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## IR-4 Ornamental Horticulture Program Bacterial Disease Efficacy

Agrobacterium tumefaciens Erwinia amylovora Erwinia chrysanthemi Erwinia sp. Pseudomonas chicorii Pseudomonas marginalis Pseudomonas spp. Pseudomonas syringae Xanthomonas campestris Xanthomonas spp.

Authors: Ely Vea and Cristi Palmer Date: October 27, 2015

> Acknowledgements: Susan Bierbrunner Lori Harrison Karen Sims

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#### Abstract

From 2008 to 2014, 54 products were tested through the IR-4 Program as drench or foliar applications against bacterial pathogens. In addition to research collected through the IR-4 program, this summary includes a review of experiments conducted from 2005 to 2014, mainly on tree crops. Species tested included: *Agrobacterium tumefaciens, Erwinia amylovora, E. chrysanthemi, Pseudomonas chicorii, P. marginalis, P. syringae, Pseudomonas* sp., *Xanthomonas campestris* and *Xanthomonas* spp. In general, all products, including the standard copper containing bactericides (Camelot, CuPRO, Cuprofix, Cuprofix MZ, Junction, Kocide, MasterCop, Phyton 27 and ReZist) and mancozebs (Dithane, Penncozeb, Protect) and biologicals (Cease, Regalia, Rhapsody and Serenade), provided variable efficacy on these bacterial pathogens. Several new products that are included in the IR-4 Bacterial efficacy project looked promising based on their efficacy relative to standards. These include Acibenzolar, CG100, Citrex, HM-0736, Kasumin, Regalia, Taegro, Tanos and ZeroTol. Further research is needed to obtain additional efficacy data to recommend actions to register or amend labels for these pests.

#### Introduction

Bacterial diseases are often very challenging to manage once established. The mainstay tools currently are copper-based products. In 2008, IR-4 initiated a high priority project to determine efficacy of several fungicides on bacterial pathogens so data can be obtained to support current and future registrations. Research for this project was conducted during 2008 to 2014. This report is based upon information generated through the IR-4 Ornamental Horticulture Program. To present a fuller picture on bacterial efficacy, additional reports from researchers published in Fungicide & Nematicide Tests (F&N) are also included, with permission from the authors. Tables containing these F&N reports have an asterisk (\*) at the beginning of their titles.

#### **Materials and Methods**

During 2008 to 2014, 54 products were tested through the IR-4 Program as drench or foliar applications against bacterial pathogens (Table 1). In addition to research collected through the IR-4 program, this summary includes a review of experiments conducted from 2005 to 2014 mainly on tree crops. Species tested included: *Erwinia amylovora, E. chrysanthemi, Pseudomonas chicorii, Pseudomonas marginalis, Pseudomonas syringae, Pseudomonas spp., Xanthomonas campestris* and *Xanthomonas* spp. Treatments were generally applied a few days before disease inoculation. A minimum of four plants (replicate treatments) were required with most researchers exceeding this minimum. Disease severity and incidence were recorded at various intervals after initial application. Phytotoxicity was recorded on a scale of 0 to 10 (0 = no phytotoxicity; 10 = complete kill) at each rating date for any treatment exhibiting damage unrelated to disease. Ten researchers were involved in the testing (Appendix 1).

Products were supplied by their respective manufacturers.

- For IR-4 testing, the following protocols were used: 08-004, 09-002, 10-008, 11-006, and 12-008. Please visit <u>http://ir4.rutgers.edu/ornamental/OrnamentalDrafts.cfm</u> to view and download these protocols.
- For all research data tables, product names have been updated where manufacturers have established trade names, and tables have been rearranged by product alphanumeric order. Where both inoculated and non-inoculated checks were included in the experiment, the inoculated check appears last in the table with the non-inoculated check immediately preceding it.

Table 1. List of Products and Rates Tested from 2008 to 2014.

Product	Active Ingredient(s)	Manufacturer	] ]	Rate(s) Tested			
A 14659C	A 14659C	Sunganta	Foliar	2 pt per 100 gal	1		
A14036C	A14036C	Syngenta	Foliai	4 pt per 100 gal	4		
A91800A	A91800A		Foliar	1 oz per 100 gal	2		
Actigard, Aciben zolar, Insimm o				0.019 oz per 100 gal			
	Acibenzolar			0.5 oz per 100 gal,	]		
						0.5 oz	
		Syngenta	Foliar	per acre	22		
				0.75 oz per 100 gal			
				1 oz per 100 gal			
				1.25 oz per 100 gal			
			Drench	0.25 oz per 100 gal	8		

Product	Active Ingredient(s)	Manufacturer	Rate(s) Tested		# Trials	
Actinovate NI108	Streptomyces lydicus	Natural Industries	Foliar	12 oz per 100 gal	8	
Agri-Mycin	Streptomycin	NuFarm	Foliar	8 oz per 100 gal	2	
Ag Streptomycin	Streptomycin Sulfate	ADAMA	Foliar	24 oz per acre	2	
Alexin	Various nutrients	Elisio, Ltd	Foliar	50 ml per 100 gal	1	
Aliatta WDC	Eccetril A1	Dovon	Falian	6.4 oz per 100 gal	6	
Allette wDG	Fosety1-AI	Dayer	Foliar	12.8 oz per 100 gal	0	
				5 ppm		
ASAP	Silver		Foliar	10 ppm	1	
				30 ppm		
BioPhos	Dipotassium phospho nate + Dipotassi um phosphat e	AgBio	Foliar	2 %	8	
	Pantoea agglomerans			10.5 oz per 100 gal	1	
BloomTime	strain E325	NuFarm	Foliar	5.3 oz per acre	1	
	Bacillus mycoides	Montana Microbial		100 g per 100 gal		
BmJ	isolate J	Produc ts	Foliar	13.5 oz per acre	2	
				16 oz per 100 gal		
Camelot	Copper salts	Sepro	Foliar	3 pt per 100 gal	4	
		I I		2 gal per 100 gal	2	
Canker Kill			Foliar	1.5 qt per 100 gal	1	
	Bacillus subtilis	BioWorks,		0.05%		
Cease, Rhapsody	strain	Agraq	Foliar	1 %	13	
	QST 713	uest		2 %		
				0.8 %	15	
CG100	Caprylic acid	AMVAC	Foliar	0.3 %	15	
				38.4 fl oz per 100 gal	1	
Champ 2F	Copper hydroxide	NuFarm	Foliar	21 fl oz per 100 gal	1	
				120 ml per 100 L		
Citrex	Citrus extracts	Citrex, Inc.	Foliar	150 ml per 100 L	23	
				5 fl oz per 100 gal		
<i>a</i> .	Bacillus subtilis		<b>F</b> 1	0.5 %		
Companion	GB03	Growth Products	Foliar	1 %	2	
	0		E 1'	2 %	1	
Copper Count-N	Copper	MRD	Foliar	1 qt per 100 gal	1	
		SePro		0.75 lb per 100 gal	12	
				2  ID per 100 gal		
CuDDO Kooida	Connor hydroxida		Folior	1 lb per 100 gal		
Cur KO, Kociuc	Copper injuroxide	DuPont	Fonai	2 lb per 100 gal	21	
		Duronit		3 lb per 100 gal		
				3.5 lb per 100 gal		
Cuprofix	Copper sulfate	UPI	Foliar	1.5 lb per 100 gal	2	
	Mancozeb + Copper		- •	0.7511 400 Sui		
Cuprofix MZ	sulfate	UPI	Foliar	8.75 lb per 100 gal	2	
Ditnane /SWP	Mancozeb	Dow Forthering 1 - 1	Foliar	16 oz per 100 gal	1	
Earth Lec	Ovutates availing		Foliar	1.5 11 02 per 100 gal	<u> </u>	
rireine	Oxytetracycline	AgroSource	гопаr	40 oz per acre	1	

