

Pre-plant applications of imidacloprid versus foliar and soil applications of Actigard for bacterial spot management on pepper, 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 pepper. 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. Pepper seedlings (cv. Aristotle) 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 applied on 20 Apr, 26 Apr, 4 May, 11 May, 18 May, and 24 May (corresponding with applications 1 to 6 below). Foliar treatments were applied with a CO₂ 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 CO₂ 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 22 Apr with a suspension (10⁶ cfu/ml) of *Xanthomonas euvesicatoria* races 4, 5, and 6 using a backpack sprayer. Plots were monitored regularly for bacterial spot, and rated on 18 May, 2 Jun, 9 Jun, and 16 Jun after disease reached appreciable levels. Marketable yield was assessed from two hand harvests on 16 May and 1 Jun. Bravo WeatherStik (1 pt/A) was applied on 11 May and 18 May to minimize the impact of anthracnose.

Except Previcur Flex, Actigard (foliar; 7- and 14-day interval; 50µM), Actigard (drip; 7-day interval; 12.5 and 25µM), Actigard (Drip; 14 day interval; 25 µM), and Kocide-Penncozeb, the other treatments significantly reduced disease severity by 39.4–70.0% compared to the untreated control based on the first disease rating on 18 May. Although disease severity increased over time, fourteen treatments still showed a significant lower level of the final disease severity than the untreated control. Of these fourteen treatments, four treatments combining Actigard, Kocide, and Penncozeb had a relatively lower level of the final disease severity than the others. One drench application of respective Admire and Previcur Flex significantly reduced the final disease severity compared to the untreated control, resulting in a comparable control efficacy resulting from the Kocide-Penncozeb standard. An additive effect was not observed in reducing the final disease severity when Admire and Previcur Flex were drench-applied together in this study. No additive effect was also found when Actigard was foliar-applied with a drench application of either Admire or Previcur Flex. Except the treatment with 14-interval drip applications of Actigard at 25µM, the other treatments significantly reduced disease progress compared to the untreated control. However, only two spray programs including Actigard, Kocide, and Penncozeb performed significantly better than the Kocide-Penncozeb standard. Contrast analysis showed that drip applications of Actigard performed significantly better than the untreated control in reducing disease severity and progress, whereas no significant difference was detected between the Kocide-Penncozeb standard, foliar applications of Actigard, and drip applications of Actigard. Although the drip application interval of Actigard did not significantly affect disease severity and progress in this study, the drip application rate at 50 µM significantly reduced the final disease severity and disease epidemics compared to lower rates at 12.5 and 25µM. No significant difference was detected between treatments in disease incidence of fruits and marketable fruit yield. No phytotoxicity was observed with any of the treatments.

Treatment, rate/A (application) ^z	Disease severity (%) ^y					Diseased fruit (%)	Marketable yield (lb/plot)
	18 May	2 Jun	9 Jun	16 Jun	AUDPC ^x		
Admire Pro (Drench), 7 fl oz (1).....	5.00 b-d ^w	9.08 cde	12.2 cd	26.4 d-f	315 e-i	8.48	18.2
Previcur Flex (Drench), 19.2 fl oz (1); Admire Pro (Drench), 7 fl oz (1).....	4.75 b-e	12.2 a-d	16.9 bcd	34.3 a-d	408 cde	6.25	21.2
Previcur Flex (Drench), 19.2 fl oz (1).....	9.00 a	12.2 a-d	20.1 b	31.2 b-e	451 bc	8.83	18.2
Actigard (Foliar; 7 day interval), 50 µM (2– 6); Admire Pro (Drench), 7 fl oz (1).....	3.50 de	9.83 cde	16.9 bcd	29.6 b-f	356 c-h	1.88	19.0
Actigard (Foliar; 7 day interval), 50 µM (2–6); Previcur Flex (Drench), 19.2 fl oz (1).....	3.50 de	11.4 b-e	16.9 bcd	37.5 abc	402 cde	4.89	18.8
Actigard (Foliar; 7 day interval), 50 µM (1–6)....	6.25 a-d	11.4 b-e	20.1 b	28.0 c-f	411 cde	5.75	17.2
Actigard (Foliar; 7 day interval), 25 µM (1–6)....	5.00 b-e	11.4 b-e	16.9 bcd	31.2 b-e	391 cde	4.21	21.6
Actigard (Foliar; 7 day interval), 12.5 µM (1–6)	3.00 e	9.00 cde	15.3 bcd	28.0 c-f	327 d-i	5.53	18.8
Actigard (Foliar; 14 day interval), 50 µM (1,3,5)	6.75 abc	9.00 cde	21.7 ab	34.3 a-d	421 cd	8.92	18.9
Actigard (Foliar; 14 day interval), 25 µM (1,3,5)	5.50 b-d	10.6 b-e	18.5 bc	37.5 abc	418 cd	5.91	18.1
Actigard (Drip; 7 day interval), 50 µM (1–6).....	4.75 b-e	12.2 a-d	16.9 bcd	28.0 c-f	386 c-f	6.51	21.5
Actigard (Drip; 7 day interval), 25 µM (1–6).....	6.75 abc	13.0 abc	16.9 bcd	34.3 a-d	432 c	9.65	16.6
Actigard (Drip; 7 day interval), 12.5 µM (1–6)	6.25 a-d	12.2 a-d	16.9 bcd	31.2 b-e	408 cde	7.77	18.1
Actigard (Drip; 14 day interval), 50 µM (1,3,5)	3.75 de	9.08 cde	10.6 d	24.8 d-f	289 f-i	6.65	21.7

