TOMATO (*Lycopersicon esculentum*)
Bacterial spot; *Xanthomonas perforans*

C. -H. Huang and G. E. Vallad
Department of Plant Pathology
University of Florida, GCREC
Wimauma, FL 33598

Foliar versus soil applications of Actigard for bacterial spot management on tomato, spring 2011.

On 15 Mar 2011, plots were established at the University of Florida's Gulf Coast Research and Education Center in Balm, FL to assess the effect of drip applications of Actigard on the control of bacterial spot of tomato. Plots consisted of 25 ft-long bed sections within 300 ft-long, raised beds with 5 ft center-to-center bed spacing. Beds were covered with black virtually impermeable mulch and irrigated with a drip system. Tomato seedlings (cv SecuriTY 28) were transplanted at 18-in spacing along beds skipping a 4-ft alley between plots as a buffer. Treatments, including a water-treated control, were arranged in a completely randomized design with each treatment repeated six times. The treatments were either drip- or foliar-applied on 18 Apr, 25 Apr, 2 May, 9 May, 17 May, and 23 May (corresponding with applications 1 to 6 below). Foliar treatments were applied with a CO_2 back pack sprayer calibrated to deliver 60 (apps. 1,2,3), and 90 gal/A (apps. 4,5,6) at 40 psi. Drip treatments were applied through a manifold by CO_2 at 12 psi through the drip tape in 2 L of water, and then followed by approximately 1.2 L of water at 10 psi to flush the tape (as predetermined by a dye test); equivalent to approx. 0.013 acre-inch of water. Plots were inoculated on 27 Apr with a suspension (10^6 cfu/ml) of *Xanthomonas perforans* race 4 using a backpack sprayer. Plots were monitored regularly for bacterial spot, and rated on 16 May, 23 May, and 1 Jun after disease reached appreciable levels. Marketable yield was assessed from a single hand harvest on 31 May. A preventative program that included alternating applications of Revus Top (7.7 fl oz/A), Endura (12.5 oz/A)-Bravo WeatherStik (1 pt/A), and Quadris top (8 fl oz/A) was established across the trial to minimize the impact of early blight, target blight, or late blight.

Based on the first disease dating on 16 May, drip applications of Actigard significantly reduced disease severity compared to the untreated control ($P = 0.0443$), whereas contrast analysis did not show a significant difference between drip applications of Actigard and the Kocide 3000-Penncozeb standard. Drip applications of Actigard ranging from 0.25–0.50 oz/A performed significantly better than those of foliar applications in reducing the initial and final disease severity ($P = 0.0068$ and 0.0051, respectively). Interestingly, contrast analysis suggested that drip applications of Actigard significantly reduced the final disease severity in comparison to the untreated control and the Kocide 3000-Penncozeb standard. The drip application rate did not significantly affect the final disease severity. However, the application interval significantly affected the final disease severity, with the 14-day interval performing significantly better than the others. Although no significant difference was detected in the area under the disease progress curves (AUDPC) between drip applications of Actigard and the standard, drip applications of Actigard significantly lowered disease progress compared to the water-treated control. Again, the drip application rate did not significantly affect disease progress, but a significant difference was detected between application intervals. Drip applications of Actigard at a 14-day interval performed significantly better than the others except a 21-day interval. No significant difference was observed in disease incidence of fruits and marketable fruit yield between drip applications of Actigard, the standard, and the untreated control. The drip application rate and interval of Actigard did not affect disease incidence of fruits. Treatments with drip-applied Actigard ranging from 0.25–0.50 oz/A had a significantly higher of the marketable yield by 27.3 % than those with foliar-applied Actigard. The drip application interval of Actigard did not affect the marketable yield. However, a significant difference was detected between drip application rates of Actigard in marketable fruit yield, suggesting that treatments with 0.5 oz/A had a higher level of marketable fruits.