Product	Active Ingredient(s)	Manufacturer	Rate(s) Tested		# Trials	
				200 ppm		
Firewall	Streptomycin sulfate	UPI	Foliar	12 oz per acre	2	
				24 oz per acre		
Eloral	Ethonhon	Dovon	Falian	Foliar 10 qt per 100 gal		
FIOTEI	Ethephon	Dayer	Foliar	20 qt per 100 gal	1	
Hankarra	Starte marin andfate		Esling.	12 oz per acre	1	
Harbour	Streptomycin sullate	ADAMA	Foliar	24 oz per acre		
UN ( 072 C	T	A	<b>F</b> 11	14.4 fl oz per 100 gal	22	
HM 0/36	Laminarin	Agrimar	Foliar	58 fl oz per 100 gal	23	
	Mancozeb + Copper			1.5 lb per 100 gal		
Junction DF	hydroxid e	SePro	Foliar	3 lb per 100 gal	2	
				45 fl oz per 100 gal		
Vannia	<i>V</i>	America	Eslian	64 fl oz per 100 gal	22	
Kasumin	Kasugamycin	Arysta	Foliar	16 fl oz per acre		
				48 fl oz per acre		
	Didecyl dimethyl			6 oz per 100 gal	2	
<b>VlaanGrow</b>	ammoniu	Daga Chamicala	Folior	25 fl oz per 100 gal	1	
KleenOlow	m chloride	Face Chemicals	Folia	50 fl oz per 100 gal	1	
		Plant Food		2 qt per 100 gal		
K-Phite	Phophorus acid salts	System	Foliar	5 at par 100 col	10	
		S		5 qi per 100 gai		
MasterCon	Copper sulfate		Foliar	1.5 pt per acre	2	
mustercop	rate	ADAWA	1 Onai	1.5 pt per dere	2	
	Potassium					
Milstop	bicarbon BioWorks		Foliar	1.25 lb per 100 gal	1	
r	ate			F 8	_	
N. 1. 1001			Foliar	5 fl oz per 100 gal	4	
NAI-4201	Tiadinil	Nichino America	Drench	5 fl oz per 100 gal	7	
Nu-Cop	Copper hydroxide	Albaugh	Foliar	1 lb per 100 gal	2	
Omega-Grow Plus	Fish oil	Omega Protein	Foliar	2 %	1	
Penncozeb	Mancozeb	UPI	Foliar	1.5 lb per 100 gal	4	
Protect	Mancozeb	Cleary	Foliar	2 lb per 100 gal	6	
	Copper sulfate	•		25 oz per 100 gal		
Phyton 27	pentahyd	Source Technology	Foliar	50 oz per 100 gal	12	
	Pauro autoria			1.0/		
Regalia SC (MOI-	<i>Reynoutria</i>			1 %		
106),	sachaline	Marrone	Foliar	2 at man agen	20	
Milsana	<i>HSIS</i>			2 qt per acre		
	Chalatad			16 og por 100 gol		
<b>D</b> o <b>7</b> ist	Chelated	Stallar	Folior	10 02 per 100 gai	1	
KeZ1st	Mn+Zn	Stoller	Foliai	32 oz per 100 gal	1	
	Racillus subtilis					
Serenade Optimum	strain	Bayer	Foliar	1.5 lb per acre	3	
	OST 713	Dujer	1 01141	The to per unit	U	
Sett	Calcium + Boron	Stoller	Foliar	32 oz per 100 gal	1	
~~~				8 oz per 100 gal		
	Famoxadone +	SePro	Foliar	12 oz per 100 gal	14	
SP2015, Tanos	Cymoxa			8 oz per 100 gal		
	nil	DuPont	Foliar	16 oz per 100 gal	14	

Product	Active Ingredient(s)	Manufacturer	Rate(s) Tested		# Trials
Starner	Oxolinic acid	Valent	Foliar	0.75 %	1
STBX-304	Cupric ammonium formate	Phyton	Foliar	25 fl oz per 100 gal	1
			Foliar	3.5 oz per 100 gal	9
			Drench	3.5 oz per 100 gal	5
Taegro	Bacillus subtilis var. amyloliq uefaciens strain FZB24	Novozymes	Alt.	3.5 oz per 100 gal	3
	Sodium		Dienen	04%	
	tetrabora			0.8 %	
Tricon	hydrate decahydr ate	BioWorks	Foliar	2 %	10
Vital	Potassium phosphite	Luxembourg- Pamol	Foliar	4 pt per 100 gal 8 pt per 100 gal	6
Vitalonil	Potassium phosphate + Chloroth alonil	Luxembourg- Pamol	Foliar	5 pt per 100 gal	2
ZeroTol	Hydrogen dioxide	BioSafe	Foliar	128 fl oz per 100 gal	6

### Results

#### Comparative Efficacy on Agrobacterium tumefaciens.

In 2011, Chase examined the efficacy of several products for preventative control of *Agrobacterium tumefaciens* on goldenrod (*Solidago* sp.). All treatments were applied as a weekly foliar spray (to drip) or drench at on 1, 8, 15, 22, 29 August, 6, 12, 19 and 26 September. Plants were inoculated with a culture of *Agrobacterium tumefaciens* sprayed onto wounded plants on 17 August, and then the plants were placed into clear plastic bags under mist (high humidity) for 48 hours. The plastic was removed and the plants remained under intermittent mist for the duration of the trial. Based on plant height, top grade, number of galls and gall size, no treatment significantly reduced disease incidence in this experiment (Table 2). Agri-Mycin caused significant phytotoxicity (smaller, yellow plants).

	Rate per	Height <sup>y</sup>	Тор	Grade	Num	ber of G	alls Per	· Plant	
Treatment		8/23	8/23	9/16	9/7	9/16	9/23	9/30	Gall Size 10/7
Acibenzolar drench	0.25 oz	40.0 a	3.6 a	3.9 bc	0.2 a	0.4 a	1.1 a	1.8 b	3.6 bc
Acibenzolar spray	1 oz	39.8 a	3.4 a	3.8 bc	0.0 a	0.7 a	1.2 a	1.8 b	2.7 bc
Agri-Mycin	8 oz	35.9 a	3.6 a	2.8 a	0.6 a	1.1 a	1.8 a	2.6 b	2.6 b
CG100	1.2 pt	42.4 a	3.7 a	3.7 bc	0.7 a	1.2 a	2.0 a	1.7 b	3.7 c
Citrex	1.5 ml/L	42.9 a	3.7 a	3.9 bc	0.2 a	0.8 a	1.2 a	2.1 b	3.1 bc
HM-0736	14.4 oz	36.0 a	3.6 a	3.9 bc	0.7 a	0.4 a	1.8 a	2.3 b	3.2 bc
Kasumin	45 fl oz	32.0 a	3.3 a	3.9 bc	0.9 a	1.3 a	1.8 a	1.9 b	3.7 c
NAI-4201 drench	5 oz	37.0 a	3.4 a	3.9 bc	0.3 a	1.3 a	1.9 a	2.1 b	3.3 bc
Regalia SC	1%	35.7 a	3.4 a	3.6 bc	0.8 a	1.2 a	1.7 a	2.8 b	3.5 bc
ZeroTol	1%	45.0 a	3.7 a	4.0 c	0.3 a	0.8 a	1.4 a	2.9 b	2.8 bc
Untreated uninocul ated	-	42.0 a	3.7 a	3.9 bc	0.0 a	0.0 a	0.0 a	0.0 a	1.0 a
Untreated inoculated	-	38.9 a	3.4 a	3.6 b	1.2 a	1.2 a	1.6 a	1.8 b	3.2 bc

#### Table 2. Efficacy on Agrobacterium tumefaciens on Goldenrod (Solidago sp.), Chase, CA, 2011.

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<sup>x</sup> Means followed by the same letter do not differ significantly based on Fisher's LSD (P=0.05.

#### Comparative Efficacy on Erwinia species.

In general, *Erwinia spp.* incidence and severity were too low in most trials to provide definitive conclusions on efficacy. The standard copper products (Camelot, CuPRO, Kocide, MasterCop) and mancozeb (Protect) were statistically comparable to the untreated non-inoculated check, while streptomycin (Ag Streptomycin, Firewall) provided excellent control (Table 3). Acibenzolar, Citrex, and KleenGrow looked promising in one trial while CG100 was ineffective in two trials. Other products (A14658C, Citrex, HM-0736, Kasumin, NAI-4201 Tanos, Taegro), provided mixed efficacy (either +/- or – ratings), but generally were comparable to copper compounds in many trials so they may be promising materials at

different rates or application intervals. Tanos mixed with CuPRO generally did not improve performance of CuPRO. See the discussion and data of individual trials for more details.

	Oncidiur	n Orchid	Phaelanop	osis Orchid	Poinsettia	Pear		Apple	
	Chase	Chase	Norman	Norman	Chase	Steddom	Cox	Cox	Yoder
Product					2				
						1			
A 14(59C						. /			
A14038C		. /			. /	+/-	. /		
Acibenzolar		+/-	-	-	+/-	+	+/-		-
Ag Streptomycin							++	++	
Aliette						-			
Bloomtime							++		
BMJ								+	
Camelot	+/-					+/-			
CG100			-	-					
Citrex		+/-	-	-	+/-	+			
CuPRO, Kocide 2000		+/-	+/-	++	+/-	-			
Firewall									++
Florel						-			
HM-0736		+/-	-	-	+/-	-			
Kasumin		-	-	-	+/-	+/-	++	++	
KleenGrow	++					+/-			
Kocide 3000	+/-								
MasterCop							+/-	+	
NAI-4201			+/-			+/-			
Protect				++					
Regalia			+/-	-		-	+/-		+/-
ReZist					+/-				
ReZist + Sett					+				
Serenade							+/-	+/-	+/-
Tanos		+/-	+/-	-	+/-				
Tanos + CuPRO		+/-	+/-	++	+/-				
Taegro		+/-	-	-	+				

 Table 3. General summary of efficacy for Erwinia spp. on various crops.

\* Not an IR-4-sponsored experiment.

1 Rating Scale: ++ = clearly statistically equivalent or better than untreated non-inoculated and/or clearly statistically different than untreated inoculated; + = statistically different from untreated inoculated and untreated non-inoculated; +/- statistically equivalent to both untreated inoculated and untreated non-inoculated; - = statistically equivalent to untreated inoculated.

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2 Where more than one rate or application type for a product was included in the experiment and each performed statistically different, the better rating is provided in this table.

In 2009, Chase examined impact of several products for preventative control of *Erwinia chrysanthemi* on Oncidium orchid. All treatments were applied as a weekly foliar spray (to drip) on 14, 21, 28 September, and 7, 14 October. Plants were inoculated with a culture of *Erwinia chrysanthemi* sprayed onto the plants on 18 September and 5 October, and then the plants were placed under clear plastic sheeting (high humidity) for 48 hours. The plastic was removed and the plants remained under intermittent mist (30 sec/hour 24 hr/day) for the duration of the trial. Based on the number of infected leaves, KleenGrow was the only treatment that significantly reduced disease incidence in this experiment (Table 4).

Treatment	Rate per 100 Gal	Number of infected leaves per plant 10-20-09	Number of infected leaves per plant 10-28-09
Agri-Mycin	8 oz	0.2 a	1.1 ab
Camelot	16 oz	0.2 a	1.3 ab
Camelot + KleenGrow	16 oz + 6 oz	0.2 a	1.5 ab
KleenGrow	6 oz	0.4 a	0.6 a
Kocide 3000	16 oz	1.7 b	1.9 ab
Kocide 3000 + KleenGrow	16 oz + 6 oz	0.9 ab	1.7 ab
Untreated non-inoculated	-	0.5 a	0.8 ab
Untreated inoculated	-	1.1 ab	2.4 b

Table 4.	* Efficacy of	n <i>Erwinia</i>	chrysanthemi	on Oncidium	orchid,	Chase,	CA, 2009
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\* Not an IR-4 Experiment (00-000-Chase-1)

In another trial, orchid liners were obtained from commercial producers (72 cell size) and established in orchid medium in 3.5 inch pots. Plants were inoculated with a strain of *Erwinia chrysanthemi* after two bactericide applications. During the trial period, Phalaenopsis did not develop disease symptoms. Oncidium developed moderate levels of *Erwinia* during the trial. For disease control at the first rating, none of the treatments were significantly different than the water sprayed controls, although the plants with fewest spotted leaves were those treated with Tanos alone, Tanos + CuPRO and CuPRO alone (Table 5). At the end of the trial, there were no significant differences between any treatments and the water sprayed controls. However, the lowest percentage of infection was found on those plants treated with Acibenzolar, Tanos alone and CuPRO alone. The greatest percentage of the plant infected was seen on those treated with Citrex, Kasumin and Taegro. Significant phytotoxicity as shown by overall top grade was found on Phalaenopsis plants treated with Acibenzolar, Tanos + CuPRO and CuPRO alone.

Treatment	Rate per 100 Gal	No. spots/plant <i>Onicidium</i> 9-4-09	No. spots/plant Oncidium 9-10-09	% soft rot <i>Oncidium</i> 9-16-09	Top grade Phalaenopsis 9-16-09
Acibenzolar	0.75 oz	0.6 a	0.6 a	7.2 a	3.2 a
Citrex	150 ml/ 100 L	0.5 a	1.0 a	31.7 ab	4.2 b
CuPRO	2 lb	0.0 a	0.4 a	2.2 a	3.3 a
HM-0736	14.4 fl oz	0.6 a	1.1 a	13.9 ab	3.4 a
Kasumin	45 fl oz	0.7 a	1.7 a	38.3 b	4.1 b
Tanos	12 oz	0.0 a	0.7 a	3.3 a	4.0 b
Tanos + CuPRO	8 oz + 2 lb	0.2 a	0.7 a	14.2 ab	3.0 a
Taegro - drench	3.5 oz	0.8 a	0.3 a	30.0 ab	3.6 ab
Untreated non- inoculated	-	0.0 a	0.0 a	5.0 a	4.2 b
Untreated inoculated	-	0.8 a	0.5 a	25.0 ab	3.6 ab

Table 5. Efficacy on *Erwinia chrysanthemi* on Orchid (*Oncidium* sp) 'Wilson's Wicked Qua' and Orchid (*Phalaenopsis* sp.), Chase, CA, 2009.

09-002-Chase-02

In 2010, Palmateer examined the efficacy of several products for preventative control of Erwinia

*chrysanthemi* on Oncidium orchid. All treatments were applied as weekly foliar sprays from 22 July to 26 Aug, except NAI-4201 and Taegro which were applied biweekly from 22 July to 16 Sept. Plants were inoculated with *Erwinia chrysanthemi* sprayed onto wounded leaves on 7-10 Aug and 19 Sept. Plants were incubated for 2 days in a humidity chamber and placed in blocks on shade house benches after incubation. Disease was rated based on the number of leaves and pseudobulbs with soft rot and the percentage of the leaf that was diseased. The ratings were then added for a total disease rating. The two scales are below. Disease levels were low for the trial, with median ratings ranging from 0-3, and 0 for both controls, and there were no significant differences between treatments (Table 6). No phytotoxicity was found on any treatment.

#### Leaf Rating Scale:

0=no disease

- 1=1 symptomatic leaf with <10% leaf diseased (severity)
- 2=1 symptomatic leaf with 10-50% diseased or 2 leaves with <10% severity
- 3=1 symptomatic leaf >50% severity or 2 leaves <50% severity
- 4=2 leaves with one >50% or 3 symptomatic leaves with <10% severity
- 5=2 leaves both >50% severity or 3 leaves with one 10-50% severity
- 6=3 leaves up to 50% severity or one >50%
- 7=3 symptomatic leaves, 2>50% or 4 symptomatic leaves <10% severity
- 8=3 symptomatic leaves, all >50% or 4 symptomatic leaves, one >10% severity
- 9=4 symptomatic leaves, 2>10% severity
- 10=4 symptomatic leaves, 3>10% severity
- 11=4 symptomatic leaves, all >10% severity or 5 symptomatic leaves, all<10% severity
- 12=5 symptomatic leaves, 1>10% severity
- 13=5 symptomatic leaves, 2>10% severity
- 14=5 symptomatic leaves, 3>10% severity
- 15=5 symptomatic leaves, 4>10% severity

#### **Pseudobulb Rating Scale:**

Note: Diseased pseudobulbs often don't recover and the affected tissue dies.

0=no disease

1=1 diseased pseudobulb

2= 2 diseased pseudobulbs

3= 3 diseased pseudobulbs

Treatment	Rate per 100 Gal	Median Disease Rati ng*	Mean Rank	Estimated Rela tive Effect <sup>y</sup>
Acibenzolar	1 oz	3	35.5	0.54
Cease + Milstop	1 % + 2.5 lb	0	16.5	0.25
CG100	0.8 %	3	35.25	0.53
Citrex	150 ml/100 L	0.5	26.88	0.41
Copper Count N	1 qt	0	26	0.39
HM-0736	14.4 fl oz	0	26	0.39
Kasumin	45 fl oz	0	25.12	0.38
NAI-4201	5 fl oz	2	33.75	0.51
Regalia	1 %	2	34.62	0.53
Tanos	12 oz	1.5	30.5	0.46
Tanos + CuPRO	8 oz + 2 lb	1.5	30.5	0.46
Taegro	3.5 oz	1.5	31.38	0.48
Untreated non-inoculated	-	0	16.5	0.25
Untreated inoculated	-	0	26	0.39
		P = 0.7	644	

Table 6. Efficacy on Soft Rot (Erwinia chrysanthemi) on Oncidium Orchid, Palmateer, FL, 2010.

10-008-Palmateer-1

\* Nonparametric analysis was used to first rank the ordinal rating data and then to compare ranks using ANOVA (SAS v 9.1), following the analysis methods described in Shah and Madden. 2004. Phytopathology 94:33-43.

<sup>y</sup> Higher relative effect signifies higher disease levels

