of dollars in losses annually and is the most widespread and serious disease affecting pepper in Georgia. BLS is usually spread by infected seed and transplants. Like most bacterial diseases, it is extremely difficult to manage. BLS is responsible for severe losses when there is either abundant rain or when overhead irrigation is employed. To control this disease, growers apply multiple applications of copper plus mancozeb as frequently as twice a week. However, the disease is not effectively controlled when environmental conditions are optimum for disease development. Furthermore, control is hampered by the development of copper-tolerant bacterial strains.

Since BLS is difficult to manage with current control strategies and because the primary existing control strategy is based on copper sprays, alternatives need to be explored. The plant activator acibenzolar-S-methyl (Actigard) has shown some promise. Despite its effectiveness against BLS the response has been variable.

Materials and Methods
Experiments were conducted in 2014 in the field at the Blackshank Farm near Tifton, GA. Treatments were replicated four times and arranged in a randomized complete block design. Treatments were as follows: 1) High copper:low iron + Actigard; 2) high iron:low copper + Actigard; 3) high zinc + Actigard; 4) standard (NPK) fertilizer + Actigard; 5) high copper:low Iron; 6) high iron:low copper; 7) high zinc; and 8) standard (NPK) fertilizer. Pepper transplants were set in 50 ft rows, 6 ft apart and 3 ft within-row-spacing. One week following transplanting, one plant at each end of a row was inoculated with a bacterial suspension (108 colony forming units/ml). At maturity, disease levels were assessed; both soil and tissue samples were collected, and mineral contents were analyzed by the soil/plant tissue lab in Athens, GA. In addition, levels of salicylic acid (SA) were also determined from pepper tissue samples.

Predictive models explaining BLS severity were developed using stepwise regression. BLS severity was used as the dependent variable. Quantities of soil and tissue nutrients as well as ratios of key cations and SA levels were used as the independent variables.

Results and Discussion
There were significant correlations between BLS and the concentrations of copper (Cu) and the ratio of iron to zinc (Fe:Zn). A significant regression model (BLS severity (%) = -13.4 Cu – 1.4 Fe:Zn + 81.8) was obtained when BLS severity was regressed with concentrations of cations and their ratios in pepper tissues with P = 0.01 and adjusted R2 = 0.99. In this study, we did not observe significant interactions between Actigard and different cations (P = 0.482).

It is interesting to note that copper applied as a protectant barrier is a bactericide and reduces X. euvesicatoria populations on leaf surfaces. This protects the plant from infections as inoculum is reduced at the infection court. However, it appears that copper may have a negative role in the physiology of the plant as these data indicate as copper concentrations increase in pepper tissue, BLS severity also increases. This may be a result of negative feedback on the production of Cu/Zn-superoxide dismutase and Fe-superoxide dismutase (SOD) enzymes. Likewise the Fe:Zn ratio may be regulating the activity of the Cu-ZnSOD enzyme. The superoxide dismutase enzymes are part of the machinery that detoxifies reactive oxygen species (ROS). ROS compounds develop from a number of normal sources such as redox reactions in the electron transport system. However, a number of plant pathogens cause an ROS burst at the point of infection. SOD enzymes
could be involved in detoxifying the ROS from the infection burst and result in the production of hydrogen peroxide. The accumulation of hydrogen peroxide would result in the production of SA. SA is thought to be the messenger that signals the activation of SAR. Actigard, a known SAR inducer is an analog of SA. Further research is required to validate these findings, but preliminary interpretation of the results could indicate that constituent levels of SA may be produced by manipulating key cation ratios in plant tissues by prescribed fertilization practices. This in turn may lead to higher levels of SAR.

The expression levels of SOD genes were determined upon treatment with Cu, Zn, and Fe, and they were compared with a standard fertility regime. In 2014, although, application of Cu, Fe, and Zn resulted in higher relative expression of Cu-ZnSOD (Cu = 2.3 fold; Fe = 2.15 fold; Zn = 1.91), the difference among the treatments were not significant (P = 0.112). Furthermore, application of Zn (0.14 fold; P = 0.005) significantly reduced FeSOD expression compared to Fe (1.58 fold) and Cu (0.99 fold) treatments. Relative expression of MnSOD was significantly higher for the Fe treatment (1.84 fold; P = 0.001) as compared to Cu (0.42 fold) and Zn (0.31 fold) treatments.

Application of Fe significantly increased relative expression of NPR1(non-pathogenesis related protein) gene in 2014 (12.8 fold; P = 0.032) as compared to Cu and Fe treatments. NPR1 gene is a master regulator of SAR. In addition, relative expression of NPR1 for the Cu and Zn treatments were 2.15- and 0.98-fold relative to standard fertility treatment. Treatments with high Fe (22.5%) and Zn (29.2%) application had significantly lower level of BLS severity than high Cu (48%) and standard fertility treatment (54%). The SA accumulated in pepper tissues treated with high Fe (12.5 ppm) was significantly higher than other treatments [high Cu (1.8 ppm) and high Zn (5.2 ppm)] and a standard fertility control (2.4 ppm).

In conclusion, based on mineral analysis of pepper tissues, several significant BLS severity models were developed. These models are comprised of Cu, Fe, Mn, or Zn as major contributors alone or in different ratios. These cations also act as cofactors for SOD. As a result, hydrogen peroxide is formed, which acts as precursor for salicylic acid (SA) formation. SA has been proposed as the signal molecule to initiate the SAR pathway.

Utilizing GACCV funds, we found evidence of SOD involvement in these models as seen by the effects of increased levels of Cu, Fe, or Zn on the relative gene expression for the three major classes of SODs (Cu-Zn SOD, MnSOD, and FeSOD) in pepper tissues. We also observed that increased levels of SA and MnSOD activity in plants showing less BLS severity than plants with severe BLS symptoms, thereby providing evidence of a SAR response. The consistency of our preliminary data observed for disease development and the interactions of cations over several different years fit within the framework of induction of SAR. Furthermore, soil as well as tissue models explained disease levels.

Hence, by using these disease models, it should be feasible to identify and thus predict higher risk planting sites for BLS in pepper. We envision the scouting of fields to identify areas at higher risk for disease development based on the mineral profile at those sites.

Acknowledgements
Thanks are extended to the Georgia Agricultural Commodity Commission for Vegetables for its financial support of this project.
Tomato Plant Growth and Fruit Yield as Affected by the Plant Biostimulant CX-11020 and Irrigation Level

Juan Carlos Díaz-Pérez
Department of Horticulture, University of Georgia, Tifton Campus, Tifton, GA 31793

Introduction
Tomato is an important vegetable crop in Georgia, with a surface of 4,300 acres and a farm gate value of $27 million (USDA NASS – Georgia, 2009). In Georgia, tomato is exposed to heat stress conditions that affect fruit quality and fruit yield. Crop biostimulants have been shown to improve crop performance and increase crop yield and quality under adverse environmental conditions (Kauffman et al., 2007; Srivastava et al., 2008; and Yvin, 1997). Biostimulant CX-11020 is expected to provide improved tolerance to heat and drought stress conditions, according to the manufacturer (CERTIS USA). The objectives of this research were to determine the effects of the plant biostimulant CX-11020 and irrigation level on plant growth and fruit yield in tomato.