Actigard (Drip; 14 day interval), 25 μ M (1,3,5)	7.50 ab	13.8 abc	28.0 a	38.5 ab	538 ab	7.14	20.8
Actigard (Drip; 14 day interval), 12.5 μ M (1,3,5)	4.75 b-e	15.3 ab	16.9 bcd	37.5 abc	454 bc	10.1	22.3
Actigard (Foliar), 1 oz (1); Actigard (Foliar), 0.5 oz (3) Kocide 3000, 1 lb (4-6); Penncozeb 75DF, 2 lb (4-6); Actigard (Foliar), 0.25 oz (5).....	4.00 cde	7.50 de	9.83 d	21.7efg	257 hi	2.54	20.5
Actigard (Foliar), 1 oz (1); Actigard (Foliar), 0.5 oz (3) Kocide 3000, 1 lb (4-6); Penncozeb 75DF, 2 lb (4-6); Actigard (Foliar), 0.5 oz (5).....	3.00 e	6.75 e	10.6 d	16.9 g	230 i	3.11	18.6
Actigard (Foliar), 1 oz (1); Actigard (Foliar), 0.5 oz (2) Kocide 3000, 1 lb (4-6); Penncozeb 75DF, 2 lb (4-6); Actigard (Foliar), 0.75 oz (5).....	5.50 b-d	11.4 b-e	11.4 cd	21.7 efg	323 d-i	3.94	17.2
Actigard (Drip), 1 oz (1); Actigard (Drip), 0.5 oz (2) Kocide 3000, 1 lb (4-6); Penncozeb 75DF, 2 lb (4-6); Actigard (Drip), 0.25 oz (5).....	4.75 b-e	7.50 de	11.4 cd	20.1 fg	268 g-i	2.78	15.6
Kocide 3000, 1 lb (2-6); Penncozeb 75DF, 2 lb (2-6).....	6.75 abc	9.83 cde	15.3 bcd	28.0 c-f	364 c-g	3.57	20.0
Control.....	9.08 a	16.9 a	28.0 a	41.7 a	596 a	5.98	23.8
<i>P > F</i>	0.0001	0.0215	<0.0001	<0.0001	<0.0001	0.0598	0.4646
Contrast							
<i>P > F</i>							
Actigard (Drip) vs. Actigard (Foliar).....	0.4361	0.1358	0.6931	0.8548	0.4479	0.2033	0.5227
Actigard (Drip) vs. Kocide-Penncozeb.....	0.3054	0.1696	0.3869	0.2790	0.1622	0.0546	0.9454
Actigard (Drip) vs. Non-treated control.....	0.0020	0.0315	0.0003	0.0234	<.0001	0.3954	0.1060
Actigard drip application rate							
50 vs. 25 μ M.....	0.0054	0.1382	0.0008	0.0086	<.0001	0.3946	0.1587
50 vs. 12.5 μ M.....	0.2192	0.0925	0.2136	0.0363	0.0094	0.2658	0.4950
25 vs. 12.5 μ M.....	0.1111	0.8390	0.0307	0.5781	0.1290	0.7907	0.4640
Actigard drip application interval							
7- vs. 14-day.....	0.4815	0.8537	0.4452	0.4245	0.5274	0.9849	0.0925

^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: $\sum[(x_i + x_{i-1})/2](t_i - t_{i-1})$ where x_i is the rating at each evaluation time and $(t_i - t_{i-1})$ is the time between evaluations.

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