In 2009 and 2010, Norman examined the efficacy of various products for preventative control of *Erwinia* sp. on Phalenopsis orchid. In 2009, plants were inoculated 11 days after the first application. For unknown reasons the disease control had less soft rot than most of the treatments, therefore, a true evaluation treatment efficacy was not possible. Although CuPro, Tanos, and Tanos + CuPro treatments had numerically lower leaf spots than untreated Control, no treatment provided significant reduction (Table 7). In 2010, all treatments were applied as foliar sprays (to runoff) on 14 and/or 21 May; disease inoculation occurred on 25 May. Softrot lesions were measured 3 days after inoculation. The only effective products were CuPRO and Protect; other treatments did not significantly reduce lesion size (Table 8). No phytotoxicity was found on any treatment.

Treatment	Rate per 100 gal	Date of Application	Number of Leaf Spots <sup>x</sup> 7-31-09
Acibenzolar	0.75 oz	July 16, 23	16.3 bcd
Actinovate	12 oz	July 23	14 bcd
CG100	0.8 %	July 23	17.2 cd
Citrex	150 ml/L	July 16, 23	20.1 cde
CuPRO	2 lb	July 23	3.4 ab
HM-0736	14.4 floz	July 16, 23	23 de
Kasumin	45 floz	July 23	14.1 bcd
NAI-4201 - drench	5 floz	July 16	8.8 abc
Regalia	1 %	July 23	12.6 abcd
Tanos	12 oz	July 23	6.5 abc
Tanos + CuPRO	8 oz + 2lb	July 23	7.5 abc
Taegro	3.5 oz	July 23	31.8 e
Vitalonil	5 pt	July 16, 23	11.4 abcd
Untreated non- inoculated	-	-	0 a
Untreated inoculated	-	-	7.8 abc

Table 7. Efficacy on Leaf Spot (Erwinia sp.) on Orchid (Phalaenopsis sp.), Norman, 2009.

09-002-Norman-1

<sup>x</sup> Means followed by same letter do not differ significantly based on Fisher's Protected LSD) (P=.05).

Treatment	Rate per 100 gal	Date of Application	Size of Soft Rot Lesions <sup>x</sup>
Acibenzolar	0.75 oz	May 14, 21	10.5 b-e
CG100	0.3 %	May 21	8.8 bcd
Citrex	150 ml/L	May 14, 21	15 de
CuPRO	2 lb	May 21	3.3 abc
HM-0736	14.4 floz	May 14, 21	12.9 de
Kasumin	45 floz	May 21	17.4 e
Protect	2 lb	May 21	2.6 ab
Regalia	1 %	May 21	11.4 cde
Tanos	12 oz	May 21	14 de
Tanos + CuPRO	8 oz + 2lb	May 21	4.1 abc
Taegro	3.5 oz	May 21	10.8 b-e
Untreated non-			0.5
inoculated	-	-	0 a
Untreated inoculated	-	-	13 de

Table 8. Efficacy on Soft Rot (Erwinia sp.) on Orchid (Phalaenopsis sp.), Norman, 2010.

10-008-Norman-2

<sup>x</sup> Means followed by same letter do not differ significantly based on Fisher's Protected LSD) (P=.05).

In 2010, Steddom conducted a field trial in a commercial nursery to determine efficacy of various products for preventative control of *Erwinia amylovora* on Keifer pear (*Pyrus communis* x *Pyrus pyrifolia*). All treatments were applied weekly except NAI-4201 and Taegro which were scheduled on a 14-day interval and the Acibenzolar drench which was scheduled on a 28-day interval. Treatments began on 24 March 2010 and due to weather were repeated 7, 15, 22, 29, and 39 days from initiation. On 24 March, most trees were at green tip with a few flowers beginning to bloom and by 9 April most trees were through flowering. Disease incidence was virtually zero and there were no significant treatment effects in this trial (Table 9). Similarly

no significant growth differences were observed between treatments. Significant but very minor leaf mottling was observed from Citrex and KleenGrow and should not reduce marketability.

	Doto non		Growth Increase At Trial End		Phytotoxicity Rating <sup>y</sup>	
	Kate per		5-9	-10	5-3-10	
Treatment	0 0 0 0 0 1	Number of Blighted Shoots <sup>x</sup> 3 May		Canopy	Leaf	
			Height			Mottling
Acibenzolar - foliar	1 oz	0.0 a	1.72 a	0.87 a	0.2 a	0.0 c
Acibenzolar - drench	0.25 oz	0.0 a	2.25 a	1.56 a	0.4 a	0.0 c
Aliette	12.8 oz	0.0 a	1.95 a	1.01 a	0.0 a	0.0 c
CG100	0.3 %	0.8	1.94 a	1.48 a	0.6 a	0.0 c
Citrex	19.2 fl oz	0.8	1.89 a	0.90 a	0.9 a	1.9 a
CuPRO	2 lb	0.0 a	1.19 a	0.69 a	0.6 a	0.0 c
HM-0736	14.4 fl oz	0.0 a	1.57 a	2.15 a	0.1 a	0.0 c
Kasumin	45 fl oz	0.0 a	2.79 a	1.39 a	0.4 a	0.0 c
KleenGrow	25 fl oz	0.0 a	1.20 a	0.87 a	0.6 a	1.2 b
NAI-4201	5 fl oz	0.3	1.06 a	1.27 a	0.6 a	0.3 c
Regalia	1 %	0.0 a	2.26 a	1.35 a	0.1 a	0.0 c
Tanos	12 oz	0.4	1.11 a	1.52 a	0.3 a	0.0 c
Tanos + CuPRO	8 oz + 2 lb	0.0 a	1.73 a	2.07 a	0.3 a	0.0 c
Taegro	3.5 oz s r a y / c r r e r t t	0.0 a	2.75 a	1.29 a	0.7 a	0.0 c
Untreated	-	0.0 a	1.07 a	0.14 a	0.3 a	0.0 c

Table 9.	Efficacy on Fireblight (Erwinia amylovora) on Keifer Pear (Pyrus communis x Pyrus
	pyrifolia) 'Keifer', Steddom TX, 2010.

10-008-Steddom-1

x Means followed by the same letter do not differ significantly based on Fisher's Protected LSD (P=0.05.

y Ratings based on a 0 to 5 scale with 0=no phytotoxicity, 3=phytotoxicity plainly visible, reducing marketability, and 5=phytotoxicity severely disfiguring tree.

In 2012, Steddom studied whether 14 products could manage fireblight (*Erwinia sp.*) on ornamental pear (Pyrus calleryana 'Cleveland'). Due to the erratic nature and long duration of disease this year, the proportion of flowers or stems blighted were summed across data collection dates. Flower blight was not significantly different for any treatments (Table 10). Shoot blight showed high variability with significant differences at the p=0.02 level. The following treatments had significantly less shoot blight than the untreated uninoculated control: Acibenzolar foliar, Acibenzolar drench, Camelot O foliar, NAI-4201 foliar, Citrex foliar, Kasumin foliar, Cease + Milstop foliar tank mix, KleenGrow foliar, and KleenGrow + CuPro foliar tank mix. Since CuPro by itself did not provide significant control and the KleenGrow + CuPro foliar tank mix did not provide significantly more disease reduction that KleenGrow by itself, it is likely that the control seen in the KleenGrow + CuPro foliar treatment was from the KleenGrow contribution. Disease progress did not follow the typical route of flower blight followed by movement of the bacterium down the pedicel to the stems. It is unclear if the treatments listed above will provide effective control against the flower blight stage of this disease but the control of the shoot blight phase can be an important management tool for suppression of this disease.

Table 10.	Efficacy on Fireblight (Erwinia sp.) on ornamental pear (Pyrus calleryana) 'Kei	ifer',
	Steddom TX, 2012.	

Product (active ingredients) Rate	Flower Blight <sup>a</sup>	Shoot Blight <sup>b</sup>
A14658C 2 pt per 100 gal	0.06	0.33 bcde
A14658C 4 pt per 100 gal	0.67	0.19 cde
Aliette (fosetyl Al) 12.8 oz per 100 gal	0.60	0.34 bcde
Camelot O (copper salts of fatty and rosin acids) 2 gal per 100 gal	0.22	0.17 de
Cease+Milstop ( <i>Bacillus subtilis</i> + potassium bicarbonate) 4 qt + 3 lb per 100 gal	0.23	0.11 de
Citrex (Citrus extraction) 150 ml per 100 L	0.00	0.15 de
CuPro (copper hydroxide) 2 lb per 100 gal	0.00	0.41 abcde
Florel (ethephon) 1 qt per 100 gal	0.36	0.85 a
Florel (ethephon) 2 qt per 100 gal	0.25	0.57 abcd
HM-0736 (laminarin) 14.4 fl oz per 100 gal	0.17	0.47 abcde
Insimmo (acibenzolar) 0.25 oz per 100 gal Foliar	0.25	0.04 e
Insimmo (acibenzolar) 1 oz per 100 gal Drench	0.00	0.08 de
Kasumin (kasugamycin) 45 fl oz per 100 gal	0.08	0.18 de
KleenGrow (didecyl dimethyl ammonium chloride) 50 fl oz per 100 gal	0.00	0.16 de
KleenGrow + CuPro (didecyl dimethyl ammonium chloride + copper hydroxide) 50 fl oz + 2 lb per 100 gal	0.00	0.14 de
NAI-4201 (5 fl oz per 100 gal	0.00	0.14 de
Regalia (extract of Reynoutria sachalinensis) 1 qt per 10 gal	0.50	0.69 ab
Untreated Non-inoculated Control	0.19	0.69 abc
Least Significant Difference	0.70	0.50

12-008-Steddom-01

<sup>a</sup> Proportions of blighted flower or stems summed across all examination dates of trial

<sup>b</sup> Differences in blighted shoots were significant at the p=0.02 level. Mean separation was by Fisher's Protected LSD test with a probability threshold of p=0.05.

In 2012, Steddom conducted another trial on Cleveland pear (*Pyrus calleryana*). All treatments were applied foliar except Acibenzolar which was applied drench 3 times or foliar 7 times (Table 11). Flower blight was not significantly different for any treatments. The following treatments

had significantly less shoot blight than the untreated uninoculated control: Acibenzolar drench or foliar, Camelot O, NAI-4201, Citrex, Kasumin, Cease + Milstop, KleenGrow, and KleenGrow + CuPro. It is unclear if these treatments will provide effective control against the flower blight stage of this disease but the control of the shoot blight phase can be an important management tool for suppression of this disease. Aliette, CG100, CuPro, Florel, HM-0736 and Regalia did not significantly reduce shoot blight incidence.

Table 11. Efficacy on Fireblight (Erwinia amylovora) on Cleveland Pear (Pyrus calleryana),<br/>Steddom TX, 2012.

				Flower	Shoot
Treatment	Rate per 100 G a l	Application Timing (DOY)	Crop Stage		
A14658C	2 pt	72,81,88,95,102	Green tip thru petal fall	0.06 a	0.33 b-e
A14658C	4 pt	72,81,88,95,102	Green tip thru petal fall	0.67 a	0.19 cde
Acibenzolar foliar	1 oz	51,58,72,81,88,95,1 02	Green tip thru petal fall	0.25 a	0.04 e
Acibenzolar drench	0.25 oz	43,72,102	Dormant and bloom	0.00 a	0.08 de
Aliette	12.8 oz	51,58,72,81,88,95,1 02	Green tip thru petal fall	0.60 a	0.34 b-e
Camelot O	2 gal	58,72,81,88,95,102	Bloom thru petal fall	0.22 a	0.17 de
Cease + Milstop	4qt + 3 lb	58,72,81,88,95,102	Bloom thru petal fall	0.23 a	0.11 de
Citrex	150 cc/100 L	51,58,72,81,88,95,1 02	Green tip thru petal fall	0.00 a	0.15 de
CuPro	2 lb	58,72,81,88,95,102	Green tip thru petal fall	0.00 a	0.41 a-e
Floral	1 qt/10 gal	72,81,88,95,102	Bloom thru petal fall	0.36 a	0.85 a
FIOIEI	2 qt/10 gal	72,81,88,95,102	Bloom thru petal fall	0.25 a	0.57 a-d
HM-0736	14.4 fl.oz	51,58,72,81,88,95,1 02	Green tip thru petal fall	0.17 a	0.47 а-е
Kasumin	45 fl.oz	58,72,81,88,95,102	Green tip thru petal fall	0.08 a	0.18 de
KleenGrow	50 fl.oz	58,72,81,88,95,102	Green tip thru petal fall	0.00 a	0.16 de
KleenGrow + CuPro	50 fl.oz + 2 lb	72,81,88,95,102	Green tip thru petal fall	0.00 a	0.14 de
NAI-4201	5 fl.oz	58,72,81,88,95,102	Bloom thru petal fall	0.00 a	0.14 de
Regalia (MOI 106)	1 qt/10 gal	58,72,81,88,95,102	Bloom thru petal fall	0.50 a	0.69 ab

Untreated	-	-	ŀ	0.19 a	0.69 abc
<sup>x</sup> Proportions of blighte	ed flower or stem	s summed across all exa	mination dates of trial. Mea	ns followed	by the same

letter do not differ significantly based on Fisher's Protected LSD (P=0.05).

\* Capsil was added at the rate of 12 fl oz/100 gal to all treatments except KleenGrow, KleenGrow + CuPro, and Cease + Milstop.

In 2013 and 2014, Cox conducted two trials to determine efficacy of various products applied foliar for preventative control of *Erwinia amylovora* on apple (*Malus domestica*). In 2013, Kasumin, Ag Streptomycin and Bloomtime provided the best control of blossom blight followed by Actigard, Fireline, MasterCop and Serenade (Table 12). While only Ag Streptomycin and Kasumin provided a considerable and significantly reduced progression of shoot blight development, Actigard and Bloomtime provided a marginal, but significant reduction in the extent of shoot blight. In 2014, Kasumin and Ag Streptomycin again provided the best control of blossom blight followed by MasterCop, BmJ and Serenade (Table 13). Kasumin and Ag Streptomycin also had the lowest progression of shoot blight on new shoots.

Treatment	Rate per A c r e	Application T i m i n g y	Blossom Bl ig ht ( % ) <sup>x</sup>	Shoot Blight Ca nke r Le ngt h (m m)
Actigard 50WG (acibenzolar)	0.5 oz	1-2, 4-5	$11.2 \pm 2.0 \text{ c}$	99.2 ± 1.9 cde
Ag Streptomycin (streptomycin) + Regulaid	24 oz + 3 pt	2, 4-5	$2.6 \pm 1.1 \text{ efg}$	$29.7\pm4.7~f$
Bloomtime ( <i>Pantoea agglomerans</i> strain E325)	5.28 oz	4-5	$6.2 \pm 2.2 \text{ de}$	91.5 ± 2.6 d
Fireline 17WP (oxytetracycline)	48 oz	2, 4	$11.2 \pm 1.2 \text{ c}$	-
Kasumin 2L (kasugamycin)	16 fl oz	4-5	$0.6 \pm 0.4 \text{ fg}$	$25.2\pm2.6~\mathrm{f}$
MasterCop (copper sulfate pentahydrate)	1.5 pt	2, 4-5	$17.2 \pm 3.1 \text{ b}$	$125.8 \pm 8.5$ a
Serenade Optimum ( <i>Bacillus subtilis</i> strain QST 713) + Regulaid	1.5 lb + 3 pt	2, 4-5	$18.4\pm1.1~\text{b}$	-
Untreated	-	-	29.6 ± 2.1 a	$121.4 \pm 8.9 \text{ ab}$

# Table 12. \*Efficacy on Fireblight (Erwinia amylovora) on Apple (Malus x domestica) 'Idared', Cox, NY, 2013.

\* Not an IR-4 Experiment: PDMR Vol. 8:PF007. Not all products tested included in table.

<sup>x</sup> Means followed by the same letter do not differ significantly based on Tukey's HSD (P=0.05).

<sup>y</sup> Treatment timings were: 1 = 20% bloom (13 May); 2 = 50% bloom (14 May); 3 = 80% bloom (15 May); 4 = full bloom (16 May); 5 = during terminal shoot growth (7 Jun).

Treatment	Rate per A c r e	Application T i m i n g y	Blossom Blight (% ) <sup>x</sup>	Shoot Blight ( % 0 f S h 0 0 t L e n g t h )
Ag Streptomycin (streptomycin) + Regulaid	24 oz + 3 pt	3	$0.3 \pm 0.3 f$	$11.5 \pm 2.2$ cd
BmJ (Bacillus mycoides isolate J)	13.5 oz	1, 3, 4	$19.0 \pm 6.3$ bcd	-
Kasumin 2L (kasugamycin)	16 fl oz	3, 6	$0.0\pm0.0\;f$	$5.1 \pm 2.6 \text{ d}$
MasterCop (copper sulfate pentahydrate)	1.5 pt	3, 6	$11.2 \pm 2.0$ cde	$24.4 \pm 8.5 \text{ bc}$
Serenade Optimum ( <i>Bacillus subtilis</i> strain QST 713) + Regulaid	1.5  lb + 3  pt	2-6	28.7 ± 8.1 b	-
Untreated	-	-	59.2 ± 4.7 a	71.9 ± 8.6 a

Table 13. \*Efficacy on Fireblight (Erwinia amylovora) on Apple (Malus x domestica) 'Idared', Cox,<br/>NY, 2014.

\* Not an IR-4 Experiment: PDMR Vol. 9:PF023. Not all products tested included in table.

<sup>x</sup> Means followed by the same letter do not differ significantly based on Tukey's HSD (P=0.05).

<sup>y</sup> Treatment timings were: 1 = 20% bloom (13 May); 2 = 50% bloom (14 May); 3 = 80% bloom (15 May); 4 = full bloom (16 May); 5 = during terminal shoot growth (7 Jun); 6 = during terminal shoot growth (12 Jun).

In 2013, Yoder conducted a trial to determine efficacy of various products applied foliar for preventative control of *Erwinia amylovora* on apple (*Malus domestica*). Firewall and Harbour provided excellent suppression of a high cluster infection; Serenade and Regalia also gave significant blossom blight suppression, but Actigard did not (Table 14).

Table 14.	*Efficacy on Fireblight	(Erwinia amylovora)	on Apple	(Malus x domestica)	'Idared',
	Yoder, VA, 2013.				

Treatment	Rate per A c r e	Application T i m i n	Blossom B li g h t (
-----------	------------------------------	--------------------------------------	----------------------------------------

		g y	% ) x