Materials and Methods
The experiment was conducted at the Horticulture Farm (Tifton, GA), University of Georgia, during the spring season of 2011. The soil of the experimental area was loamy sand, with a pH of about 6.5. The experimental design was a randomized complete block (three biostimulant rates x two irrigation levels) and six replications (Table 1). The biostimulant rates were 0, 8, or 16 oz/a. The irrigation rates were 40% the rate of crop evapotranspiration (ETc) and 100% ETc. The experimental plot consisted of an 8 m long bed section, leaving a 1.6 m separation between plots within the same bed.

Crop management. Tomato (‘BHN-602’) was planted to the field on 22 April 2011 on raised beds (on 1.8 m centers). Plants were established on one row per bed with a distance of 60 cm between plants within the row. The beds were covered with 1.5-m-wide, low-density polyethylene, black plastic mulch. One drip tape line (John Deere, 10-cm separation between emitters) was placed 2-3 cm deep into the soil in the center of the bed. The field was fertilized before planting with 672 kg/ha of 10N-10P2O5-10K2O fertilizer. After planting, N and K2O were applied weekly through the drip tape. Total amount of N, P2O5 and K2O applied were 169, 67, and 169 kg/ha, respectively.

Crop evapotranspiration (ETc) was calculated by multiplying the reference evapotranspiration (ET0) by the crop factor (dependent on the crop stage of development). Irrigation water was applied when cumulative ETc was 12 mm, which corresponded to about every two to three days in mature plants (mean ET0 was about 6 mm/day). Weather data (air temperature and ET0) were obtained from a nearby University of Georgia weather station (< 300 m).

Biostimulant application. Plant biostimulant CX-11020 was applied with a backpack sprayer, providing full coverage of the plant canopy, as recommended by Certis. Water pH was about 6-7, and a non-ionic surfactant (80-20 surfactant; UCPA LLC, Eagan, MN) was used at 0.05%. The biostimulant was sprayed during the growing season at 0, 8, or 16 oz/a, using sufficient volume to ensure full canopy coverage.

Leaf chlorophyll. Leaf chlorophyll SPAD values were measured with a chlorophyll meter (SPAD-502, Minolta) in five mature, well exposed leaves per plot. Chlorophyll measurements were conducted twice per week for the entire season.

Canopy temperature. Plant canopy temperature (indirect measurement of plant stress) was measured weekly, between 12:00 and 14:00 HR, on clear days, with an infrared thermometer.

Fruit yield. Fruit were harvested four times from 22 June to 12 July and graded as marketable or culls, according to the tomato U.S. Grading Standards (USDA, 1997). The number and weight of fruit in each grading category and the incidence of fruit with blossom-end rot (BER) and scald symptoms were also determined.

Plant growth. Plant height and stem diameter were measured once a week over the entire season. After the last harvest, four plants (tops) per plot were excised at the base of the stem, and their weight (vegetative top fresh weight) was immediately determined.

Statistical analysis. Data were analyzed using the GLM Procedure of SAS (SAS 9.1; SAS Inst. Inc., Cary, NC).
Results

Weather. Maximal, minimal, and mean daily temperatures during the growing season are shown in Figure 1. The mean temperature for the season was 26.1°C and the cumulative rainfall was 164 mm. The season was drier and warmer than in typical years.

Leaf chlorophyll. Leaf chlorophyll SPAD values were unaffected by biostimulant rate (Table 1). Leaf chlorophyll SPAD values were higher in plants irrigated at 100% ETc than in plants irrigated at 40% ETc.

Plant growth. Top vegetative fresh weight and stem diameter were unaffected by biostimulant rate, although plants were taller when treated with the biostimulant at 16 oz/a. Top vegetative fresh weight, plant height, and stem diameter were higher in plants irrigated at 100% ETc than in those irrigated at 40% ETc, which shows that water stress reduced overall plant growth.

Canopy temperature. Canopy temperature was unaffected by biostimulant rate. Canopy temperature was higher in plants irrigated at 40% ETc than in plants irrigated at 100% ETc, suggesting that plants irrigated at 40% ETc had reduced stomatal closure that resulted in increased canopy temperature.

Phytotoxicity. There were no phytotoxicity symptoms in any of the treatments.

Fruit yield. Biostimulant rate had no effects on marketable, cull, or total yields, incidences of blossom-end rot and fruit scald, nor individual fruit weight (Table 2). Plants irrigated at 100% ETc had higher marketable, cull, and total yields, and a higher individual fruit weight compared to plants irrigated at 40% ETc. Irrigation rate had no influence on the incidences of blossom-end rot or fruit scald.

There was no interaction between biostimulant rate and irrigation rate, which means that the plant growth and fruit yield responses of tomato plants to water stress were not affected by the application rate of the biostimulant.

Conclusions

Regardless of irrigation level, the plant biostimulant CX-11020 had little effects on leaf chlorophyll SPAD values, top vegetative fresh weight, stem diameter, and canopy temperature in tomato. CX-11020 also had no impact on marketable and total tomato fruit yields and incidences of blossom-end rot and fruit scald. Plants irrigated at 40% ETc (water stress) showed reduced plant growth (vegetative top fresh weight, height, and stem diameter), increased canopy temperature, reduced marketable and total fruit yields, and reduced individual fruit weight, compared to plants irrigated at 100% ETc (well-irrigated).