	Disease severity (%)[y]					
Treatment, rate/A (application)[z]	**16 May**	**23 May**	**1 Jun**	**AUDPC[x]**	**Diseased fruit (%)**	**Marketable fruit yield (Boxes/A)[w]**
Actigard, 0.5 oz (Drip, 1–6)…….	68.8 cd[v]	87.8	89.4 abc	1249	9.24	499
Actigard, 0.5 oz (Drip 1,3,6)…..	75.2 abc	84.7	81.5 d	1194	8.42	561
Actigard, 0.5 oz (Drip 1,4)…..	72.0 bcd	84.7	87.0 abc	1218	12.8	483
Actigard, 0.5 oz (Drip 1,5)…..	72.0 bcd	86.3	89.4 abc	1243	9.80	473
Actigard, 0.25 oz (Drip 1–6)…..	65.7 d	83.1	84.7 cd	1182	9.36	428
Actigard, 0.25 oz (Drip 1,3,6)….	65.7 d	84.7	84.7 cd	1194	12.5	503
Actigard, 0.25 oz (Drip 1,4)….	68.8 cd	83.1	84.7 cd	1188	12.8	380
Actigard, 0.25 oz (Drip 1,5)….	72.0 bcd	83.1	86.3 bcd	1203	9.15	408
Actigard, 0.125 oz (Drip 1–6)….	72.0 bcd	87.8	89.4 abc	1255	9.97	423
Actigard, 0.125 oz (Drip 1,3,6)	75.2 abc	81.5	81.5 d	1170	12.0	456
Actigard, 0.125 oz (Drip 1,4)	75.2 abc	81.5	86.3 bcd	1197	7.52	412
Actigard, 0.125 oz (Drip 1,5)	75.2 abc	87.8	87.8 abc	1251	7.64	468
Actigard, 0.5 oz (Foliar 1–6)…..	65.7 d	86.3	84.7 cd	1205	8.71	365
Actigard, 0.5 oz (Foliar 1,3,6)…	78.3 ab	81.5	84.7 cd	1194	9.83	384
Actigard , 0.25 oz (Foliar 1–6)…	81.5 a	86.3	87.8 abc	1251	9.58	423
Actigard , 0.25 oz (Foliar 1,3,6)	75.2 abc	84.7	89.4 abc	1237	9.04	391
Kocide 3000, 1.5 lb (1-6); Penncozeb 75DF, 0.5 lb (1-6)……..…..	72.0 bcd	87.8	90.2 ab	1259	6.68	518

Control……	78.3 ab	87.8	91.8 a	1279	12.7	473
P > F	*0.021*	*0.3887*	*0.0051*	*0.0846*	*0.5723*	*0.3893*
Contrast						
P > F						
Drip vs. Foliar application (0.25 and 0.50 oz at 7- and 14-day interval)……..	*0.0068*	*0.8044*	*0.0051*	*0.3511*	*0.7245*	*0.0047*
Drip vs. Kocide-Penncozeb…….....	*0.8756*	*0.1806*	*0.0402*	*0.0834*	*0.1204*	*0.2721*
Drip vs. Non-treated control…….....	*0.0443*	*0.1806*	*0.0050*	*0.0145*	*0.1956*	*0.7752*
Drip application rate						
0.5 vs. 0.25 oz…….....	*0.0866*	*0.1398*	*0.1907*	*0.0638*	*0.5535*	*0.0462*
0.5 vs. 0.125 oz…….....	*0.3012*	*0.4582*	*0.6650*	*0.6722*	*0.5521*	*0.0854*
0.25 vs. 0.125 oz…….....	*0.0068*	*0.4582*	*0.3789*	*0.1499*	*0.2377*	*0.7777*
Application interval						
7- vs 14-day…….....	*0.2331*	*0.1552*	*0.0010*	*0.0439*	*0.4361*	*0.1869*
7- vs 21-day…….....	*0.2331*	*0.0889*	*0.2332*	*0.1880*	*0.4648*	*0.5565*
7- vs 28-day…….....	*0.1130*	*0.7750*	*1.0000*	*0.8647*	*0.6590*	*0.9948*
14- vs 21-day…….....	*1.0000*	*0.7750*	*0.0302*	*0.4746*	*0.9643*	*0.0581*
14- vs 28-day…….....	*0.6899*	*0.2545*	*0.0010*	*0.0294*	*0.2257*	*0.1848*
21- vs 28-day…….....	*0.6899*	*0.1552*	*0.2332*	*0.1378*	*0.2448*	*0.5609*

[z] Listed treatment rates are on a per acre basis unless noted otherwise.

[y] The severity of bacterial spot was assessed as the percentage of canopy affected. The Horsfall-Barratt scale was used for all ratings, but values were converted to mid-percentages prior to statistical analyses.

[x] Area under the disease progress curves (AUDPC) was calculated using the formula: $\Sigma([(x_i+x_{i-1})/2](t_i-t_{i-1}))$ where x_i is the rating at each evaluation time and (t_i-t_{i-1}) is the time between evaluations.

[w] Marketable yield is based on a hand harvest on 31 May , assumes 4356 plants/A and 20 lb/box, and includes medium, large, and extra-large fruits.

[v] Values followed by the same letter are not statistically significant ($P = 0.05$) according to Fisher's LSD test.