Actigard 50WG (acibenzolar) + Regulaid	0.5 oz + 1 pt	Pk, B1, B2, B 3 , P F , 1 C	58.4 hi
FireWall 17W (streptomycin) + Regulaid	12 oz + 1 pt	B1, B2, B3	25.2 b-d
FireWall 17W (streptomycin) + Regulaid	24 oz + 1 pt	B1, B2, B3	6.0 a
Harbour 17W (streptomycin) + Regulaid	12 oz + 1 pt	B1, B2, B3	20.4 bc
Harbour 17W (streptomycin) + Regulaid	24 oz + 1 pt	B1, B2, B3	15.1 ab
Regalia (Reynoutria sachalinensis extract)	2 qt	B1, B2, B3	53.1 gh
Serenade Optimum ( <i>Bacillus subtilis</i> strain QST 713) + Regulaid	1.5  lb + 1  pt	B1, B2, B3	50.5 f-h
Untreated	-	-	72.3 i

\* Not an IR-4 Experiment: PDMR Vol. 8:PF026. Not all products tested included in table.

<sup>x</sup> Means followed by the same letter do not differ significantly based on Waller-Duncan K-ratio t-test (P=0.05).

<sup>y</sup> Treatment dates: Pk, Apr 11; B1, Apr 18; B2, Apr 23; B3, May 1; PF, May 10; 1C, May 18.

In 2009, Chase conducted an experiment to determine efficacy of several products for preventative control of *Erwinia chrysanthemi* on poinsettia (*Euphorbia pulcherrima*). All treatments were applied as foliar sprays (to drip) on 22, 29 September and 7, 13 October except Taegro which was applied as drench on 22 September. Plants were inoculated with a strain of *Erwinia chrysanthemi* after two foliar applications. Poinsettia plants developed slight to moderate levels of *Erwinia* during the trial. Disease severity was slight to moderate due to the cool temperatures. Least disease occurred on plants treated with Taegro and Rezist + Sett (Table 15). Other treatments were statistically the same as the inoculated control.

Treatment	Rate per 100 Gal	Number of infected leaves per plant 10-20-09	Number of infected leaves per plant 10-28-09
Acibenzolar	0.75 oz	1.8 b	2.2 bc
Citrex	1.5ml per liter	1.0 a	2.1 abc
CuPRO	2 lb	1.4 ab	1.4 abc
HM-0736	14.4 fl oz	1.1 a	1.5 abc
Kasugamycin	45 fl oz	1.2 ab	1.6 abc
ReZist	32 oz	1.4 ab	1.4 abc
ReZist + Sett	16 oz + 32 oz	1.2 ab	1.5 abc
ReZist + Sett	32 oz + 32 oz	1.0 a	1.2 ab
Tanos	12 oz	1.4 ab	1.4 abc
Tanos + CuPRO	8 oz + 2 lb	1.3 ab	1.6 abc

Table 15. Efficacy on Erwinia chrysanthemi on Poinsettia (Euphorbia pulcherrima) 'Prestige' and<br/>'Autumn Red', Chase, CA, 2009.

Taegro - drench	3.5 oz	1.2 ab	1.1 a
Untreated non-inoculated	-	1.1 a	1.2 ab
Untreated inoculated	-	1.6 ab	2.3 c

09-002-Chase-1

#### Comparative Efficacy on Pseudomonas species

All products, including the standard copper compounds, providing very inconsistent performance for *Pseudomonas* spp., ranging from no to good control (Table 16). Most experimental products, including Acibenzolar, Citrex, HM-0736, Kasumin, NAI-4201, Regalia, Taegro and Zerotol, may be promising enough based on their efficacy compared to standards. Tanos mixed with CuPRO generally did not improve performance of CuPRO. See the discussion and data of individual trials for more details.

Product	Chrysan	themum	Hibi	iscus	Impatiens	Oak	Leaf Hyd rang ea	Bolivian	Lavender		Lilac		Japanese
	Norman 2 0	Norman 2 0	Strandberg 2 0	Strandberg 2 0	Norman 2 0 1	Strandberg 2 0	Strandberg 2 0	Chase 2010	Chase 2009	Pscheidt 2	Pscheidt 2	Pscheidt 2	Regan 2009
A14658C		-			-							+/-	
A91800A											-		
Acibenzolar	-	-			++			++	-				-
Aliette											-	++	
Camelot												++	
Cease								1				,	-
CG100	-	-			-			+/-			-	+/-	
Citrex	+	++			-			+/-	-		-		-
CuPRO, Kocide, Nu-Cop	++	++	-	-	+	-	-	. /		++	++		- 3
HM-0/36	-	-	-		+	-		+/-			-	-	
Junction										+			
Kasumin Kasumin	+	++	-		+	-		++	-		++		-
Kasumin + Kocide				+			-					. /	
NAL 4201												+/-	
Dhyton 27		-			+			+/-					
Protect				-			-	±/-	-				
Regalia	+				+			+/-			_	+/-	
Tanos	_		_		1			+/-				17	
Tanos + CuPRO (Tanos + Kocide)	+		-	-		-	-	++	+				_ 3
STBX										+/-			
Taegro	+							+/-	_	.,			_
ZeroTol		+			-							++	

Table 16. General summary of efficacy for *Pseudomonas* spp. on various crops.

26

\* Not an IR-4-sponsored experiment.

<sup>1</sup> Rating Scale: ++ = clearly statistically equivalent or better than untreated non-inoculated and/or clearly statistically different than untreated inoculated; += statistically different from untreated inoculated and untreated non-inoculated; +/- statistically equivalent to both untreated inoculated and untreated non-inoculated; -= statistically equivalent to untreated inoculated.

<sup>2</sup> Where more than one rate or application type for a product was included in the experiment and each performed statistically different, the better rating is provided in this table.

<sup>3</sup>No disease observed in these treatments, but high variability in untreated non-inoculated so statistically equivalent to control.

In 2010 and 2012, Norman examined the efficacy of various products for preventative control of *Pseudomonas chicorii* (strain P329) on chrysanthemum (*Chrysanthemum/Dendrathema* sp). In 2010, treatments were applied as foliar sprays (to runoff) or drenches on 17 and/or 24 and 31 May; disease inoculation occurred on 29 May. Treatments that significantly decreased the number of leaf spots as compared to the disease control treatment included: ZeroTol, Citrex, Kasumin and the standard CuPro (Table 17). Note that ZeroTol was applied 24 hours after plants were inoculated and unbagged. Some control was observed with the Acibenzolar treatments, HM-07361, and NAI-4201, however not significant at the P = 0.05 level. No phytotoxicicty was observed in any of the treatments. In 2012, all treatments were applied at various times as foliar sprays except Insimmo and NAI-4201 applied as drench from 10 to 31 May; disease inoculation occurred on 29 May. The number of leaves with characteristic black lesions were counted on 6 June. Treatments that significantly decreased the number of leaf spots included: ZeroTol, Citrex, Kasumin and the standard CuPro (Table 17). Insimmo treatments, HM-07361 and NAI-4201 decreased number of lesions, however not significantly at the P = 0.05 level. No phytotoxicicty was observed in any of the treatments of lesions, however not significantly at the P = 0.05 level. No phytotoxicicty was observed in any of the treatment of lesions.

Table 17.	Efficacy on Pseudomonas	<i>chickorii</i> on	Chrysanthemum	(Chrysanthemum/	Dendrathema
	sp), Norman, 2010.				

Treatment	Rate per 100 Gal	Application Dates	No. Leaves With Lesions <sup>x</sup> 6-4-10
Acibenzolar	0.75 oz	May 13, 20, 27	15.9 ef
CG100	0.3 %	May 20, 27	23.1 g
Citrex	150 ml/L	May 13, 20, 27	8.3 c
CuPRO	2 lb	May 20, 27	2.8 ab
HM-0736	14.4 floz	May 13, 20, 27	13.9 de
Kasumin	45 floz	May 20, 27	3.4 b
Protect	2 lb	May 20, 27	5.2 bc
Regalia	1 %	May 20, 27	5.7 bc
Tanos	12 oz	May 20, 27	18.8 f
Tanos + CuPro	8 oz + 2lb	May 20, 27	3.7 b
Taegro	3.5 oz	May 20, 27	12.7 d
Untreated non-inoculated	-	-	0.0 a
Untreated inoculated	-	-	16.7 ef

10-008-Norman-1

<sup>x</sup> Means followed by same letter do not differ significantly based on Fisher's Protected LSD) (P=.05).

Treatment	Rate per 100 Gal	Application Dates	No. of Lesions <sup>x</sup> 6/6/12
A14658C	4 pt	May 24, 31	15.2 cd
Insimmo drench	0.25 oz	May 10	13.9 bc
Insimmo spray	0.50 oz	May 17, 24, 31	14.9 cd
Insimmo spray	0.75 oz	May 17, 24, 31	12.7 bc
CG100	38.4 fl oz	May 24, 31	20 e
Citrex	150 ml/100 L	May 17, 24, 31	2.2 a
CuPro TNO	2 lb	May 24, 31	1.6 a
HM-0736	14.4 fl oz	May 17, 24, 31	14 bc
Kasumin	64 floz	May 24, 31	3 a
NAI-4201 drench	5 fl oz	May 17, 31	12.9 bc
Regalia	1% v:v	May 24, 31	17.7 de
ZeroTol	128 fl oz	May 31	10.4 b
Untreated non-inoculated	-	-	0 a
Untreated inoculated	-	-	16.1 cd

Table 18. Efficacy on *Pseudomonas chicorii* on Chrysanthemum (*Chrysanthemum*/ *Dendrathema* sp) 'Shasta Improved', Norman, 2012.

11-006-Norman

<sup>x</sup> Means followed by same letter do not differ significantly based on Fisher's Protected LSD) (P=.05).

In 2006 and 2007, Strandberg examined efficacy of several products for control of *Pseudomonas chicorii* on hibiscus (*Hibiscus rosa-sinensis*) and oak leaf hydrangea (*Hydrangea quercifolia*). All treatments were applied as foliar sprays at 14-day intervals during May through early November in a 2006 trial and at 7-day intervals during June through September in the 2007 experiment. In the 2006 experiment, Actinovate + Tricon was the only treatment that consistently suppressed *P. chicorii* on both plants, but the levels of disease were not always significantly different than the controls or from other treatments (Table 19 and Table 21). In 2007, Kasumin + Kocide and Tricon alternated with Phyton significantly reduced a slight to moderate *P. chicorii* severity (AUDPC) on hibiscus; other treatments somewhat reduced disease though not significantly (Table 20). On oak leaf hydrangea, no treatment significantly reduced a moderate to severe *P. chicorii* severity (Table 22). No phytotoxicity was found on any treatment in both trials.

Table 19.	Efficacy on Pseudomonas chicorii on Hibiscus (Hibiscus rosa-sinensis), Strandberg, FL,
	2006.

Treatment	Rate per 1 0 0 G a 1	AUDPC <sup>1</sup> Per cent LA D	Last <sup>2</sup> Percent LA D	AUDPC <sup>3</sup> Perc ent Infe cted	Last <sup>4</sup> % leaves Infe cted
Actinovate + Tric on	12 oz + 0.4 %	64.8 a	1.4	24.1	50.0
BioPhos + Chel ated copp er	2 % + 0.2 lb a i	141.1 bc	2.5	25.9	67.5

Cease + Kocide 2000 + Vital	1 % + 3 lb + 8 p t	93.2 ab	2.6	21.1	52.5
HM-0736	58 fl oz	110.2 bc	2.0	23.4	52.5
Kasumin	64 fl oz	155.2 c	2.0	25.2	55.0
Kocide 2000	3.5 lb	112.0 bc	2.7	25.2	57.5
K-Phite	5 qt	126.7 bc	1.6	24.4	50.0
Tanos 50% WG + Koci de 2000	16 oz + 3 lb	145.7 c	2.3	27.7	70.0
Untreated	-	132.4 b	2.0	28.0	57.5

00-000-Strandberg-2

Means followed by the same letter do not differ significantly based on Student-Newman-Keuls Test (P = 0.05).

<sup>1</sup> Calculated mean area under the disease progress curves in arbitrary units for percent leaf area damaged (LAD).

<sup>2</sup> Percent LAD on last sampling day.

<sup>3</sup> Calculated mean area under the disease progress curves in arbitrary units for percent of leaves infected.

<sup>4</sup> Percent of leaves infected on last sampling day.

Table 20. Efficacy on Pseudomonas chicorii on Hibiscus (Hibiscus rosa-sinensis), Strandberg, FL,<br/>2007.

Treatment	Rate per 1 0 0 G a 1	AUDPC <sup>1</sup> Per cent LA D	Last <sup>2</sup> Percent LA D	AUDPC <sup>3</sup> Perc ent Infe cted	Last <sup>4</sup> % leaves Infe cted
BioPhos + Chel ated copp er	2 % + 0.1 lb a i	31.84 ab	0.38	20.40 ab	0.12
Kasumin + Koci de 3000	64 fl oz + 2 l b	6.02 a	0.20	22.68 ab	0.07
Kocide 3000	2 lb	22.34 ab	0.35	28.54 ab	0.08
K-Phite + Tricon	2 qt + 0.4 %	29.98 a	0.75	19.37 ab	0.12
Phyton 27	25 oz	18.72 ab	0.93	35.73 ab	0.15
Tanos + Kocide 3000	8 oz + 2 lb	30.94 ab	0.67	40.55 ab	0.10
Tricon	0.8 %	14.06 ab	0.37	28.08 ab	0.10
Tricon alt. Phyt on	0.8 % + 25 o z	33.02 ab	0.25	14.91 a	0.05
Untreated	-	39.62 b	1.07	40.13 b	0.20

07-022-Strandberg-1

Means followed by the same letter do not differ significantly based on Student-Newman-Keuls Test (P = 0.05.

<sup>1</sup> Calculated mean area under the disease progress curves in arbitrary units for percent leaf area damaged (LAD).

<sup>2</sup> Percent LAD on last sampling day.

<sup>3</sup> Calculated mean area under the disease progress curves in arbitrary units for percent of leaves infected.

<sup>4</sup> Percent of leaves infected on last sampling day.

Treatment	Rate per 100 Ga l	AUDPC <sup>1</sup> Per cen t LA D	Last <sup>2</sup> Percent LA D	AUDPC <sup>3</sup> Per cent Infe cted	Last <sup>4</sup> % leaves Infe cted
Actinovate + Tric	12 oz + 0.4 %	346.6 a	2.20	66.7 a	77.5
BioPhos + Chel ated cop per	2 % by volume 0.2 lb ai	499.4 b	3.50	75.0 ab	85.0
Cease + Kocide 200 0 + Vita 1	1 % + 3 lb + 8 pt	641.2 bc	5.90	79.3 ab	95.0
HM-0736	58 fl oz	657.7 bc	5.10	80.2 b	87.5
Kasumin	64 fl oz	612.1 bc	5.30	81.63 b	90.0
Kocide 2000	3.5 lb	541.9 bc	5.30	75.3 ab	87.5
K-Phite	5 qt	653.7 bc	2.90	78.6 ab	87.5
Tanos + Kocide 200 0	16 oz + 3 lb	676.8 bc	5.70	79.0 ab	92.5
Untreated	-	707.4 c	4.20	80.7 b	97.5

Table 21.	Efficacy on Pseudomonas chickorii and an unknown Xanthomonas spp. on Oak Leaf
	Hydrangea (Hydrangea quercifolia), Strandberg, FL, 2006.

00-000-Strandberg-3

Means followed by the same letter do not differ significantly based on Student-Newman-Keuls Test (P = 0.05.

<sup>1</sup> Calculated mean area under the disease progress curves in arbitrary units for percent leaf area damaged (LAD).

<sup>2</sup> Percent LAD on last sampling day.

<sup>3</sup> Calculated mean area under the disease progress curves in arbitrary units for percent of leaves infected.

<sup>4</sup> Percent of leaves infected on last sampling day.

Table 22.	Efficacy on Pseudomonas chicorii and an unknown Xanthomonas spp. on Oak Leaf
	Hydrangea (Hydrangea quercifolia), Strandberg, FL, 2007.

Treatment	Rate per 1 0 0	AUDPC <sup>1</sup> Per cent	Last <sup>2</sup> Percent LA D	AUDPC <sup>3</sup> Perc ent	Last <sup>4</sup> % leaves Infe cted
-----------	-------------------------	-----------------------------------	--------------------------------------	-----------------------------------	-----------------------------------------------

	G	LA		Infe	
	a	D		cted	
	1				
BioPhos +					
Chel	2 % + 0.1 lb				
ated	a	218.05	3.38	179.04	63.3
copp	i				
er					
Kasumin +	$64 \text{ fl} \text{ oz} \pm 2$				
Koci	$04 \text{ II } 02 \pm 2$	225.28	2 78	168.92	55.0
de	h l	225.20	2.70	100.72	55.0
3000	0				
Kocide 3000	2 lb	228.06	2.83	204.69	50.0
K-Phite + Tricon	2 qts + 0.4 %	255.55	3.59	194.21	56.7
Phyton	25 oz	257.83	3.22	222.31	55.0
Tanos + Kocide 3000	8 oz + 2 lb	210.67	2.71	168.38	53.8
Tricon	0.8 %	196.76	1.72	188.79	46.7
Tricon alt.					
Phyt	0.8 % +25 oz	244.89	3.55	250.35	61.7
on					
Untreated	-	231.78	3.37	239.91	58.3

07-022-Strandberg-2

Means followed by the same letter do not differ significantly based on Student-Newman-Keuls Test (P = 0.05.

<sup>1</sup> Calculated mean area under the disease progress curves in arbitrary units for percent leaf area damaged (LAD). <sup>2</sup> Percent LAD on last sampling day.

<sup>3</sup> Calculated mean area under the disease progress curves in arbitrary units for percent of leaves infected.

<sup>4</sup> Percent of leaves infected on last sampling day.