Literature Cited


Acknowledgements

My sincere gratitude to Jesús Bautista and Nélida Bautista for their invaluable technical support. Thanks also to Jason Brock of the Plant Disease Clinic, University of Georgia, Tifton Campus, for identification of plant diseases. Financial support provided by the Georgia agricultural experiment stations and CERTIS USA is highly appreciated.
Table 1. Chlorophyll (SPAD) values, plant growth, and canopy temperature in tomato as affected by biostimulant (CX-11020) rate and irrigation rate. Tifton, GA, spring 2011.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Chlorophyll (SPAD)</th>
<th>Vegetative Top Fresh Wt. (g)</th>
<th>Plant Height (cm)</th>
<th>Stem Diameter (mm)</th>
<th>Canopy Temp. (ºC)</th>
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<td><strong>Biostimulant Rate</strong></td>
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<tr>
<td>0 oz/a</td>
<td>64.8</td>
<td>582</td>
<td>50.7 b</td>
<td>18.9</td>
<td>33.6</td>
</tr>
<tr>
<td>8 oz/a</td>
<td>65.0</td>
<td>618</td>
<td>50.4 b</td>
<td>18.7</td>
<td>33.4</td>
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<tr>
<td>16 oz/a</td>
<td>65.0</td>
<td>678</td>
<td>51.7 a</td>
<td>19.1</td>
<td>33.5</td>
</tr>
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<td><strong>Irrigation Rate</strong></td>
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<tr>
<td>40% ETc</td>
<td>64.4 b</td>
<td>96 b</td>
<td>50.2 b</td>
<td>18.7 b</td>
<td>34.1 a</td>
</tr>
<tr>
<td>100% ETc</td>
<td>65.5 a</td>
<td>177 a</td>
<td>51.6 a</td>
<td>19.1 a</td>
<td>32.9 b</td>
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**Significance**

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<th>Biostimulant (B)</th>
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</tbody>
</table>

* ETc = Crop evapotranspiration. 100% ETc = well-irrigated; 40% ETc = water-stressed.

y Means followed by the same letter are not significantly different based on Fisher’s protected least significant test at 95% confidence.

NS, *, **, ***, **** Nonsignificant or significant at P < 0.05, P < 0.01, P < 0.001, or P < 0.0001, respectively.

Table 2. Cumulative fruit yields and incidences of blossom-end rot (BER) and fruit scald in tomato as affected by biostimulant (CX-11020) rate and irrigation rate. Tifton, GA, spring of 2011.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Marketable 1000/ha</th>
<th>Cull 1000/ha</th>
<th>Total 1000/ha</th>
<th>Ber (%)</th>
<th>Scald (%)</th>
<th>Fruit Wt. g/fruit</th>
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<td><strong>Biostimulant Rate</strong></td>
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<tr>
<td>0 oz/a</td>
<td>131</td>
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<td>8 oz/a</td>
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<td>19.0</td>
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<td>16 oz/a</td>
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<td>48</td>
<td>10.3</td>
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<tr>
<td>40% ETc</td>
<td>96 b</td>
<td>6.4 b</td>
<td>37 b</td>
<td>6.9 b</td>
<td>134 b</td>
<td>13.3 b</td>
</tr>
<tr>
<td>100% ETc</td>
<td>177 a</td>
<td>15.4</td>
<td>52 a</td>
<td>11.2 a</td>
<td>229 a</td>
<td>23.6 a</td>
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**Significance**

<table>
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</table>

* ETc = Crop evapotranspiration. 100% ETc = well-irrigated; 40% ETc = water-stressed.

y Means followed by the same letter are not significantly different based on Fisher’s protected least significant test at 95% confidence.

NS, *, **, ***, **** Nonsignificant or significant at P < 0.05, P < 0.01, P < 0.001, or P < 0.0001, respectively.

Figure 1: Max, Mean, and Min Air Temperatures in Tomatoes From Planting to the Last Harvest, Tifton, GA, Spring of 2011
Evaluation of Insecticide Treatments in Tomato: Spring 2013

David G. Riley
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Materials and Methods

Tomato hybrid ‘Red Bounty’, was transplanted into 1-row per plastic mulch bed on March 28 and maintained with standard cultural practices at the Lang-Rigdon Farm, Coastal Plain Experiment Station at Tifton, GA. A total of 500 pounds of 10-10-10 per acre was applied to Tift pebbly clay loam field plots, and irrigation occurred weekly through a drip irrigation system with 7 lb/a of 20-20-20 liquid fertilizer every other week. A drench application was made into the transplant hole on 18 April. Five foliar applications of insecticide were made on 24 April and 6, 13, 21, and 28 May. Scouting was initiated on April 5 and continued weekly until harvest. One sample of six plants was scouted per plot after weekly applications. Thrips were sampled from 10 tomato blossoms per plot and counted to species.

Tomatoes were harvested from 11 ft of row (seven plants) on 18 and 24 June. Fruit were categorized as marketable, thrips damaged, or worm damaged, and the average weight was measured. Percent marketable ratings were reported excluding all lepidopteran damaged fruit. Data were analyzed using GLM and LSD tests for separation of means (SAS Institute 1990).

Results

The main thrips species present was flower thrips. Although the scout data did not reflect a buildup of cabbage looper, there were enough at the end of the test to cause significant damage to the crop. IKI-3106 at the higher rate provided significant partial control of flower thrips while the Movento treatment did not (Table 1). The aphids present were most likely potato aphids, but the identification was not confirmed, and the treatment effect was not significant at these low levels of aphids. Lepidoptera damage on fruit was significantly reduced by the IKI-3106 treatments at both rates. Both IKI-3106 rates tended to have the highest percent marketable fruit of all the treatments.

Table 1. Thrips counts from 10-blossom sample on some individual dates.

<table>
<thead>
<tr>
<th>Treatment - Rate per Acre</th>
<th>F. tritici on May 22</th>
<th>F. occidentalis on May 22</th>
<th>Total Thrips on May 22</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Untreated Check</td>
<td>68.3a*</td>
<td>2.3a</td>
<td>73.8a</td>
</tr>
<tr>
<td>2. Movento 240SC (5 oz/a)</td>
<td>63.8a</td>
<td>1.0a</td>
<td>64.8a</td>
</tr>
<tr>
<td>3. IKI-3106 50SL (11 oz/a)</td>
<td>55.8ab</td>
<td>1.3a</td>
<td>57.1ab</td>
</tr>
<tr>
<td>4. IKI-3106 50SL (16.4 oz/a)</td>
<td>43.5b</td>
<td>1.3a</td>
<td>44.8b</td>
</tr>
</tbody>
</table>

*Means within columns followed by the same letter are not significantly different (LSD, P < 0.05).

Table 2. Insect data for tomatoes in spring 2013.

<table>
<thead>
<tr>
<th>Treatment - Rate per Acre</th>
<th>Aphids Over All Dates</th>
<th>Total Lepidoptera</th>
<th>Predatory Arthropods</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Untreated Check</td>
<td>0.3a*</td>
<td>0.08a</td>
<td>0.2a</td>
</tr>
<tr>
<td>2. Movento 240SC (5 oz/a)</td>
<td>0.2a</td>
<td>0.04a</td>
<td>0.4a</td>
</tr>
<tr>
<td>3. IKI-3106 50SL (11 oz/a)</td>
<td>0.6a</td>
<td>0.00a</td>
<td>0.3a</td>
</tr>
<tr>
<td>4. IKI-3106 50SL (16.4 oz/a)</td>
<td>0.3a</td>
<td>0.04a</td>
<td>0.2a</td>
</tr>
</tbody>
</table>

*Means within columns followed by the same letter are not significantly different (LSD, P < 0.05).

