

## CONTROL OF BACTERIAL SPOT AND BACTERIAL SPECK OF TOMATO THROUGH THE INTRODUCTION OF MICROBIAL ANTAGONISTS

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**Objective:** To use microbial antagonists, alone and in combination with the Novartis resistance-inducing chemical Actigard, as a means of controlling bacterial speck of tomato and bacterial spot of pepper and tomato.

### Screening for biocontrol agents:

To date we have isolated and tested 210 microbial strains for the ability to inhibit speck, spot and canker bacteria. These strains came from greenhouse soil, greenhouse water, or the surfaces of field-grown pepper and tomato plants. One strain, BC-87, which inhibited all three pathogens was field-tested. We now have a second strain, BC23-15, which markedly inhibits a wide range of speck, spot and canker strains. We currently are testing this isolate in our plant growth room for the ability to suppress disease development on tomato and pepper seedlings.

### Field-testing microbial biocontrol agents alone and in combination with Actigard:

We tested Actigard and three microbial biocontrol agents, A506 (trade name is BlightBan; a *Pseudomonas fluorescens* strain), Cit7 (a *Pseudomonas syringae* strain), and BC-87 (a gram-positive strain), for the ability to suppress disease development on field-grown tomato (cv. H9478) and pepper (cv. Merlin) plants. The microbial biocontrol strains and Actigard were sprayed on test plants at regular intervals throughout June, July and early August (microbials were applied weekly; Actigard sprays were applied at 10 da intervals). The guard rows were sprayed with the pathogens 6 (peppers) and 12 (tomatoes) days after planting. Disease incidence/severity readings and yield data were taken in August and September. SAS ANOVA or GLM statistical procedures were used to analyse the data. The results are given in Table 1.

**Speck trial:** Plants sprayed with the A506/Actigard combination had much less disease than the controls (disease incidence and severity on the leaves were reduced by 81 and 89 % respectively); Actigard alone reduced disease incidence and severity by 63 and 77%; significant disease reduction also occurred with the other treatments; no significant yield increases were observed.

**Spot-tomato trial:** Again, Actigard effectively suppressed disease incidence and severity (30% and 68%); unlike A506, Cit7 did not enhance the Actigard effect; A506 increased yield but not significantly.

**Spot-pepper trial:** plants were very badly infected with yields being sharply down from last year; yet, the A506/Actigard combination reduced disease incidence and severity by 30 and 70% respectively; Actigard treatment reduced yields significantly with A506 counteracting this effect to a certain extent; the A506 yield enhancement observed last year was not repeated in 1997 but this was probably due to the extremely high levels of disease that were present in this year's trial.

In summary, these results indicate that microbial antagonists in combination with chemical inducers of resistance, such as Actigard, hold tremendous promise as a viable alternative to copper for the control of bacterial pathogens of tomato and pepper.

TABLE 1. EFFECT OF MICROBIAL BIOCONTROL AGENTS ALONE AND IN COMBINATION WITH ACTIGARD ON THE SEVERITY OF BACTERIAL SPECK AND BACTERIAL SPOT IN TOMATO AND PEPPER TEST PLOTS.<sup>1</sup>

Treatment	Plant-disease <sup>2</sup>	No. infected leaves per 50 leaves	No. lesions per 20 leaves	%Infected fruit(#)	%Infected fruit (wt)	Yield (kg/10 plants)	Yield (fruit/10 plants)
A506	T-Speck	<b>17.2b (23.6)<sup>3</sup></b>	<b>27.0b (40.0)<sup>3</sup></b>	17.9ab (27.2) <sup>4</sup>	17.8abc (21.2) <sup>2</sup>	48.9a (3.2) <sup>3</sup>	804.8a (10.4) <sup>3</sup>
BC87	T-Speck	<b>15.5b (31.1)</b>	33.5ab (25.6)	22.9a (6.9)	21.7abc (4.0)	44.3a (0)	710.5a (0)
Cit7	T-Speck	<b>14.7b (34.7)</b>	<b>26.0b (42.2)</b>	25.3a (0)	24.8a (0)	46.8a (0)	729.0a (0)
Actigard	T-Speck	<b>8.3c (63.1)</b>	<b>10.5c (76.7)</b>	<b>15.2b (38.2)</b>	<b>16.1bc (28.8)</b>	44.9a (0)	706.3a (0)
A506+Ac.	T-Speck	<b>4.2d (81.3)</b>	<b>4.8c (89.3)</b>	<b>14.2b (42.2)</b>	<b>14.6c (35.4)</b>	46.8a (0)	714.3a (0)
Control	T-Speck	22.5a	45.0a	24.6a	22.6ab	47.41a	728.8a
A506	T-Spot	32.4a (8.5)	179.6ab (25.3)	28.4a (16.5)	24.0a (20.0)	41.0a (27.7)	734.0a (23.3)
BC87	T-Spot	31.1ab (12.1)	<b>161.0b (32.8)</b>	32.7a (3.8)	28.4a (5.3)	35.7a (11.2)	654.3a (9.9)
Cit7	T-Spot	30.8ab (13.0)	175.0ab (27.0)	32.2a (5.2)	28.0a (6.7)	36.7a (14.3)	678.5a (13.9)
Actigard	T-Spot	<b>24.9c (29.7)</b>	<b>76.8c (68.0)</b>	26.6a (21.8)	24.6a (18.0)	36.0a (12.2)	629.5a (5.7)
Cit7+Ac.	T-Spot	<b>26.5bc (25.1)</b>	<b>79.5c (66.8)</b>	30.4a (10.6)	27.9a (7.0)	37.8a (17.8)	667.5a (12.0)
Control	T-Spot	35.4a	239.7a	34.0a	30.0a	32.1a	595.5a
A506	P-Spot	17.8a (2.7)	880.6a (0)	77.5ab (4.3)	81.1a (5.3)	2.3ab (0)	19.5a (0)
BC87	P-Spot	18.4ab (0)	<b>624.3b (26.8)</b>	70.7ab (12.7)	72.6a (15.2)	2.7a (0)	20.0a (0)
Cit7	P-Spot	<b>15.7b (14.2)</b>	<b>622.0b (27.1)</b>	69.7ab (14.0)	76.6a (10.5)	2.7a (0)	21.8a (0)
Actigard	P-Spot	17.0ab (7.1)	<b>569.9b (33.2)</b>	66.3b (18.1)	72.4a (15.4)	<b>0.7c (0)</b>	7.8a (0)
A506+Ac.	P-Spot	<b>12.9c (29.5)</b>	<b>252.2c (70.4)</b>	90.9a (0)	90.8a (0)	<b>1.1bc (0)</b>	14.3a (0)
Control	P-Spot	18.3a	853.3a	81.0ab	85.6a	3.1a	23.8a

<sup>1</sup> For each 'plant-disease' set, the numbers in each column followed by the same letter do not differ significantly (P=0.05) by Duncan's multiple range test. Significant differences from the control are indicated in bold letters.

<sup>2</sup> T=tomato, cv. H9478; P=pepper, cv. Merlin.

<sup>3</sup> Numbers in parentheses represent the percent reduction in number of infected leaves, number of lesions/20 leaves, or percentage of diseased fruit as compared with the control.

<sup>4</sup> Numbers in parentheses represent the percent increase in yield as compared with the control.