In 2009, Chase examined impact of several products for preventative control of *Pseudomonas sp.* on lavender (*Lavandula heterophylla*). Treatments were applied as weekly foliar spray (to drip) on 26 January and 2, 9, 16 February, or drench on 26 January and 9 February. Rooted cuttings developed leaf blight before inoculation and no inoculation was performed. Tanos + Kocide was the only treatment that significantly reduced number of infected leaves (Table 23). Most products failed to give any prevention of Pseudomonas leaf blight in this trial. The fact that the plants were asymptomatic when the experiments started but clearly were infected dramatically affected the results. Acibenzolar, Citrex and Kasumin caused significant loss of top grade (poorer quality) due to phytotoxicity compared to all other treatments. These products also caused significantly reduced plant height.

Table 23.	Efficacy on Pseudomonas Leaf Spot (Pseudomonas sp.) on Lavender (Lavandula
	heterophylla), 'Patriot Bright Red', Chase, CA, 2009.

Treatment	Rate per 100	No. Infected	No Infected	Top Grade	Height (cm)
	G	Lea	Lea	2-24-09	2-24-09
	al	ves	ves		
		2-10-09	2-23-09		
Acibenzolar	0.75 oz	4.7 a	3.9 b	3.7 c	13.7 b
Citrex + Latron B 1956	1.5 ml/L + 4 oz	3.8 a	3.3 b	3.2 b	10.1 a
Kasumin	45 fl oz	13.6 b	20.3 c	2.5 a	9.6 a

Phyton 27	50 oz	3.8 a	3.2 b	3.8 d	14.2 bc
Regalia SC + Nu- Film P	1% + 0.02%	2.1 a	2.4 b	4.0 d	15.2 bcd
SP-2015	12 oz	2.8 a	3.5 b	4.0 d	14.3 bc
Taegro - Drench	3.5 oz	2.0 a	1.7 b	4.0 d	16.6 d
Tanos + Kocide 3000	8 oz + 32 oz	1.9 a	1.3 a	4.0 d	15.4 cd
Untreated noninoc ulated	-	2.6 a	1.9 b	3.9 d	16.0 d
Untreated inoculated	-	2.4 a	2.3 b	4.0 d	15.7 cd

In 2010, Chase examined impact of several products for preventative control of *Pseudomonas* sp. on Bolivian jasmine (*Mandevilla boliviensis*). All treatments were applied as weekly foliar sprays except Acibenzolar and NAI-4201 applied as drench, with 28- and 14-day intervals, respectively. Also, Taegro was applied as alternate spray/drench every 14 days. Initial treatments were applied on 29 March, with additional applications occurring on 5, 12, 19, 26 April, and 3 May. Plants were inoculated on 17 April. Kasumin was the best treatment, providing excellent control of Pseudomonas leaf spot (Table 24). Acibenzolar as a drench or spray, HM-0736, NAI-4201, Phyton 27 and Tanos + CuPRO significantly reduced number of leaf spots; CG100, Citrex, Protect, Regalia, Tanos alone and Taegro did not give significant control. There were a few treatments that resulted in a very high level of prevention of vine infection including: Kasumin, Phyton 27 and Tanos + CuPRO; Acibenzolar foliar, CG100, Citrex, Protect and Regalia also significantly reduced vine infection. Protect and Tanos + CuPRO showed significantly more residue than the water treated controls. Kasumin significantly reduced vine length.

#### Table 24. Efficacy on Pseudomonas Leafspot (Pseudomonas sp.) on Bolivian Jasmine (Mandevilla boliviensis) 'Alice DuPont', Chase, CA, 2010.

			Vine Length	Disease S e v		Vine Length	No Spots	No. Spots
Treatment	Rate per 100 Gal	Residue 4-15-10	c m	e r	Residue <sup>z</sup> 5-7-10	(c m) 5 12 10		
			4-22-10	y y		5-12-10	5-12-10	5-12-10
	1	1 6 1	15.4	5-7-10	2.1	44.01	12.2.1	2.5
Acıbenzolar – foliar	l oz	1.6 ab	15.4 a	1.8 bc	2.1 a	44.9 b	13.3 ab	2.5 a
Acıbenzolar – drench	0.25 oz	1.5 ab	19.6 a	2.0 bcd	2.0 a	49.2 b	12.5 ab	5.8 ab
CG100	0.3 %	2.2 c	19.0 a	2.2 bcd	2.0 a	46.7 b	22.1 bc	2.1 a
Citrex	150 ml/100 L	1.7 abc	20.2 a	2.0 bcd	2.0 a	50.7 b	20.4 bc	2.9 a
HM-0736	14.4 fl oz	2.0 bc	19.0 a	1.7 b	2.1 a	46.8 b	15.0 ab	6.2 ab
Kasumin	45 fl oz	1.6 ab	14.7 a	1.0 a	2.1 a	16.3 a	1.2 a	0.1 a
NAI-4201 – drench	5 fl oz	1.4 ab	18.2 a	2.0 bcd	2.2 a	50.0 b	13.7 ab	5.8 ab
Phyton 27	25 oz	1.7 abc	19.3 a	2.6 d	2.0 a	50.9 b	13.3 ab	0.4 a
Protect	1.5 lb	4.5 e	17.2 a	2.1 bcd	4.1 c	45.7 b	19.6 bc	1.2 a
Regalia	1 %	1.6 ab	20.3 a	1.6 b	2.0 a	45.1 b	18.7 bc	2.9 a
Tanos	12 oz	1.7 abc	20.8 a	2.0 bcd	2.1 a	45.8 b	20.8 bc	4.2 ab
Tanos + CuPRO	8 oz + 2 lb	3.5 d	18.9 a	1.0 a	3.0 b	51.6 b	9.6 ab	0.4 a
Taegro	3.5 oz spra y/dre nch alt.	2.2 c	19.6 a	2.2 bcd	2.1 a	45.8 b	23.5 bc	4.6 ab
Untreated non- inoculated	-	1.3 a	20.4 a	1.0 a	2.0 a	54.1 b	0.0 a	0.0 a
Untreated inoculated	-	1.6 ab	25.0 a	2.4 cd	2.0 a	61.7 b	32.1 c	10.4 b

<sup>y</sup> Scale: 1-5 where 1 – no spots, 2 – slight, 3 – moderate, 4 – severe to 5 – plant dead.
<sup>z</sup> Scale: 1-5 where 1 – no spots, 2 – slight, 3 – moderate, 4 – severe to 5 – plant completely covered in residue.

In 2011, Norman examined the efficacy of various products for preventative control of *Pseudomonas syringiae* pv. *hibiscus* (strain X1720) on hibiscus (Table 25). Treatments were applied as foliar sprays (to runoff) or drench; disease inoculation occurred on 19 September. Number of leafspots per plant were counted on 4 October. Because of high variability within treatments, no significant differences in number of leafspots were obtained except with NAI-4201 which appeared to enhance disease development. Eight treatments had substantially less lesion development than the disease control and they included Acibenzolar (spray), CG100, Citrex, Kasumin, Regalia, Protect, CuPro, and EarthTec at the highest rate. No phytotoxicity was found on any treatment except the high rate of EarthTec (chlorosis and leaf drop) and Acibenzolar drench (lighter green plants).

Treatment	Rate per 100 Gal	Application Metho d	Application Date( s)	No. of Leafspots <sup>x</sup> 10-4-11
Acibenzolar	0.75 oz	Foliar	9/8,9/15,9/22,9/29	1.0 a
Acibenzolar	0.25 oz	Drench	8/30	3.7 a
CG100	0.3 %	Foliar	9/22,9/29	0.8 a
Citrex	150 ml/100 L	Foliar	9/8,9/15,9/22,9/29	1.2 a
CuPRO TNO	2 lb	Foliar	9/22,9/29	0.3 a
EarthTec	1.5 fl oz	Foliar	9/22,9/29	3.1 a
EarthTec	8 fl oz	Foliar	9/22,9/29	0.0 a
HMO-0736	14.4 fl oz	Foliar	9/8,9/15,9/22,9/29	4.6 a
Kasumin	45 fl oz	Foliar	9/22,9/29	0.0 a
NAI-420	5 fl oz	Drench	8/30,9/6,9/20	15.7 b
Protect	2 lb	Foliar	9/22,9/29	0.0 a
Regalia	1 % v:v	Foliar	9/22,9/29	1.2 a
ZeroTol	128 fl oz	Foliar	9/22,9/29	4.0 a
Untreated non- inoculate d	-	-	-	0.0 a
Untreated inoculated	-	-	-	3.6 a

 Table 25. Efficacy on Pseudomonas Leafspot (Pseudomonas syringiae pv. hibiscus) on Hibiscus (Hibiscus sp) 'Double Red', Norman, 2011.

<sup>x</sup> Means followed by same letter do not differ significantly based on Fisher's Protected LSD (P=.05).

In 2012, Norman examined the efficacy of various products for preventative control of *Pseudomonas syringae* on impatiens. Treatments were applied as foliar sprays (to runoff) or drenches; disease inoculation occurred on 29 May. Number of leafspots per plant were counted on 6 June. Acibenzolar provided the most effective control of leaf spots, followed by the standard CuPro, Kasumin, HM-07361, Regalia and NAI-4201 (Table 26). Plants were stunted and chlorotic with the Citrex treatment as well as both spray applications of Actigard. No chlorosis or stunting was observed with the drench application of Actigard. There also appeared to be an abnormally high number of leaf abscission with plants treated with A14658C.

Treatment	Rate per 100 Gal	Application Metho d	Application Date(s )	No. of Leafspots <sup>x</sup> 6-6-12
A14658C	4 pt	Foliar	5/24, 5/31	20.1 g
Acibenzolar	0.5 oz	Foliar	5/17, 5/24, 5/31	1.3 ab
Acibenzolar	0.75 oz	Foliar	5/17, 5/24, 5/31	0.8 ab
Acibenzolar	0.25 oz	Drench	5/10	0.8 ab
Cg100	38.4 fl oz	Foliar	5/24, 5/31	21.8 g
Citrex	1.5 ml/L	Foliar	5/17, 5/24, 5/31	19.7 g
CuPro TNO	2 lb	Foliar	5/24, 5/31	4.2 bc
HM-07361	14.4 fl oz	Foliar	5/17, 5/24, 5/31	7.1 cd
Kasumin	64 fl oz	Drench	5/24, 5/31	5.6 c
NAI-4201	5 fl oz	Drench	5/17, 5/31	11 e
Regalia	1% v:v	Foliar	5/24, 5/31	9.4 de
ZeroTol	128 fl oz	Foliar	5/31	12.2 ef
Untreated non- inoculate d	-	-	-	0 a
Untreated inoculated	-	-	-	14.8 f

Table 26. Efficacy on Pseudomonas Leafspot (Pseudomonas syringae) on Impatiens (Impatiens sp)'Super Elfin XP Violet Improved', Norman, 2012.

<sup>x</sup> Means followed by same letter do not differ significantly based on Fisher's Protected LSD (P=.05).

Pscheidt conducted field trials in 2005, 2011 and 2012 to determine efficacy of several products applied as foliar sprays for preventative control of bacterial blight (Pseudomonas syringae pv syringae) on lilac (Syringa vulgaris) 'Ellen Willmott'. In 2005, treatments were applied on 14 February, and 1, 15, 30 March (from bud swell to early bloom). On 11 April, all bactericide treated bushes had significantly fewer shoots with bacterial blight than nontreated bushes (Table 18). On 28 Apr, only bushes treated with Kocide or Phyton 27 had significantly fewer shoots with bacterial blight than nontreated bushes. There was no significant difference in the number of shoots with bacterial blight on bushes treated with Phyton 27 or STBX-304. In 2011, treatments were applied on 3, 11, 18, 24, and 31 Mar (from bud swell to 6 inch shoot growth). Inoculated nontreated bushes did not have significantly more disease than noninoculated bushes, indicating plenty of natural inoculum (Table 28). Kasumin and Nu-Cop provided the best control, resulting in more vigorous plants. A91800A, Aliette, Citrex, HM-0736, CG100 and Regalia did not significantly reduce disease. In 2012, treatments were applied on 16 Mar (buds swollen), 23 Mar (bud break to half inch growth), 1 Apr (2 to 3 inch growth), 5 Apr (3 inch growth), and 17 Apr (beginning of bloom). Nontreated, non-inoculated bushes were diseased indicating plenty of natural inoculum. Aliette, Camelot and ZeroTol provided the best control; A14658C, CG100, KleenGrow and Regalia were not significantly different from either the inoculated or the non-inoculated bushes (Table 29). In both trials, no phytotoxicity was found on any treatment.
Table 27. \* Efficacy on Bacterial Blight (Pseudomonas syringae pv syringae) on Lilac (Syringa<br/>vulgaris) 'Ellen Willmott', Pscheidt, OR, 2005.

Treatment	Data non 100 Cal	% Infected Shoots <sup>x</sup>				
	Rate per 100 Gai	4-11-05	4-28-05			
Junction DF	3.0 lb	12.8 b	14.3 ab			
Kocide 2000	1.5 lb	14.0 b	4.5 b			
Phyton 27	25 fl oz	7.8 b	10.5 b			
STBX-304	25 fl oz	20.3 b	13.0 ab			
Untreated	-	37.8 a	24.5 a			

\* Not an IR-4 Experiment: F&N Tests Vol 61: OT031.

<sup>x</sup> Means followed by the same letter do not differ significantly based on Fisher's protected LSD (P=0.05).

Table 28.	Efficacy on Bacterial Blight (Pseudomonas syringae pv syringae) on Lilac (Syringa
	vulgaris) 'Ellen Willmott', Pscheidt, OR, 2011.

		Percent Diseased Shoots <sup>x</sup>			Shoots/Bu	Change in	
Treatment	Rate per	4/5/11	4/22/11	5/5/11	4/22/11	5/5/11	
A91800A WG	1 oz	21.0 a	78.3 a	94.3 a	30.0 a	72.3 a	12.0 c
Aliette	12.8 oz	12.3 a	30.0 bcd	70.8 b	6.5 cd	30.0 cd	20.0 bc
CG100	38.4 fl oz	17.0 a	49.0 abc	93.8 a	17.0 a-d	58.8 ab	13.3 c
Citrex	18.2 fl oz	19.3 a	58.3 ab	97.5 a	27.5 ab	74.5 a	9.5 c
HM-0736	14.4 fl oz	13.5 a	56.5 ab	93.8 a	24.3 abc	56.8 abc	11.0 c
Vacumin	45 fl oz	1.8 a	18.3 cd	32.0 c	2.3 d	12.0 d	37.5 a
Kasumm	64 fl oz	4.5 a	8.5 d	21.3 c	1.5 d	6.0 d	33.3 ab
Nu-Cop 50 DF	1 lb	25.5 a	35.8 bcd	31.5 c	8.0 cd	12.3 d	39.5 a
Regalia	1 gal	20.3 a	74.3 a	96.5 a	31.3 a	66.5 ab	4.5 c
Untreated, non-inoculated	-	12.5 a	48.5 abc	86.5 ab	16.5 a-d	47.5 abc	7.0 c
Untreated, inoculated	-	15.5 a	46.5 abc	80.0 ab	11.8 bcd	41.3 bc	9.0 c

<sup>x</sup> Means followed by the same letter do not differ significantly based on Fisher's protected LSD (*P*=0.05).

Table 29. Efficacy on Bacterial Blight (Pseudomonas syringae pv syringae) on Lilac (Syringa<br/>vulgaris) 'Ellen Willmott', Pscheidt, OR, 2012.

	Rate per		Shoots/Bush With $\geq$ 50 %	Change in
		Percent Diseased Shoots <sup>x</sup>	Blighted	] ]
Treatment			Leaves	1

		4/20/12	5/4/12	4/20/12	5/4/12	
A14658C	64 fl oz	63.8 abc	40.6 a	3.0 a	6.4 a	22.4 a
Aliette	12.8 oz	27.8 с	30.2 a	0.0 a	2.8 a	30.5 a
Camelot	2 gal	29.0 c	31.4 a	1.4 a	1.6 a	34.0 a
CG100 (AMV-4024)	38.4 fl oz	54.0 abc	39.6 a	3.6 a	9.0 a	30.5 a
KleenGrow	25 fl oz	62.2 abc	48.0 a	9.8 a	12.4 a	27.4 a
Regalia	1 gal	43.0 abc	36.6 a	2.4 a	8.6 a	27.9 a
ZeroTol	128 fl oz	24.4 c	30.6 a	1.4 a	4.8 a	18.3 a
Untreated, non-inoculated	-	53.0 abc	45.0 a	4.6 a	6.2 a	22.9 a
Untreated, inoculated	-	70.6 a	59.4 a	13.8 a	11.4 a	30.0 a

<sup>x</sup> Means followed by the same letter do not differ significantly based on Fisher's protected LSD (P=0.05).

- In 2008-09, Regan evaluated efficacy of several products for preventative control of a natural infection of *Pseudomonas syringae* on Japanese maple (*Acer palmatum*). All treatments except Taegro were applied as six weekly foliar sprays from 15 October to 19 November 2008; Taegro was applied as spray alternated with drench application every 14 days from 1 October to 10 December 2008. Based on percent plants showing stem cankers, no treatment significantly reduced disease infection (
- Table 30). Overall, the disease infection level was about 28 percent of the trees, which is very similar to the level expected under typical nursery conditions in western Oregon. No phytotoxicity was found on any treatment.

Table 30.	Efficacy on Pseudomonas syringae on Japanese Maple (Acer palmatum) trees, Regan, OR,
	2008-09.

Treatment	Rate per 100 Gal	Percent trees with visible cankers <sup>x</sup> 4-9-09
Acibenzolar	1 oz	8.3 a
Cease	2% solution	16.7 ab
Citrex	150 ml/100 L	50.0 bc
Kasumin	45 fl. oz	33.3 abc
Kocide	2 lb	0.0 a
Protect	2 lb	58.3 c
Tanos	12 oz	50.0 bc
Taegro*	3.5 oz	33.3 abc
Tanos+Kocide	8 oz. + 2 lb	0.0 a
Untreated non-inoculated	-	25.0 abc

<sup>x</sup> Means followed by the same letter do not differ significantly based on Fisher's protected LSD (P=0.05). \* Spray alternated with drench application every 14 days from 10-1-08 to 12-10-08. In 2011, Pscheidt conducted a field trial to determine the efficacy of various products for preventative control of bacterial blight (*Pseudomonas syringae* pv. *syringae*) on Japanese maple (Table 31). Treatments were applied on 1, 7, 16, 21 Apr, 1 and 6 May (from bud break to 10 inch shoot growth), and inoculated on 13 Apr. Unfortunately, no disease developed and plant height change was not significant between treatments (Table 31). Trees treated with either rate of Kasumin developed a washed, light red color more typical of sun bleaching in the summer. These trees clearly stood out from the normal deep burgundy color typical of this cultivar. No phytotoxicity was found on other treatments.