Table 3. Harvest data (note % marketable includes all thrips damage).

<table>
<thead>
<tr>
<th>Treatment - Rate per Acre</th>
<th>No. Lep. Damaged Fruit</th>
<th>Marketable Wt. of Fruit</th>
<th>% Marketable Fruit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Untreated Check</td>
<td>50a*</td>
<td>30.7a</td>
<td>85%a</td>
</tr>
<tr>
<td>2. Movento 240SC (5 oz/a)</td>
<td>34ab</td>
<td>40.8a</td>
<td>90%a</td>
</tr>
<tr>
<td>3. IKI-3106 50SL (11 oz/a)</td>
<td>13b</td>
<td>35.8a</td>
<td>95%a</td>
</tr>
<tr>
<td>4. IKI-3106 50SL (16.4 oz/a)</td>
<td>20b</td>
<td>38.1a</td>
<td>94%a</td>
</tr>
</tbody>
</table>

*Means within columns followed by the same letter are not significantly different (LSD, P < 0.05).
Materials and Methods
Tomato, hybrid Tigress, was transplanted into 1 row per plastic mulch bed on 12 Aug. and maintained with standard cultural practices at the Lang-Rigdon Farm, Coastal Plain Experiment Station at Tifton, GA. A total of 500 pounds of 10-10-10 per acre was applied to Tift pebbly clay loam field plots and irrigation occurred weekly through a drip irrigation system with 7 lb/a of 20-20-20 liquid fertilizer every other week. A drench application was used on the transplants 11 Aug. before transplanting on 12 Aug. Insecticide drenches in the field were made on 12 and 18 Aug., and foliar applications of insecticide were made on 21 Aug, 2 Sept. and 24 Sept.

Scouting was initiated on 20 Aug., and one sample of five plants was scouted per plot after applications. Whiteflies were sampled from five tomato leaflets per plot and counted as adults, eggs, and nymphs.

Tomatoes were harvested from the whole plot on 9 Oct., and fruit were categorized as marketable, tomato yellow leaf curl virus (TYLCV) damaged, or worm damaged by number of fruit and weight per plot. Data were analyzed using GLM and LSD tests for separation of means (SAS Institute 1990).

Results
The main pest was TYLCV transmitted by whiteflies, since by the end of the test, the entire field was infected. There were low levels of lepidopteran pests, mainly cabbage looper and tobacco hornworm, but they did not significantly impact tomato quality. The treatments that had the strongest impact on both whiteflies and incidence of TYLCV were the Sivanto and Venom drench treatments (Tables 1-4). These treatments resulted in significantly more weight of tomato yield per plot even though all of the harvested fruit were considered unmarketable due to TYLCV symptoms.

NOTE: The chemical in treatments 2-5 have been redacted by the author. For more information, contact David Riley at dgr@uga.edu or 229-386-3374.
Table 2. Whitefly counts from five leaf samples and combined lepidoptera counts.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Untreated Check</td>
<td>2.35a*</td>
<td>0.25cb</td>
<td>1.61a</td>
<td>0.07b</td>
<td>1.10bdc</td>
<td>0.95ebdac</td>
</tr>
<tr>
<td>2. RDS63 200SC 50 G AI/HAA</td>
<td>0.55b</td>
<td>0.25cb</td>
<td>1.03ba</td>
<td>0.25ba</td>
<td>1.50bdc</td>
<td>0.40ebdc</td>
</tr>
<tr>
<td>3. RDS63 200SC 100 G AI/HAA</td>
<td>0.65b</td>
<td>0.25cb</td>
<td>0.76b</td>
<td>0.11ba</td>
<td>3.25bac</td>
<td>1.45bac</td>
</tr>
<tr>
<td>4. RDS63 200SC 150 G AI/HAA</td>
<td>0.65b</td>
<td>0.25cb</td>
<td>0.86b</td>
<td>0.07b</td>
<td>3.40ba</td>
<td>0.70ebdac</td>
</tr>
<tr>
<td>5. RDS63 200SC 200 G AI/HAA</td>
<td>0.75b</td>
<td>0.00c</td>
<td>0.98b</td>
<td>0.04b</td>
<td>2.90bdac</td>
<td>1.80a</td>
</tr>
<tr>
<td>6. Coragen SC 5 Fl oz prod/aA</td>
<td>0.45b</td>
<td>0.00c</td>
<td>1.46ba</td>
<td>0.04b</td>
<td>0.35d</td>
<td>1.55ba</td>
</tr>
<tr>
<td>7. Avaunt WDG at 3.5 oz prod/aA</td>
<td>0.30b</td>
<td>0.25cb</td>
<td>1.04ba</td>
<td>0.18b</td>
<td>5.30a</td>
<td>0.50ebdc</td>
</tr>
<tr>
<td>8. Movento 240 SC 5 Fl oz prod/aA</td>
<td>0.60b</td>
<td>0.50cb</td>
<td>1.01ba</td>
<td>0.18b</td>
<td>1.55bdc</td>
<td>0.70ebdac</td>
</tr>
<tr>
<td>9. Sivanto 0.975 ML/1000 plants(^t) + Sivanto 14 oz/a twice(^c), D</td>
<td>0.50b</td>
<td>0.25cb</td>
<td>0.76b</td>
<td>0.21ba</td>
<td>0.35d</td>
<td>0.00e</td>
</tr>
<tr>
<td>10. Sivanto 0.975 ML/1000 plants(^t) + Sivanto 28 oz/a(^a)</td>
<td>0.30b</td>
<td>0.25cb</td>
<td>0.93ba</td>
<td>0.04b</td>
<td>0.65dc</td>
<td>0.15ed</td>
</tr>
<tr>
<td>11. Sivanto 14 Fl oz prod/aA</td>
<td>0.60b</td>
<td>2.00a</td>
<td>0.86b</td>
<td>0.32a</td>
<td>0.90bdc</td>
<td>0.05ed</td>
</tr>
<tr>
<td>12. Oberon 8.5 Fl oz prod/aA</td>
<td>0.25b</td>
<td>1.00b</td>
<td>1.04ba</td>
<td>0.25ba</td>
<td>1.20bdc</td>
<td>1.25bdac</td>
</tr>
<tr>
<td>13. Venon 4.0 oz/a(^a) and post drench(^a)</td>
<td>0.95b</td>
<td>0.25cb</td>
<td>1.11ba</td>
<td>0.04b</td>
<td>0.65dc</td>
<td>0.30edc</td>
</tr>
</tbody>
</table>

*Means within columns followed by the same letter are not significantly different (LSD, P < 0.05).
\(^a\) Applications for spray treatments were on 21 Aug., 2 Sept., and 24 Sept.
\(^t\) Application for transplant drench was on 11 Aug.
\(^c\), D Applications for field drench treatments were on 20 Aug., 12 Aug., and 18 Aug., respectively.

Table 3. Whitefly counts from five leaf samples on individual dates.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Untreated Check</td>
<td>1.00bac*</td>
<td>3.60bac</td>
<td>5.65a</td>
<td>7.50a</td>
<td>8.90a</td>
<td>12.30a</td>
</tr>
<tr>
<td>2. RDS63 200SC 50 G AI/HAA</td>
<td>0.50bc</td>
<td>6.85a</td>
<td>6.30a</td>
<td>6.95ba</td>
<td>5.85bac</td>
<td>8.95bac</td>
</tr>
<tr>
<td>3. RDS63 200SC 100 G AI/HAA</td>
<td>1.75ba</td>
<td>2.10bc</td>
<td>2.10b</td>
<td>2.80bc</td>
<td>3.20dec</td>
<td>4.50ebdc</td>
</tr>
<tr>
<td>4. RDS63 200SC 150 G AI/HAA</td>
<td>0.70bac</td>
<td>2.05bc</td>
<td>1.15b</td>
<td>2.05c</td>
<td>8.40ba</td>
<td>11.15ba</td>
</tr>
<tr>
<td>5. RDS63 200SC 200 G AI/HAA</td>
<td>1.80a</td>
<td>2.70bc</td>
<td>2.25b</td>
<td>3.30bac</td>
<td>4.80bdec</td>
<td>6.65ebdac</td>
</tr>
<tr>
<td>6. Coragen SC 5 Fl oz prod/aA</td>
<td>1.60ba</td>
<td>4.80ba</td>
<td>1.50b</td>
<td>1.75c</td>
<td>3.05fdec</td>
<td>7.90bdac</td>
</tr>
<tr>
<td>7. Avaunt WDG at 3.5 oz prod/aA</td>
<td>0.55bac</td>
<td>2.20bc</td>
<td>3.10b</td>
<td>4.35bac</td>
<td>3.50fdec</td>
<td>8.00bdc</td>
</tr>
<tr>
<td>8. Movento 240 SC 5 Fl oz prod/aA</td>
<td>0.75bac</td>
<td>0.80c</td>
<td>0.90b</td>
<td>1.20c</td>
<td>3.35fdec</td>
<td>7.05ebdac</td>
</tr>
<tr>
<td>9. Sivanto 0.975 ML/1000 plants(^t) + Sivanto 14 oz/a twice(^c)</td>
<td>1.75ba</td>
<td>4.20bac</td>
<td>0.40b</td>
<td>1.85c</td>
<td>5.45bdac</td>
<td>12.50a</td>
</tr>
<tr>
<td>10. Sivanto 0.975 ML/1000 plants(^t) + Sivanto 28 oz/a(^a)</td>
<td>0.00c</td>
<td>0.60c</td>
<td>0.05b</td>
<td>0.05c</td>
<td>1.75fde</td>
<td>2.80edc</td>
</tr>
<tr>
<td>11. Sivanto 0.975 ML/1000 plants(^t) + Sivanto 28 oz/a(^a)</td>
<td>0.15c</td>
<td>0.25c</td>
<td>0.05b</td>
<td>0.05c</td>
<td>0.15f</td>
<td>0.45e</td>
</tr>
<tr>
<td>12. Sivanto 14 Fl oz prod/aA</td>
<td>0.05c</td>
<td>0.85bc</td>
<td>0.65b</td>
<td>0.85c</td>
<td>0.85f</td>
<td>2.00ed</td>
</tr>
<tr>
<td>13. Oberon 8.5 Fl oz prod/aA</td>
<td>1.25bac</td>
<td>1.20bc</td>
<td>1.10b</td>
<td>1.15c</td>
<td>1.40fe</td>
<td>3.05edc</td>
</tr>
<tr>
<td>14. Venon 4.0 oz/a(^a) and post drench(^a)</td>
<td>0.30c</td>
<td>0.40c</td>
<td>0.05b</td>
<td>0.10c</td>
<td>1.00fe</td>
<td>2.90edc</td>
</tr>
</tbody>
</table>

*Means within columns followed by the same letter are not significantly different (LSD, P < 0.05).
\(^a\) Applications for spray treatments were on 21 Aug., 2 Sept., and 24 Sept.
\(^t\) Application for transplant drench was on 11 Aug.
\(^c\), D Applications for field drench treatments were on 20 Aug., 12 Aug., and 18 Aug., respectively.

Continued on next page.
Table 4. Overall whitefly nymph counts from five leaf samples and final rating of mild and severe tomato yellow leaf curl virus (TYLCV) symptoms in tomato.

<table>
<thead>
<tr>
<th>Treatment - Rate per Acre</th>
<th>Whitefly Sm. Nymphs</th>
<th>Whitefly Lg. Nymphs</th>
<th>Whitefly Nymphs</th>
<th>Plants with Mild TYLCV Symptoms</th>
<th>Plants with Severe TYLCV Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Untreated Check</td>
<td>1.60a*</td>
<td>1.00bdac</td>
<td>0.50a</td>
<td>5.50bdc</td>
<td>5.15a</td>
</tr>
<tr>
<td>2. RDS63 200SC 50 G AI/HAA</td>
<td>1.55a</td>
<td>1.45a</td>
<td>0.00b</td>
<td>10.25ba</td>
<td>1.90a</td>
</tr>
<tr>
<td>3. RDS63 200SC 100 G AI/HAA</td>
<td>0.85a</td>
<td>0.80bdec</td>
<td>0.00b</td>
<td>9.50ba</td>
<td>1.55a</td>
</tr>
<tr>
<td>4. RDS63 200SC 150 G AI/HAA</td>
<td>1.05a</td>
<td>0.50de</td>
<td>0.00b</td>
<td>9.00bac</td>
<td>1.90a</td>
</tr>
<tr>
<td>5. RDS63 200SC 200 G AI/HAA</td>
<td>0.90a</td>
<td>1.10bac</td>
<td>0.00b</td>
<td>8.25bac</td>
<td>2.70a</td>
</tr>
<tr>
<td>6. Coragen SC 5 Fl oz prod/aA</td>
<td>2.65a</td>
<td>1.05bac</td>
<td>0.00b</td>
<td>10.00ba</td>
<td>4.55a</td>
</tr>
<tr>
<td>7. Avaunt WDG at 3.5 oz prod/aA</td>
<td>1.15a</td>
<td>0.60dec</td>
<td>0.00b</td>
<td>7.50bdac</td>
<td>3.75a</td>
</tr>
<tr>
<td>8. Movento 240 SC 5 Fl oz prod/aA</td>
<td>1.20a</td>
<td>0.50de</td>
<td>0.25ba</td>
<td>11.25a</td>
<td>4.05a</td>
</tr>
<tr>
<td>9. Sivanto 0.975 ML/1000 plantsT</td>
<td>1.50a</td>
<td>1.20ba</td>
<td>0.00b</td>
<td>9.25ba</td>
<td>3.10a</td>
</tr>
<tr>
<td>10. Sivanto 1.3 ML/1000 plantsT + Sivanto 14 oz/a twiceC, D</td>
<td>0.65a</td>
<td>0.30e</td>
<td>0.00b</td>
<td>2.75d</td>
<td>3.00a</td>
</tr>
<tr>
<td>11. Sivanto 0.975 ML/1000 plantsT + Sivanto 28 oz/aB</td>
<td>0.75a</td>
<td>0.30e</td>
<td>0.00b</td>
<td>4.25dc</td>
<td>3.90a</td>
</tr>
<tr>
<td>12. Sivanto 14 Fl oz prod/aA</td>
<td>1.20a</td>
<td>0.50dec</td>
<td>0.00b</td>
<td>6.75bdac</td>
<td>2.20a</td>
</tr>
<tr>
<td>13. Oberon 8.5 Fl oz prod/aA</td>
<td>1.15a</td>
<td>0.90bdc</td>
<td>0.00b</td>
<td>11.00a</td>
<td>3.40a</td>
</tr>
<tr>
<td>14. Venom 4.0 oz/aA and post drenchA</td>
<td>1.35a</td>
<td>0.50de</td>
<td>0.00b</td>
<td>3.00d</td>
<td>3.85a</td>
</tr>
</tbody>
</table>