Treatment	Rate per 100 Gal	Change in Plant Ht (cm) <sup>x</sup>
91800A WG	1 oz	9.3 a
Aliette	12.8 oz	15.3 a
CG100	38.4 fl oz	12.0 a
Citrex	18.2 fl oz	3.0 a
HM-0736	14.4 fl oz	9.8 a
Vacumin	45 fl oz	9.0 a
Kasumm	64 fl oz	7.0 a
Nu-Cop 50 DF	1 lb	10.3 a
Regalia	1 gal	1.5 a
Untreated, non-inoculated	-	8.3 a
Untreated, inoculated	-	7.5 a

Table 31.	Efficacy on Bacterial Blight (Pseudomonas syringae pv. syringae) on Japanese Maple
	(Acer palmatum) 'Bloodgood', Pscheidt, OR, 2011.

<sup>x</sup> Means followed by the same letter do not differ significantly (P=0.05).

### Comparative Efficacy on Xanthomonas sp.

The tables below contain a general summary of *Xanthomonas* efficacy. While there were many trials conducted, experimental products were included in very few experiments; hence more trials are needed to make definitive conclusions. Most experimental products, including Acibenzolar, CG100, Citrex, HM-0736, Kasumin, Regalia, Tanos and Taegro, may prove promising based on their efficacy compared to standards. See the discussion and data of individual trials for more details.

				(	Geranium						
	Buck	Norman	Norman	Norman	Norman	Norman	Norman	Chasa	Doddy	Norman	Norman
								Chase	Keuuy		
Product											
Acibonzolar											
Actinovato								++	+		++
Alovin			+/-			1/	-				-
		-	-			+/-					
ASAF Ploomtime					+						
DIOOIIIIIIIE							-				
Divij Camalat							-				
Canleol		+			++	. /					
						+/-					
Collog									+		-
Cease A stin sents	+						-			-	
Cease + Actinovate			-								
Cease + Citrex										-	
Cease + Kocide 2000		-	++								
Cease + KPhite			+								
Cease + Milstop										-	
Cease + Penncozeb			++								
Cease + Phyton 27	+		+								
Cease + Tricon										+	
Cease + Vital				-							
Citrex								+/-	+	+	++
Companion			++				-				
CuPRO										+	++
CuProfix		+			++						
CuProfix MZ					++						
HM-0736				-					+		-
HM-0736 + Kocide 2000				++							
HM-0736 + KPhite				-							
HM-0736 + Penncozeb				-							
HM-0736 + Phyton				++							
Junction		+			++						

## Table 32. General summary of efficacy for Xanthomonas spp. on various crops – Part 1.

				(	Geranium						
	Buck	Norman	Norman	Norman	Norman	Norman	Norman	Chase	Reddy	Norman	Norman
								Chase	Reduy		
Product											
Kasumin			-			-		-	+		-
Kasumin + Kocide 2000			++								
Kocide 2000		+									
Kocide 3000					+						
KPhite				-							
KPhite + Kocide 2000				++							
KPhite + Penncozeb				++							
KPhite + Phyton				++							
Milstop										-	
NAI-4201											-
Omega-Grow Plus						+/-					
Penncozeb		+			++						
Phyton 27	+		+				+	+			
Regalia								-			++
Tanos						-		-	+		-
Tanos + CuPRO		++						++	+		++
Taegro								+/-	+	-	-
Taegro + Milstop										-	
Tricon						-				+	
Vital				++		-					++
Vitalonil											

\* Not an IR-4-sponsored experiment.

<sup>1</sup> Rating Scale: ++ = clearly statistically equivalent or better than untreated non-inoculated and/or clearly statistically different than untreated inoculated; + = statistically different from untreated inoculated and untreated non-inoculated; +/- statistically equivalent to both untreated inoculated and untreated non-inoculated; +/- statistically equivalent to both untreated inoculated and untreated inoculated.

<sup>2</sup> Where more than one rate or application type for a product was included in the experiment and each performed statistically different, the better rating is provided in this table.

<sup>3</sup>Inconclusive data due to extremely low disease incidence

	Ornamental Kale		Japanes	e Plum	Poinsettia	Wax Myrtle		
Bec		er 2008						
Product	'Nagoya	White	Strandberg 200 6	Strandberg 20 07	Norman 2011	Strandberg 200 6	Strandberg 20 07	
Acibenzolar	++	+/-			++			
Aliette	+	+/-						
Cease	+	+/-						
CG100					-			
Champ	+	-						
Citrex	+	-						
CuPro, K o c i d e Dithane, P r o t	+ + +	+	-	-	+	+	-	
t e c t HM-0736					+			
Kasumin	+	+/-	-		-	-		
Kasumin + K o c				_			-	

## Table 33. General summary of efficacy for Xanthomonas spp. on various crops – Part 2.

	i							
	d							
	e							
NAI-4201						-		
Phyton 27					-			-
Regalia						-		
Tanos		+	-					
Tanos +								
	Κ							
	0							
	с	+	-	-	-		-	-
	i							
	d							
	e							
Taegro		+	-					
ZeroTol						-		

<sup>1</sup> Rating Scale: ++ = clearly statistically equivalent or better than untreated non-inoculated and/or clearly statistically different than untreated inoculated; + = statistically different from untreated inoculated and untreated non-inoculated; +/- statistically equivalent to both untreated inoculated and untreated non-inoculated; +/- statistically equivalent to both untreated inoculated and untreated non-inoculated; +/- statistically equivalent to both untreated inoculated and untreated inoculated.

<sup>2</sup>Where more than one rate or application type for a product was included in the experiment and each performed statistically different, the better rating is provided in this table.

<sup>3</sup>Inconclusive data due to extremely low disease incidence

In 2003, Buck evaluated Phyton 27 and Cease AS for preventative control of *Xanthomonas campestris* on geranium (*Pelargonium x hortorum*) 'Patriot Cranberry Red'. Treatments were applied as foliar spray (to drip) two days before and 5 days after inoculation. Both treatments significantly reduced number of lesions per leaf 15 days post-inoculation (Table 34). The combination also reduced infection but the number of lesions was not statistically different from Cease or Phyton 27 applied alone. No phytotoxicity was found on any treatment.

Table 34.	* Efficacy on Bacterial Spot (Xanthomonas campestris) on Geranium (Pelargonium x
	hortotum) 'Patriot Cranberry Red', Buck, GA, 2003.

Treatment	Rate per 100 Gal	No. Lesions per leaf <sup>x</sup>
Phyton-27	25 oz	83.1 a
Cease AS	1.0 gal	79.3 a
Cease + Phyton-27	1.0 gal + 25 oz	83.5 a
Untreated inoculated	-	149.6 b

\* Not an IR-4 Experiment: F&N Tests Vol 60: OT010.

<sup>x</sup> Means followed by the same letter do not differ significantly based on Fisher's Protected LSD (P=0.05).

In 2006, Norman conducted three trials to determine efficacy of new products and product combinationsfor control of Xanthomonas leaf spot (*Xanthomonas* sp.) on geranium (*Pelargonium x hortorum*) 'Patriot Bright Red' (Table 35 through Table 37). All treatments were applied twice as weekly foliar spray (to drip). Plants were inoculated with a culture of *Xanthomonas* sp. 3 days after the first fungicide application. The most effective treatments were products that contained copper hydroxide (Camelot, CuPro/Kocide, Cuprofix, Junction, Phyton 27), copper sulfate, and mancozeb. Biologicals including Actinovate, Companion and Cease, and some of the antibiotics including Firewall, were also effective. HM-0736, Kasumin and K-Phite were not effective. Further research is needed to determine other combinations

and rotations of products that would be effective against bacterial pathogens. Due to the high temperature in Florida during these trials (100°F+), all copper containing products as well as Cease and Companion caused some marginal burning of leaves. This may not have occurred in cooler temperatures.

 Table 35. Efficacy on Xanthomonas leaf spot (Xanthomonas sp.) on Geranium (Pelargonium x hortorum) 'Patriot Bright Red' – Test 1, Norman, FL, 2006a.

Treatment	Rate per 100 Gal	Number of Leaf Spots <sup>x</sup>
Camelot	3 pt	59 bcd
Cuprofix	1.5 lb	77 cd
Cuprofix MZ	8.75 lb	23 ab
Firewall	200 ppm	45 abc
Junction	1.5 lb	52 bc
Kocide 2000	0.75 lb	67 bcd
Penncozeb	1.5 lb	52 bc
Starner	0.75 %	55 bc
Tanos + Kocide 2000	8 oz + 1 lb	45 abc
Untreated non-inoculated	-	0 a
Untreated inoculated	-	154 e

<sup>x</sup> Means followed by same letter do not differ significantly based on Fisher's Protected LSD (P=.05).

Treatment	Rate per 100 Gal	Number of Leaf Spots <sup>x</sup>
Actinovate	12 oz	119 cd
Cease	8 qt	128 de
Cease + Actinovate	8 qt + 12 oz	117 bcd
Cease + Kocide	8 qt + 2 lb	41 a
Cease + KPhite	8qt + 2qt	157 de
Cease + Penncozeb	8qt + 1.5 lb	34 a
Cease + Phyton 27	8 qt + 50 oz	53 ab
Companion	2 %	47 a
Kasumin	2 qt	189 ef
Kasumin+ Kocide 2000	2 qt + 2 lb	56 abc
Phyton 27	50 oz	42 a
Untreated non-inoculated	-	0 a
Untreated inoculated	-	230 f

Table 36.	Efficacy on Xanthomonas leaf spot (Xanthomonas sp.) on Geranium (Pelargonium x
	hortorum) 'Patriot Bright Red' – Test 2, Norman, FL, 2006b.

<sup>x</sup> Means followed by same letter do not differ significantly based on Fisher's Protected LSD (P=.05).

Table 37.	Efficacy on Xanthomonas leaf spot (Xanthomonas sp.) on Geranium (Pelargonium x
	hortorum) 'Patriot Bright Red' – Test 3, Norman, FL, 2006c.

Treatment	Rate per 100 Gal	Number of Leaf Spots <sup>x</sup>
HM-0736	58 oz	234 d
HM-0736 + Kocide	58 fl oz + 2 lb	29 a
HM-0736 + K-Phite	58 fl oz + 2 qt	163 c
HM-0736 + Penncozeb	58 fl oz + 1.5 lb	137 c
HM-0736 + Phyton	58 fl oz + 50 oz	44 a
K-Phite	2 qt	157 c
K-Phite + Kocide	2 qt + 2 lb	26 a
K-phite + Penncozeb	2 qt + 1.5 lb	46 a
K-Phyte + Phyton	2 qt + 50 oz	53 ab
Vital	2 qt	26 a
Vital + Cease	2 qt + 8 qt	114 c
Untreated non-inoculated	-	0 a
Untreated inoculated	-	120 c

<sup>x</sup> Means followed by same letter do not differ significantly based on Fisher's Protected LSD (P=.05).

In 2007, Norman conducted three additional tests on geranium (Table 38 through Table 40). Results confirmed data obtained in 2006 that showed the most effective treatments were products that contained copper hydroxide, copper sulfate, and mancozeb, including Camelot, Cuprofix, Junction, Kocide, Phyton 27 and Penncozeb, However the biologicals tested in 2007, including Actinovate, BloomTime, Companion and Cease, were not effective. Also other products like Alexin, Canker Kill, Kasumin, Milsana, Omega-Grow Plus, Tanos, Tricon, and Vital were not effective. Due to the high temperature in Florida during these trials (100°F+), all copper containing products as well as Cease and Companion caused some marginal burning of leaves. This may not have occurred in cooler temperatures.

Table 38. Efficacy on Xanthomonas leaf spot (Xanthomonas sp.) on Geranium (Pelargonium x<br/>hortorum) 'Patriot Bright Red' – Test 1, Norman, FL, 2007a.

Treatment	Rate per 100 Gal	Number of Leaf Spots <sup>x</sup>
ASAP	5 ppm	3.9 ab
ASAP	10 ppm	9.2 b
ASAP	30 ppm	4.2 ab
Camelot	3 pt	4.2 ab
Cuprofix	1.5 lb	0.8 a
Cuprofix MZ	8.75 lb	1.7 ab
Junction	1.5 lb	0.4 a
Kocide 3000	0.75 lb	4.9 ab
Penncozeb	1.5 lb	0 a
Untreated non-inoculated	-	0 a
Untreated inoculated	-	19 c

<sup>x</sup> Means followed by same letter do not differ significantly based on Fisher's Protected LSD (P=.05).

Table 39.	Efficacy on Xanthomonas leaf spot (Xanthomonas sp.) on Geranium (Pelargonium x
	hortorum) 'Patriot Bright Red' – Test 2, Norman, FL, 2007b.

Treatment	Rate per 100 Gal	Number of Leaf Spots <sup>x</sup>
Alexin	50 ml	24 abc
Canker Kill	1.5 lb	26 abcd
Kasumin	1.5 qt	27 bcd
K-Phite	2 qt	94 f
Omega-Grow Plus	2 %	21 abc
Tanos	8 oz	52 de
Tricon	0.8 %	73 ef
Vital	2 qt	32 bcd
Untreated non-inoculated	-	0 a
Untreated inoculated	-	41 cd

<sup>x</sup> Means followed by same letter do not differ significantly based on Fisher's Protected LSD (P=.05).

 Table 40. Efficacy on Xanthomonas leaf spot (Xanthomonas sp.) on Geranium (Pelargonium x hortorum) 'Patriot Bright Red' – Test 3, Norman, FL, 2007d.

Treatment	Rate per 100 Gal	Number of Leaf Spots <sup>x</sup>
Actinovate	12 oz	173 d
BloomTime	10.5 oz	140 cd
BMJ	100 g	173 d
Cease	0.5 %	91 bc
Componion	0.5 %	99 c
Companion	1 %	107 cd
Milsana	1 %	145 cd
Phyton 27	50 oz	23 ab
Untreated non-inoculated	-	0 a
Untreated inoculated	-	130 cd

<sup>x</sup> Means followed by same letter do not differ significantly based on Fisher's Protected LSD (P=.05).

In 2009, Norman continued evaluation of products for preventative control of *Xanthomonas campestris* on geranium. In the first trial, CuPRO, Cease at the low rate, Tricon, Citrex, Cease + Citrex, and Cease + Tricon significantly reduced number of Xanthomonas leaf spots (Table 41), though not as low as non-inoculated Control. Milstop, Taegro and Milstop + Taegro provided no control. In the second trial, Acibenzolar, Citrex, CuPro, Regalia and Vitalonil were effective in controlling Xanthomonas (Table 42). Actinovate, CG100, HM-0736, Kasumin, NAI-420, SP-2015 and Taegro provided no control. Cease, Tricon and Vitalonil caused some leaf burn that was probably related to very warm temperatures in the greenhouse (100°F+). Leaf burn in these cases may not have occurred under cooler weather conditions.

Treatment	Rate per 100 Gal	Number of Leaf Spots <sup>x</sup>
Cassa	1 %	165 def
Cease	2 %	201 fg
Cease + Citrex	1 % + 1.2 ml/L	158 de
Cease + Milstop	1 % + 1.25 lb	218 gh
Cease + Tricon	1 % + 2 %	64 b
Citrex	1.2 ml/L	151 d
CuPRO	0.75 lb	103 c
Milstop	1.25 lb	246 h
Taegro	3.5 oz	180 defg
Taegro + Milstop	3.5 oz + 1.25 lb	193 efg
Tricon	2 %	75 bc
Untreated non-inoculated	-	0 a
Untreated inoculated	-	217 gh

## Table 41. Efficacy on Xanthomonas leaf spot (Xanthomonas campestris) on Geranium (Pelargonium x hortorum) 'Patriot Bright Red', Norman, FL, 2009.

<sup>x</sup> Means followed by same letter do not differ significantly based on Fisher's Protected LSD (P=.05).

Table 42. Efficacy on Xanthomonas leaf spot (Xanthomonas campestris) on Geranium<br/>(Pelargonium x hortorum) 'Patriot Bright Red', Norman, FL, 2009.

Treatment	Rate per 100 Gal	Number of Leaf Spots <sup>x</sup>
Acibenzolar	0.01875 oz	34.7 abc
Actinovate	12 oz	86.2 cde
CG100	0.8 %	97.7 de
Citrex	150 ml/L	8.1 a
CuPRO	2 lb	10.7 a
HM-0736	14.4 fl oz	125.2 e
Kasumin	45 fl oz	85.4 cde
NAI-4201	5 fl oz	69.7 bcd
Regalia SC	1 %	12.3 a
Tanos	12 oz	133.3 e
Tanos + CuPRO	8 oz + 2 lb	8.8 a
Taegro	3.5 oz	116.9 de
Vitalonil	5 pt	22.3 ab
Untreated non-inoculated	-	0 a
Untreated inoculated	-	97.4 de

<sup>x</sup> Means followed by same letter do not differ significantly based on Fisher's Protected LSD (P=.05).

In 2008, Chase evaluated several new biopesticide products and mixtures with the potential for suppression and control of Xanthomonas leaf spot (*Xanthomonas* sp.) on geranium (*Pelargonium x hortorum*) 'Patriot Bright Red' (Table 43). All treatments were applied as a foliar spray to drip on 3, 10 and 17 November, except Taegro which was applied as drench on 3 and 17 November, alternated with a spray on 10 November. Based on number of spots three weeks after inoculation (12-1-08), acibenzolar and Tanos + Kocide were the only treatments that significantly reduced Xanthomonas infection. Phyton, Citrex and MOI-106 were also somewhat effective. The products performing poorly in this trial included Kasumin, SP-2015 and Taegro. Final plant height and top grade were significantly reduced by the presence of Xanthomonas and also by direct phytotoxicity of acibenzolar. The only plants that appeared close to the noninoculated controls in top grade were those receiving the combination of Tanos and Kocide.

		Height		No.	No. spots	Height	Тор
Treatment	Rate per 100 G al	11-20-08	Top grade <sup>z</sup> ] - 2 ( - ( 8	11-25-08		12-1-08	12-1-08
Acibenzolar	0.75 oz	10.0 a	2.9 a	0.0 a	0.0 a	9.9 a	2.3 a
Citrex + Latron B	1.5 ml/L + 4 oz	10.4 a	3.2 ab	19.0 a	50.0 ab	11.3 abc	2.5 ab
Kasumin	45 oz	9.8 a	3.1 ab	42.0 a	156.5 bc	11.0 abc	2.5 ab
Phyton 27	50 oz	11.2 a	3.5 b	13.9 a	37.0 ab	12.5 bc	2.7 b
Regalia SC + Nu-Film P	1% + 0.02 %	11.1 a	3.5 ab	34.2 a	84.5 abc	11.9 abc	2.6 ab
Tanos	12 oz	9.8 a	3.1 ab	42.5 a	174.0 c	10.5 ab	2.4 ab
Taegro drench alt. spray	3.5 oz	10.7 a	3.4 ab	81.5 b	115.0 abc	11.3 abc	2.5 ab
Tanos + Kocide 3000	8 oz + 32 oz	11.0 a	3.3 ab	8.6 a	16.0 a	12.3 abc	3.2 c
Untreated non-inoculated	-	10.9 a	3.5 ab	0.0 a	0.0 a	13.1 c	3.7 d
Untreated inoculated	-	11.1 a	3.4 ab	25.1 a	154.5 bc	11.8 abc	2.7 b

# Table 43. Efficacy on Xanthomonas leaf spot (Xanthomonas sp.) on Geranium (Pelargonium x hortorum) 'Patriot Bright Red', Chase, CA, 2008.

<sup>z</sup> Top grade was recorded using the following scale: 1 - plant dead, unsaleable, 2 - poor, unsaleable, 3 - moderate, saleable, 4 - good, saleable to 5 - excellent, saleable.

In 2009, Reddy evaluated the efficacy of various products for control of *Xanthomonas campestris* pv. *pelargonii* on geranium (*Pelargonium sp.*). All treatments were applied as weekly foliar spray (to drip) starting 4 days after inoculation and every week after this. The experiment lasted 7 weeks. All products significantly reduced disease severity (Table 44). No phytotoxicity was found on any treatment.

Treatment	Rate per 100 Gal	Disease Severity <sup>x, y</sup>
Acibenzolar	1.25 oz	2.8 *
CG100	0.8 %	3.6 *
Citrex	150 ml/100 L	4.5 *
HM-0736	14.4 fl oz	5.3 *
Kasumin	45 fl oz	4.9 *
Tanos	12 oz	6.1 *
Tanos + CuPRO	8 oz + 2 lb	1.8 *
Taegro	3.5 oz	5.6 *
Untreated non-inoculated	-	0.4 *
Untreated inoculated		9.6 b

Table 44. Efficacy on Xanthomonas campestris pv. pelargonii on geranium (Pelargonium sp.),<br/>Reddy, AL, 2009.

<sup>x</sup> All treatment means differed significantly from untreated inoculated control based on a LSD (P=.05).

<sup>y</sup> Mean number of lesions per plant 7 weeks after transplant.

In 2008, Becker evaluated several products for preventative control of *Xanthomonas campestris* pv *campestris* on two cultivars of ornamental kale (*Brassica oleracea*) 'Nagoya Rose' and 'White Crane'. Treatments were applied as weekly foliar spray (to drip) on 3 March to 28 April. Plants were inoculated on 4 and 17 March. Kocide was the only treatment that significantly reduced disease severity on 'White Crane' while all treatments provided significant disease reduction on 'Nagoya Rose' (Table 45). Acibenzolar was the only treatment that caused slight chlorosis and necrosis on 'White Crane'. On 'Nagoya Rose', Acibenzolar, Citrex, Aliette and Dithane caused slight chlorosis.

		% foliar severity <sup>x y</sup>					
Treatment	Rate per 100		'Nagoya Ros	se'	'White Crane'		
	Gal	3-18-09	4-28-09	5-15-09	3-18-09	4-28-09	5-15-09
Acibenzolar	0.75 oz	1.67 ab	5.25 ab	0.2 d	3 a	5.9 abc	7.05 abc
Aliatta	6.4 oz	5 a	2.6 ab	1.15 bcd	2.92 a	4.3 abc	9 abc
Allette	12.8 oz	2.5 ab	4.8 ab	1.7 bcd	5 a	4.95 abc	11.8 ab
Corre	1 %	2.71 ab	2.6 ab	3.95 b	3.75 a	5 abc	8.6 abc
Cease	2 %	4.17 a	1.95 ab	3.4 bc	4.75 a	6.1 abc	12.9 ab
Champ	21 fl oz	1.67 ab	8.15 a	2.65 bcd	3.75 a	9.1 a	11.85 ab
Citrex	5 fl oz	4.17 a	3.3 ab	2.85 bcd	4.25 a	9.25 a	13.5 ab
Dithane	16 oz	3.96 a	4.6 ab	3 bcd	4.5 a	9.25 a	12.15 ab
Kasumin	45 fl oz	3.33 a	6.15 ab	1.55 bcd	4 a	7.05 ab	10.45 abc
Kocide 3000	2 lb	3.83 a	2.6 ab	0.85 cd	4.75 a	1.7 bc	2.15 bc
Tanos	12 oz	2.5 ab	5.8 ab	2.75 bcd	4.75 a	8.05 ab	15.7 a
Taegro	3.5 oz	2.75 ab	3.7 ab	2.75 bcd	4.75 a	7.85 ab	13.8 ab
Tanos + Kocide							
300	8 oz + 2 lb	3.75 a	3.75 ab	2.35 bcd	4.75 a	4.45 abc	17.8 a
0							
Untreated non-inoculated		0 b	0 b	0 d	0 b	0 c	0 c
Untreated inoculated		2.64 ab	3.7 ab	6.55 a	3 a	7.95 ab	19.5 a

 Table 45. Efficacy on Xanthomonas campestris pv campestris on Ornamental Kale (Brassica oleracea), Becker, NY, 2008.

<sup>x</sup> Means followed by the same letter do not differ significantly based on Student-Newman-Keuls Test (P = 0.05.

<sup>y</sup> Percentage of leaf area with necrotic lesions.

In 2006 and 2007, Strandberg examined efficacy of several products for control of *Xanthomonas* on Japanese plum (*Prunus incisa x campanulata*) 'Okame' and wax myrtle (*Myrica cerifera*). All treatments were applied as foliar spray at 14-day intervals during May through early November in a 2006 experiment and at 7-day intervals during June through September in the 2007 experiment. In the 2006 experiment, Actinovate + Tricon was the only treatment that consistently suppressed leaf area damaged on both plants, but thepercent of leaves infected were not always significantly different than the controls or from other treatments (Table 46 through Table 49). In 2007, no treatment significantly reduced a severe Xanthomonas severity on both plants. No phytotoxicity was found on any treatment in both trials.

Treatment	Rate per 1 0 0 G a 1	AUDPC <sup>1</sup> Per cent LA D	Last <sup>2</sup> Percent LA D	AUDPC <sup>3</sup> Perc ent Infe cted	Last <sup>4</sup> % leaves Infe cted
Actinovate + Tric on	12 oz + 0.4 %	934.2 a	12.3 a	69.0	82.5
BioPhos + Chel ated copp er	2 % + 0.2 lb a i	1681.4 b	29.3 b	74.0	97.5
Cease + Kocide 2000 + Vital	1% + 3 lb + 8 p t	1417.2 ab	33.3 b	75.5	95.0
HM-0736	58 fl oz	1908.7 b	29.2 b	79.3	90.0
Kasumin	64 fl oz	2014.5 b	31.6 b	76.5	97.5
Kocide 2000	3.5 lb	1800.1 b	34.1 b	76.8	100.0
K-Phite	5 qt	2229.1 b	32.4 b	77.5	97.5
Tanos + Kocide 2000	16 oz + 3 lb	1842.6 b	27.4 b	73.8	97.5
Untreated	-	1986.4 b	32.4 b	78.8	95.0

Table 46. Efficacy on Xanthomonas campestris pv. pruni on Japanese Plum (Prunus incise x<br/>campanulata) 'Okame', Strandberg, FL, 2006.

00-000-Strandberg-3

Means followed by the same letter do not differ significantly based on Student-Newman-Keuls Test (P = 0.05.

<sup>1</sup> Calculated mean area under the disease progress curves in arbitrary units for percent leaf area damaged (LAD). <sup>2</sup> Percent LAD on last sampling day.

<sup>3</sup> Calculated mean area under the disease progress curves in arbitrary units for percent of leaves infected.

<sup>4</sup> Percent of leaves infected on last sampling day.

#### Table 47. Efficacy on Xanthomonas spp. on Wax Myrtle (Myrica cerifera), Strandberg, FL, 2006.

Treatment	Rate per 100 G a 1	AUDPC <sup>1</sup>	Per cent LA D	Last <sup>2</sup> Percent LA D	AUDPC <sup>3</sup>	Perc ent Infe cted	Last <sup>4</sup> % leaves	Infe cted
Actinovate + Tricon	12 oz + 0.4 %	506.6		0.6	57.2 a		52.5	
BioPhos + Chelat ed coppe r	2 % + 0.2 lb a i	604.6		0.5	63.2 ab		52.5	
Cease+ Kocide 2000 + Vital	1% + 3 lb + 8 p t	545.7		0.7	59.8 a		47.5	
HM-0736	58 fl oz	605.0		0.7	67.1 ab		50.0	
Kasumin	64 fl oz	595.0		1.1	65.3 ab		62.5	
Kocide 2000	3.5 lb	522.4		0.9	60.5 a		57.5	
K-Phite	5 qt	628.9		1.0	71.8 b		65.0	
Tanos 50% WG + Kocid e 2000	16 oz + 3 lb	599.2		0.9	63.8 ab		52.5	
Untreated inocul ated	-	731.5		1.1	73.2 b		60.0	

00-000-Strandberg-4

Means followed by the same letter do not differ significantly based on Student-Newman-Keuls Test (P = 0.05.

<sup>1</sup> Calculated mean area under the disease progress curves in arbitrary units for percent leaf area damaged (LAD). <sup>2</sup> Percent LAD on last sampling day.

<sup>3</sup> Calculated mean area under the disease progress curves in arbitrary units for percent of leaves infected.

<sup>4</sup> Percent of leaves infected on last sampling day.

Table 48. Efficacy on Xanthomonas campestris pv. pruni on Japanese Plum (Prunus incise x campanulata) 'Okame', Strandberg, FL, 2007.

Treatment	Rate per 1 0 0 G a 1	AUDPC <sup>1</sup> Per cent LA D	Last <sup>2</sup> Percent LA D	AUDPC <sup>3</sup> Perc ent Infe cted	Last <sup>4</sup> % leaves Infe cted
BioPhos + Chel ated copp er	2 % + 0.1 lb a i	5105.9 b	8.50	4111.5 ab	78.33
Kasumin + Koci de 3000	64oz + 2 lb	4278.7 a	7.20	3915.3 ab	70.00
Kocide 3000	2 lb	4211 4 a	14.76	3939.5 ab	80.00
K-Phite + Tricon	2 qt + 0.4 %	4182.2 a	18.12	4683.7 ab	88.33

Phyton 27	25 oz	4350.6 a	31.86	4877.8 b	88.33
Tanos + Kocide 3000	8 oz + 2 lb	3957.6 a	11.38	4353.7 ab	66.67
Tricon	0.8 %	4105.4 a	24.00	3977.1 ab	91.67
Tricon alt.					
Phyt	0.8% + 25 oz	5174 9 h	24.28	3968 3 ah	95.00
on	0.0 /0 125 02	5171.90	21.20	5700.5 <b>u</b> 0	25.00
27					
Untreated	-	4550.9 a	12.47	3644.7 a	81.67

07-022-Strandberg-3

Means followed by the same letter do not differ significantly based on Student-Newman-Keuls Test (P = 0.05.

<sup>1</sup> Calculated mean area under the disease progress curves in arbitrary units for percent leaf area damaged (LAD). <sup>2</sup> Percent LAD on last sampling day.

<sup>3</sup> Calculated mean area under the disease progress curves in arbitrary units for percent of leaves infected.

<sup>4</sup> Percent of leaves infected on last sampling day.

Treatment	Rate per 1 0 0 G a 1	AUDPC <sup>1</sup> Per cent LA D	Last <sup>2</sup> Percent LA D	AUDPC <sup>3</sup> Perc ent Infe cted	Last <sup>4</sup> % leaves Infe cted
BioPhos + Chel ated copp er	2 % + 0.1 lb a i	2963.8	2.38	3077.5	40.00
Kasumin + Koci de 3000	64 oz + 2 lb	2844.0	2.07	3038.9	40.00
Kocide 3000	2 lb	3112.1	1.68	3065.7	31.67
K-Phite + Tricon	2 qt + 0.4 %	2946.6	2.37	3566.3	51.67
Phyton 27	25 oz	2957.1	2.62	3298.6	45.00
Tanos + Kocide 3000	8 oz + 2 lb	2986.0	2.28	3156.7	41.67
Tricon	0.8 %	2946.6	3.05	3357.7	45.00
Tricon / Phyton 27	0.8 % / 25 oz	3133.5	5.65	3521.3	53.33
Untreated	-	3304.3	4.23	3278.6	46.67

Table 49.	Efficacy on <i>Xanthomonas</i> spp.	. on Wax Myrtle (	Myrica cerifera)	, Strandberg, FI	L, 2007.
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07-022-Strandberg-4

Means followed by the same letter do not differ significantly based on Student-Newman-Keuls Test (P = 0.05.

<sup>1</sup> Calculated mean area under the disease progress curves in arbitrary units for percent leaf area damaged (LAD). <sup>2</sup> Percent LAD on last sampling day.

<sup>3</sup> Calculated mean area under the disease progress curves in arbitrary units for percent of leaves infected.

<sup>4</sup> Percent of leaves infected on last sampling day.

In 2011, Norman examined the efficacy of various products for preventative control of Xanthomonas leaf spot (*Xanthomonas axonopodis* pv. *poinsetticola* strain X1720) on poinsettia (*Euphorbia* 

*pulcherrima*) (Table 50). Treatments were applied as foliar sprays (to runoff) or drench; disease inoculation occurred on 19 September. Number of leaf spots per plant were counted on 4 October. Acibenzolar drench and Protect provided the best control, followed by Acibenzolar foliar, CuPro and HMO-07361. A moderate amount of leaf burning was observed with the Acibenzolar spray treatment. This may be related to the warm temperatures or to specific cultivar used. EarthTec at the high rate burned leaves and appeared to enhance disease. Citrex produced extensive leaf burn on the poinsettia leaves prohibiting any counting of any lesions. No phytotoxicicty was observed in any of the other treatments.

Treatment	Rate per 100 Gal	Application Metho d	Date(s) of Application	No. of Leafspots <sup>x</sup> 10-4-11
Acibenzolar	0.75 oz	Foliar	9/8,9/15,9/22,9/29	83.9 b
Acibenzolar	0.25 oz	Drench	8/30	8.7 a
Cg100	1.2 pts	Foliar	9/22,9/29	187.2 de
Citrex	1.5 ml/L	Foliar	9/8,9/15,9/22,9/29	Burn
CuPro TNO	2 lb	Foliar	9/22,9/29	70.6 b
EarthTec	1.5 fl oz	Foliar	9/22,9/29	133.3 bc
EarthTec	8 fl oz	Foliar	9/22,9/29	200+ e
HMO-0736	14.4 fl oz	Foliar	9/8,9/15,9/22,9/29	99.4 b
Kasumin	45 fl oz	Foliar	9/22,9/29	172.2 cde
NAI-4201	5 fl oz	Drench	8/30,9/6,9/20	143.3 bcd
Protect	2 lb	Foliar	9/22,9/29	19.3 a
Regalia	1% v:v	Foliar	9/22,9/29	178.2 cde
ZeroTol	128 fl oz	Foliar	9/22,9/29	200+ e
Untreated non-				
Inoculate d	-	-	-	0 a
Untreated inoculated	-	-	-	171.1 cde

Table 50. Efficacy on Xanthomonas Leaf Spot (Xanthomonas axonopodis pv. poinsettiicola) on<br/>Poinsettia (Euphorbia pulcherrima) 'Eckespoint Prestige Red', Norman, FL, 2011.

<sup>x</sup> Means followed by same letter do not differ significantly based on Fisher's Protected LSD (P=.05).

### Efficacy Summary by Product/Active Ingredient

- A brief efficacy summary for select products is given below, with a reminder that there are very limited published data available to draw definitive conclusions for each product/pest species. Products were selected based on interest in these products for testing for bacterial efficacy from 2008 to 2014.
- **A14658C.** This active ingredient provided no efficacy on *Erwinia amylovora* in a Cleveland pear trial, *Pseudomonas chicorii* in a chrysanthemum trial, and *Pseudomonas syringae* in an impatiens and a lilac trial.