*Means within columns followed by the same letter are not significantly different (LSD, P < 0.05).
A Applications for spray treatments were on 21 Aug., 2 Sept., and 24 Sept.
T Application for transplant drench was on 11 Aug.
C, D Applications for field drench treatments were on 20 Aug., 12 Aug., and 18 Aug., respectively.

Table 5. Tomato yield based on a single harvest (note that all fruit had TYLCV symptoms).

<table>
<thead>
<tr>
<th>Treatment - Rate per Acre</th>
<th>Total No. of Tomato Fruit</th>
<th>Total Wt. of Tomato Fruit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Untreated Check</td>
<td>69.25e</td>
<td>8.65e</td>
</tr>
<tr>
<td>2. RDS63 200SC 50 G AI/HAA</td>
<td>117.25edc</td>
<td>13.57ed</td>
</tr>
<tr>
<td>3. RDS63 200SC 100 G AI/HAA</td>
<td>199.0ba</td>
<td>25.20bdac</td>
</tr>
<tr>
<td>4. RDS63 200SC 150 G AI/HAA</td>
<td>139.00bdac</td>
<td>15.68edc</td>
</tr>
<tr>
<td>5. RDS63 200SC 200 G AI/HAA</td>
<td>115.25edc</td>
<td>15.98edc</td>
</tr>
<tr>
<td>6. Coragen SC 5 Fl oz prod/aA</td>
<td>116.50edc</td>
<td>15.95edc</td>
</tr>
<tr>
<td>7. Avaunt WDG at 3.5 oz prod/aA</td>
<td>219.25a</td>
<td>21.95ebdac</td>
</tr>
<tr>
<td>8. Movento 240 SC 5 Fl oz prod/aA</td>
<td>145.25ebdac</td>
<td>15.58edc</td>
</tr>
<tr>
<td>9. Sivanto 0.975 ML/1000 plantsT</td>
<td>84.50ed</td>
<td>8.83e</td>
</tr>
<tr>
<td>10. Sivanto 1.3 ML/1000 plantsT + Sivanto 14 oz/a twiceC, D</td>
<td>174.00bac</td>
<td>28.35bac</td>
</tr>
<tr>
<td>11. Sivanto 0.975 ML/1000 plantsT + Sivanto 28 oz/aB</td>
<td>161.25bdac</td>
<td>29.93ba</td>
</tr>
<tr>
<td>12. Sivanto 14 Fl oz prod/aA</td>
<td>154.50bdac</td>
<td>21.35ebdac</td>
</tr>
<tr>
<td>13. Oberon 8.5 Fl oz prod/aA</td>
<td>138.00ebdc</td>
<td>19.08ebdc</td>
</tr>
<tr>
<td>14. Venom 4.0 oz/aA and post drenchA</td>
<td>176.50bac</td>
<td>32.80a</td>
</tr>
</tbody>
</table>

*Means within columns followed by the same letter are not significantly different (LSD, P < 0.05).
A Applications for spray treatments were on 21 Aug., 2 Sept., and 24 Sept.
T Application for transplant drench was on 11 Aug.
C, D Applications for field drench treatments were on 20 Aug., 12 Aug., and 18 Aug., respectively.
Efficacy of Soil Applied Systemic Insecticides Against Silverleaf Whitefly in Fall Tomato

Alton N. Sparks, Jr.
Department of Entomology, University of Georgia, Tifton, GA 31793

Materials and Methods

Crop: Tomato (Variety: BHN 602)

Targeted pests: Silverleaf whitefly

Location: The University of Georgia, Tifton Vegetable Park, Tifton Campus, Tifton, GA.

Experimental design: RCBD with four replications

Establishment: Transplanted on 4 Aug. 2014

Plot size: One row (6-foot spacing on 30-inch plastic) by 20 plants (2-foot in-row spacing)

Treatments:
- Admire Pro at 10.5 oz/a
- Coragen at 5 oz/a
- Verimark at 13.5 oz/a
- Sivanto at 28 oz/a
- Non-Treated Control

Application dates: 4 Aug. 2014

Application methods: Rate per plant was calculated based on 3,630 plants per acre. Treatments were applied in a 3 ounce drench per plant. The transplant hole was punched; transplants were placed in dry holes; the drench or water was poured on the rootball in the hole; the drench was allowed to soak into the rootball and soil; and the hole was closed around the plant.

Data collection: Phytotoxicity was rated as present or absent based on obvious “burn” on the oldest leaves. Additional observations were made:

Whitefly adult counts. One leaf was selected on each of five randomly selected plants per plot. The leaf was gently turned, and all adult whiteflies were counted. Leaves of similar age were selected on each date.

Whitefly immature counts. One leaf on each of five randomly selected plants in each plot was collected and examined under a microscope in the lab. All eggs, small nymphs (1st and 2nd instar), and large nymphs (3rd and 4th instar) were counted on one microscope field on each leaf.

Statistical analyses: PROC ANOVA in SAS Enterprise Guide (P < 0.05); LSD (P = 0.05).

Results

Phytotoxicity. A “burn” on oldest leaves was noted with Sivanto at ten days after transplanting, however, younger leaves were asymptomatic and no consistent growth effects were noted with any treatment.

Whitefly adults. Populations were low to moderate and increased during the test. Coragen was the only insecticide that did not show a significant decrease in adults on at least one sample date.

Whitefly immatures. All insecticide treatments reduced egg densities in the first two samples. This is assumed to be a result of adult mortality (although Coragen did not show this in adult counts). Nymph densities were significantly reduced by all insecticide treatments on all three sample dates with the exception of large nymphs on 3 Sept. No significant differences occurred among the insecticide treatments. Egg and small nymph counts were increasing but still suppressed on 10 Sept., suggesting that the insecticide residual activity may have been playing out (37 days after treatment).

Continued on next page.
### Whitefly adult counts, soil applied insecticide test in tomato, UGA Tifton Vegetable Park, Tifton, GA, 2014.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>14 Aug.</th>
<th>19 Aug.</th>
<th>28 Aug.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check</td>
<td>1.75 a</td>
<td>4.50 ab</td>
<td>12.00 a</td>
</tr>
<tr>
<td>Admire Pro</td>
<td>0.75 a</td>
<td>5.00 ab</td>
<td>4.00 b</td>
</tr>
<tr>
<td>Coragen</td>
<td>1.00 a</td>
<td>7.50 a</td>
<td>8.75 ab</td>
</tr>
<tr>
<td>Verimark</td>
<td>0.50 a</td>
<td>3.00 bc</td>
<td>4.50 b</td>
</tr>
<tr>
<td>Sivanto</td>
<td>0.75 a</td>
<td>0.00 c</td>
<td>4.25 b</td>
</tr>
</tbody>
</table>

Means within the same column followed by different letters are significantly different according to Fisher’s Least Significant Difference Test (P < 0.05).

### Whitefly immature counts, soil applied insecticide test in tomato, UGA Tifton Vegetable Park, Tifton, GA, 2014.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>28 Aug.</th>
<th>3 Sept.</th>
<th>10 Sept.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of Eggs per Sample</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check</td>
<td>125.50 a</td>
<td>297.67 a</td>
<td>67.75 a</td>
</tr>
<tr>
<td>Admire Pro</td>
<td>16.75 b</td>
<td>101.67 b</td>
<td>42.25 a</td>
</tr>
<tr>
<td>Coragen</td>
<td>38.25 b</td>
<td>146.33 b</td>
<td>103.25 a</td>
</tr>
<tr>
<td>Verimark</td>
<td>9.00 b</td>
<td>61.67 b</td>
<td>51.50 a</td>
</tr>
<tr>
<td>Sivanto</td>
<td>12.25 b</td>
<td>77.00 b</td>
<td>49.50 a</td>
</tr>
</tbody>
</table>

| **Number of Small Nymphs per Sample**          |         |         |          |
| Check                                               | 122.75 a| 39.00 a | 160.25 a |
| Admire Pro                                         | 3.00 b  | 3.67 b  | 23.75 b  |
| Coragen                                            | 13.00 b | 2.67 b  | 50.25 b  |
| Verimark                                           | 2.00 b  | 3.33 b  | 17.00 b  |
| Sivanto                                            | 2.25 b  | 4.33 b  | 31.25 b  |

| **Number of Large Nymphs per Sample**            |         |         |          |
| Check                                             | 2.25 a  | 0.67 a  | 44.75 a  |
| Admire Pro                                        | 0.25 b  | 0.00 a  | 0.50 b   |
| Coragen                                           | 0.75 b  | 0.00 a  | 3.50 b   |
| Verimark                                          | 0.25 b  | 0.00 a  | 1.50 b   |
| Sivanto                                           | 0.00 b  | 0.67 a  | 3.25 b   |

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Efficacy of Soil and Foliar Insecticides Against Thrips and Tomato Spotted Wilt in Tomato

Alton N. Sparks, Jr.
Department of Entomology, University of Georgia, Tifton, GA 31793

Materials and Methods
Crop: Tomato (Variety: Fl 47)

Targeted pests: Thrips and tomato spotted wilt virus

Location: The University of Georgia, Tifton Vegetable Park, Tifton Campus, Tifton, GA.

Experimental design: RCBD with 4 replications

Establishment: Transplanted 21 April 2014

Plot size: One row (6 foot centers on 30 inch plasticulture) by 20 plants (2-foot in-row spacing)

Treatments:
- **Foliar applied insecticide test** (all insecticides mixed with Dyne-Amic at 0.25% v/v). Non-Treated Check, Radiant at 6 oz/a, Torac at 21 oz/a, Agri-Mek SC at 3.5 oz/a, and Exirel at 13.5 oz/a.
- **Soil applied insecticide test.** Non-Treated Check, Admire Pro at 10.5 oz/a, Venom at 6 oz/a, Verimark at 13.5 oz/a, and Sivanto at 21 oz/a.

Application dates:
- Foliar test: 25 April; 2, 11, 17, 22, and 29 May; and 3 June 2014
- Soil test: 21 April 2014

Application methods:
- Foliar applications: CO₂ pressurized backpack sprayer (60 psi) in 40 gal/a with three hollow-cone nozzles per row (one over-the-top, two on drops).
- Soil applications: Applied as a transplant drench. Transplant holes were punched; the transplants placed in the holes; a 3 ounce drench was poured onto the rootball in the hole; the drench was allowed to soak in; and the transplant hole was closed.

Data collection: Thrips were monitored with two methods. Beat samples were collected to evaluate foliar thrips. Plants in five locations per plot were “beat” against a white collection box, and all thrips in the box were counted. For bloom infesting thrips, 10 blooms were collected from each plot and placed in alcohol. The blooms were dissected under a microscope in the laboratory, and all thrips present were counted. Tomato spotted wilt virus was monitored by visual examination of all plants in each plot and recording the number with obvious TSWV symptoms. On the last sample date, all plants were rated as no virus or light, moderate, or severe virus.

Statistical analyses: PROC ANOVA in SAS Enterprise Guide (P < 0.05); LSD (P = 0.05).

Results

**Soil applied insecticides.** The soil applied insecticides did not show significant effects on thrips on any sample date; however, the first sample was collected at 21 days after treatment (thrips populations were extremely low prior to the first sample). There was an apparent effect on TSWV incidence, with Verimark and Sivanto exhibiting possible suppression of infection. This possible effect requires additional evaluation, preferably under greater virus pressure, but justifies additional study.

**Foliar applied insecticides.** Foliar insecticides did show a significant effect on thrips densities, primarily with foliar thrips. Foliar thrips densities were generally suppressed by Torac, Radiant, and Agri-Mek. The high count for Torac on 28 May might be an indication of short residual control and rapid reinfestation (this was six days after an application); however, additional studies are needed to further evaluate this result. Foliar treatments did not show a significant effect on thrips in blooms, although, Torac and Radiant generally had the numerically lowest densities. TSWV incidence was low in this test, but Torac, Exirel, and Radiant did show a trend for symptom suppression.
### Thrips data, soil insecticide test for thrips and tomato spotted wilt virus (TSWV) management study, Tifton, GA, 2014.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Thrips per Five Beats</th>
<th>Thrips per 10 Blooms</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>12 May</td>
<td>19 May</td>
</tr>
<tr>
<td>Check</td>
<td>13.25 a</td>
<td>20.00 a*</td>
</tr>
<tr>
<td>Admire Pro</td>
<td>6.50 a</td>
<td>11.00 a</td>
</tr>
<tr>
<td>Venom</td>
<td>14.25 a</td>
<td>19.25 a</td>
</tr>
<tr>
<td>Verimark</td>
<td>12.75 a</td>
<td>23.50 a</td>
</tr>
<tr>
<td>Sivanto</td>
<td>16.75 a</td>
<td>30.00 a</td>
</tr>
</tbody>
</table>

Means within the same column followed by different letters are significantly different according to Fisher’s Least Significant Difference Test (P < 0.05).

*Differences were indicated at P < 0.10.

### Tomato spotted wilt (TSWV) data, soil insecticide test for thrips and TSWV management study, Tifton, GA, 2014.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>TSWV Incidence</th>
<th>TSWV Ratings on 13 June</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>22 May</td>
<td>30 May</td>
</tr>
<tr>
<td>Check</td>
<td>0.50 a</td>
<td>1.75 a</td>
</tr>
<tr>
<td>Admire Pro</td>
<td>0.25 a</td>
<td>0.25 a</td>
</tr>
<tr>
<td>Venom</td>
<td>0.25 a</td>
<td>0.75 a</td>
</tr>
<tr>
<td>Verimark</td>
<td>0.00 a</td>
<td>0.00 a</td>
</tr>
<tr>
<td>Sivanto</td>
<td>0.00 a</td>
<td>0.25 a</td>
</tr>
</tbody>
</table>

Means within the same column followed by different letters are significantly different according to Fisher’s Least Significant Difference Test (P < 0.05).

*Differences were indicated at P < 0.10.

### Thrips data, foliar insecticide test for thrips and tomato spotted wilt virus (TSWV) management study, Tifton, GA, 2014.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Thrips per Five Beats</th>
<th>Thrips per 10 Blooms</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>12 May</td>
<td>19 May</td>
</tr>
<tr>
<td>Check</td>
<td>14.5 a</td>
<td>25.5 a</td>
</tr>
<tr>
<td>AgriMek</td>
<td>9.0 ab</td>
<td>9.0 b</td>
</tr>
<tr>
<td>Exirel</td>
<td>14.5 a</td>
<td>19.3 a</td>
</tr>
<tr>
<td>Torac</td>
<td>6.0 b</td>
<td>9.0 b</td>
</tr>
<tr>
<td>Radiant</td>
<td>3.3 b</td>
<td>3.5 b</td>
</tr>
</tbody>
</table>

Means within the same column followed by different letters are significantly different according to Fisher’s Least Significant Difference Test (P < 0.05).

### Tomato spotted wilt (TSWV) data, foliar insecticide test for thrips and TSWV management study, Tifton, GA, 2014.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>TSWV Incidence</th>
<th>TSWV Ratings on 13 June</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>22 May</td>
<td>30 May</td>
</tr>
<tr>
<td>Check</td>
<td>0.00 a</td>
<td>0.50 a</td>
</tr>
<tr>
<td>AgriMek</td>
<td>0.25 a</td>
<td>0.75 a</td>
</tr>
<tr>
<td>Exirel</td>
<td>0.00 a</td>
<td>0.25 a</td>
</tr>
<tr>
<td>Torac</td>
<td>0.00 a</td>
<td>0.25 a</td>
</tr>
<tr>
<td>Radiant</td>
<td>0.25 a</td>
<td>0.50 a</td>
</tr>
</tbody>
</table>

Means within the same column followed by different letters are significantly different according to Fisher’s Least Significant Difference Test (P < 0.05).

*Differences were indicated at P < 0.10.
## Appendix A:
### Chemical and Trade Names of Insecticides Trialed in This Report

( Note: some pesticides listed are currently in the development stage and chemical names are not available)

<table>
<thead>
<tr>
<th>Trade Name</th>
<th>Chemical Name (active ingredient)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Admire Pro</td>
<td>imidacloprid</td>
</tr>
<tr>
<td>AgriMek</td>
<td>abamectin</td>
</tr>
<tr>
<td>Avaunt</td>
<td>indoxacarb</td>
</tr>
<tr>
<td>Beleaf</td>
<td>flonicamid</td>
</tr>
<tr>
<td>Belt</td>
<td>flubendiamide</td>
</tr>
<tr>
<td>Besiege</td>
<td>lambda-cyhalothrin + chlorantraniliprole</td>
</tr>
<tr>
<td>Brigade</td>
<td>bifenthrin</td>
</tr>
<tr>
<td>Coragen</td>
<td>chlorantraniliprole</td>
</tr>
<tr>
<td>Dipel</td>
<td><em>Bacillus thuringiensis subsp. kurstaki</em></td>
</tr>
<tr>
<td>DoubleTake</td>
<td>diflubenzuron + lambda-cyhalothrin</td>
</tr>
<tr>
<td>Exirel or Verimark (HGW86)</td>
<td>cyantraniliprole</td>
</tr>
<tr>
<td>Karate</td>
<td>lambda-cyhalothrin</td>
</tr>
<tr>
<td>Knack</td>
<td>pyriproxyfen</td>
</tr>
<tr>
<td>Lannate</td>
<td>methomyl</td>
</tr>
<tr>
<td>Lorsban</td>
<td>chlorpyrifos</td>
</tr>
<tr>
<td>Movento</td>
<td>spirotetramat</td>
</tr>
<tr>
<td>Oberon</td>
<td>spiromesifen</td>
</tr>
<tr>
<td>Radiant</td>
<td>spinetoram</td>
</tr>
<tr>
<td>Rimon</td>
<td>novaluron</td>
</tr>
<tr>
<td>Sivanto</td>
<td>flupyradifurone</td>
</tr>
<tr>
<td>Torac</td>
<td>tolfenpyrad</td>
</tr>
<tr>
<td>Venom</td>
<td>dinotefuran</td>
</tr>
<tr>
<td>Vydate</td>
<td>Oxamyl</td>
</tr>
<tr>
<td>Xentari</td>
<td><em>Bacillus thuringiensis subsp. aizawai</em></td>
</tr>
</tbody>
</table>

*In some instances, results are reported for products that are not yet registered for the crops to which they were applied. The data in this report is for informational purposes only. The product label must be followed and supersedes any information that is presented in this report. Refer to the current edition of the Georgia Pest Management Handbook for timely product information.*
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