- Acibenzolar. A trial on goldenrod for Agrobacterium tumefaciens was not conclusive because all treatments, including standards, did not significantly reduce disease incidence. Acibenzolar provided no to poor efficacy on Erwinia on Phalaenopsis orchid and poinsettia. Trials for Erwinia amylovora on Keifer pear and E. chrysanthemi on Oncidium orchid were inconclusive due to extremely low disease incidence. In a Cleveland pear trial for Erwinia amylovora, Acibenzolar applied drench or foliar significantly reduced shoot blight incidence; mixed results were obtained from foliar treatment in 2 apple trials. On Pseudomonas, excellent efficacy was observed in an impatiens trial but no to mediocre efficacy was observed in single trials on chrysanthemum, Bolivian jasmine, lavender and Japanese maple; inconclusive data were obtained in a hibiscus trial. Acibenzolar provided excellent control of Xanthomonas campestris on 'Nagoya Rose' cultivar of ornamental kale but no control on 'White Crane' cultivar. Excellent control of X.axonopodis on poinsettia was obtained with Acibenzolar drench, but mediocre with spray application. In three geranium trials, it provided fair to good control of Xanthomonas.
- Actinovate. This biological product provided no efficacy on *Erwinia* in one Phalaenopsis orchid trial. On *Xanthomonas*, no to poor efficacy was observed in three geranium trials.
- Ag Streptomycin/Firewall. This standard provided excellent control of Erwinia amylovora in 3 apple field trials.
- Aliette. A field trial for Erwinia amylovora on Keifer pear was inconclusive due to extremely low disease incidence. In a Cleveland pear trial for Erwinia amylovora, Aliette did not significantly reduce shoot blight incidence. It provided good control of Pseudomonas syringiae in a lilac trial. This active ingredient provided mediocre to good control of Xanthomonas campestris on 'Nagoya Rose' cultivar of ornamental kale but no control on 'White Crane' cultivar.
- Cease/Serenade Optimum. A trial for Erwinia chrysanthemi on Oncidium orchid was inconclusive due to extremely low disease incidence. In a Cleveland pear trial for Erwinia amylovora, Cease + Milstop significantly reduced shoot blight incidence; in 2 apple trials, Serenade Optimum significantly reduced blossom blight incidence. Cease provided no efficacy on Pseudomonas syringiae in a Japanese maple trial. It provided no or mediocre control of Xanthomonas in three geranium trials, and mediocre control on 'Nagoya Rose' cultivar of ornamental kale but no control on 'White Crane' cultivar.
- *CG100.* A trial on goldenrod for *Agrobacterium tumefaciens* was not conclusive because all treatments, including standards, did not significantly reduce disease incidence. This active ingredient provided no efficacy on *Erwinia* in two Phalaenopsis orchid trials. Trials for *Erwinia amylovora* on Keifer pear and *E. chrysanthemi* on Oncidium orchid were inconclusive due to

extremely low disease incidence. In a Cleveland pear trial for *Erwinia amylovora*, CG100 did not significantly reduce shoot blight incidence. Virtually no efficacy was observed on *Pseudomonas* on chrysanthemum, Bolivian jasmine, impatiens and lilac; inconclusive data were obtained in a hibiscus trial. On *Xanthomonas*, no to poor efficacy was observed in a poinsettia and two geranium trials.

- *Citrex.* A trial on goldenrod for *Agrobacterium tumefaciens* was not conclusive because all treatments, including standards, did not significantly reduce disease incidence. Citrex provided no efficacy on *Erwinia* on Oncidium orchid, Phalaenopsis orchid and poinsettia. Trials for *Erwinia amylovora* on Keifer pear and *E. chrysanthemi* on Oncidium orchid were inconclusive due to extremely low disease incidence. In a Cleveland pear trial for *Erwinia amylovora*, Citrex significantly reduced shoot blight incidence. On *Pseudomonas*, no efficacy was observed in single trials on Bolivian jasmine, impatiens, lavender, lilac and Japanese maple; poor and excellent efficacy was observed on chrysanthemum, and inconclusive data were obtained in a hibiscus trial. Citrex provided no to poor efficacy on *Xanthomonas* in an ornamental kale trial. In 4 geranium trials, poor to good *Xanthomonas* control was observed.
- Copper Compounds. The copper products CuPRO, Kocide or ReZist provided poor to mediocre efficacy on *Erwinia* on Oncidium orchid, Phalaenopsis orchid and poinsettia. Trials for *Erwinia amylovora* on Keifer pear and *E. chrysanthemi* on Oncidium orchid were inconclusive due to extremely low disease incidence. In a Cleveland pear trial for *Erwinia amylovora*, Camelot O significantly reduced shoot blight incidence but CuPro did not. On *Pseudomonas*, no efficacy was observed with Kocide and Phyton on lavender, Japanese maple, hibiscus, and oak leaf hydrangea. Camelot O, Junction, Kocide, Nu-Cop and Phyton 27 did provide some control of *Pseudomonas* in lilac, while CuPRO and Phyton provided mediocre control in a Bolivian jasmine trial. CuPRO provided good control in chrysanthemum and impatiens, but inconclusive data were obtained in a hibiscus trial. Champ and Kocide provided mediocre and good control of *Xanthomonas* on 'Nagoya Rose' cultivar of ornamental kale, but no and good control on 'White Crane' cultivar. Camelot, CuPRO, Cuprofix, Cuprofix MZ, Junction, Kocide and Phyton 27, provided poor to good efficacy on *Xanthomonas* in geranium, Japanese plum, poinsettia and wax myrtle trials.
- *Dithane/Penncozeb/Protect.* This active ingredient provided good efficacy on *Erwinia* in a Phalaenopsis orchid trial. It provided no efficacy on *Pseudomonas* on Japanese maple, mediocre efficacy on chrysanthemum, and variable efficacy on Bolivian jasmine; inconclusive data were obtained in a hibiscus trial. It provided excellent control of *Xanthomonas axonopodis* on poinsettia, mediocre control of *X. campestris* on 'Nagoya Rose' cultivar of ornamental kale but no control on 'White Crane' cultivar. It provided excellent control of *Xanthomonas* sp. in a geranium trial.
- *Florel.* In a Cleveland pear trial for *Erwinia amylovora*, this active ingredient did not significantly reduce shoot blight incidence.
- HM-0736. A trial on goldenrod for Agrobacterium tumefaciens was not conclusive because all treatments, including standards, did not significantly reduce disease incidence. This active ingredient provided provided no to poor efficacy on Erwinia on Oncidium orchid, Phalaenopsis orchid and poinsettia. Trials for Erwinia amylovora on Keifer pear and E. chrysanthemi on Oncidium orchid were inconclusive due to extremely low disease incidence. In a Cleveland pear trial for Erwinia amylovora, it did not significantly reduce shoot blight incidence. On Pseudomonas, it provided no efficacy in two chrysanthemum trials, and in

single trials on hibiscus, lilac and oak leaf hydrangea. Mediocre efficacy was obtained on Bolivian jasmine and impatiens, and inconclusive data obtained in a hibiscus trial. HM-0736 provided mediocre efficacy on *Xanthomonas* in a poinsettia trial, and no to poor efficacy in three trials on geranium and in single trials on Japanese plum and wax myrtle.

- Kasumin. A trial on goldenrod for Agrobacterium tumefaciens was not conclusive because all treatments, including standards, did not significantly reduce disease incidence. Kasumin provided no to poor efficacy on Erwinia on Oncidium orchid, Phalaenopsis orchid and poinsettia. Trials for Erwinia amylovora on Keifer pear and E. chrysanthemi on Oncidium orchid were inconclusive due to extremely low disease incidence. In a Cleveland pear trial for Erwinia amylovora, Kasumin significantly reduced shoot blight incidence; in 2 apple trials, it provided effective control comparable to the standard Ag Streptomycin. On Pseudomonas, no efficacy was observed in single trials on lavender, Japanese maple, hibiscus, and oak leaf hydrangea; inconclusive data were obtained in a hibiscus trial. Kasumin did provide mediocre control of Pseudomonas on impatiens, good control on chrysanthemum and lilac, and excellent control on Bolivian jasmine. It provided good control of Xanthomonas on 'Nagoya Rose' cultivar of ornamental kale but no control on 'White Crane' cultivar. It provided no to poor efficacy on Xanthomonas in five trials on geranium and in single trials on Japanese plum, poinsettia and wax myrtle. When tank-mixed with Kocide, it did not improve efficacy of Kocide alone.
- KleenGrow. This active ingredient was the only treatment that significantly reduced Erwinia chrysanthemi infection on Oncidium orchid; it was superior to Kocide. A field trial for Erwinia amylovora on Keifer pear was inconclusive due to extremely low disease incidence. In a Cleveland pear trial for Erwinia amylovora, KleenGrow significantly reduced shoot blight incidence.
- NAI-4201. A trial on goldenrod for Agrobacterium tumefaciens was not conclusive because all treatments, including standards, did not significantly reduce disease incidence. This active ingredient provided no efficacy on Erwinia in one Phalaenopsis orchid trial. Trials for Erwinia amylovora on Keifer pear and E. chrysanthemi on Oncidium orchid were inconclusive due to extremely low disease incidence. In a Cleveland pear trial for Erwinia amylovora, NAI-4201 significantly reduced shoot blight incidence. Poor efficacy was observed on Pseudomonas on impatiens, mediocre efficacy on Bolivian jasmine, and no efficacy in hibiscus and chrysanthemum trials. On Xanthomonas, no efficacy was observed in a geranium and a poinsettia trial.
- Regalia. A trial on goldenrod for Agrobacterium tumefaciens was not conclusive because all treatments, including standards, did not significantly reduce disease incidence. This extract of Reynoutria provided no efficacy on Erwinia in two Phalaenopsis orchid trial. Trials for Erwinia amylovora on Keifer pear and E. chrysanthemi on Oncidium orchid were inconclusive due to extremely low disease incidence. In a Cleveland pear trial for Erwinia amylovora, Regalia did not significantly reduce shoot blight incidence; in an apple trial it did significantly reduce blossom blight incidence. On Pseudomonas, it provided no to mediocre efficacy on chrysanthemum, poor efficacy on Bolivian jasmine and impatiens, and no efficacy on lavender and lilac; inconclusive data were obtained in a hibiscus trial. It provided poor to good efficacy on Xanthomonas in three geranium trials, but no efficacy in a poinsettia trial.
- *Taegro.* This biological product provided no to poor efficacy on *Erwinia* on Oncidium orchid, Phalaenopsis orchid and poinsettia. Trials for *Erwinia amylovora* on Keifer pear and *E. chrysanthemi* on Oncidium orchid were inconclusive due to extremely low disease

incidence. On *Pseudomonas*, poor efficacy was observed on chrysanthemum, and no efficacy on Bolivian jasmine, lavender and Japanese maple. It provided mediocre control of *Xanthomonas* on 'Nagoya Rose' cultivar of ornamental kale but no control on 'White Crane' cultivar. It provided no to poor efficacy on *Xanthomonas* in four trials on geranium.

- Tanos. This active ingredient provided no to poor efficacy on Erwinia on Oncidium orchid, Phalaenopsis orchid and poinsettia. Trials for *Erwinia amylovora* on Keifer pear and *E. chrysanthemi* on Oncidium orchid were inconclusive due to extremely low disease incidence. On *Pseudomonas*, no efficacy was observed in single trials on chrysanthemum, Bolivian jasmine, lavender and Japanese maple. It provided mediocre control of Xanthomonas on 'Nagoya Rose' cultivar of ornamental kale but no control on 'White Crane' cultivar. It provided no to poor efficacy on Xanthomonas in four trials on geranium and in single trials on Japanese plum and wax myrtle. When tank-mixed with Kocide, it did not improve efficacy of Kocide alone. At this time Tanos will not be introduced to the ornamental hortiuculture marketplace.
- ZeroTol. A trial with this active ingredient on goldenrod for Agrobacterium tumefaciens was not conclusive because all treatments, including standards, did not significantly reduce disease incidence. In a chrysanthemum trial, ZeroTol provided poor efficacy on Pseudomonas chicorii. It provided good efficacy on Pseudomonas syringae in a lilac trial, but poor efficacy in an impatiens trial; inconclusive data were obtained in a hibiscus trial. It provided no efficacy on Xanthomonas axonopodis on poinsettia.

Please see Table 51 for individual summaries of IR-4 trials conducted during 2008 – 2014.

### **Phytotoxicity**

In general most products did not exhibit damage to the treated crops. Significant phytotoxicity was observed on Phalaenopsis plants treated with Acibenzolar and CuPRO. Significant but very minor leaf mottling on Keifer pear was observed from Citrex and KleenGrow and should not reduce marketability. Kasumin caused significant stunting on Bolivian jasmine. Acibenzolar, Citrex and Kasumin caused significant phytotoxicity on lavender. Acibenzolar caused significant injury on geranium. Due to the high temperature in Florida trials (+100F), all copper containing products (Camelot, Cuprofix, Cuprofix MZ, Junction, Kocide, Phyton 27), as well as Cease, Companion, Cease, Tricon and Vitalonil caused some leaf burning of leaves on geranium; this may not occur in cooler temperatures. Acibenzolar was the only treatment that caused slight chlorosis and necrosis on ornamental kale 'White Crane'. On 'Nagoya Rose', Acibenzolar, Citrex, Aliette and Dithane caused slight chlorosis. On Japanese maple, Kasumin resulted in lighter leaf color. Acibenzolar foliar, Citrex and EarthTec caused significant leaf burn on poinsettia. Acibenzolar foliar and Citrex caused significant chlorosis and stunting on impatiens. There also appeared to be an abnormally high number of leaf abscission with impatiens treated with A14658C. Agri-Mycin caused significant phytotoxicity (smaller, yellow plants) on goldenrod.

## Table 51. Summary of product efficacy by pathogen and crop.

Note: Table entries are sorted by product, pathogen Latin name, and then by crop Latin name. Only those IR-4 trials received by 10/23/2015 are included in the table below.

				Production				Application	
PR#	Product (Active Ingredients)	Target	Сгор		Researcher	State	Year		Results
29554	Actinovate Soluble (Streptomyc es lydicus WYEC 108)	Erwinia (Erwinia sp.)	Orchid, Moth (Phalaenops is sp.)	Greenhouse	Norman	FL	2009	Foliar	Very low disease pressure in inoculated Check; not possible to evaluate efficacy of all treatments.
27588	Actinovate Soluble (Streptomyc es lydicus WYEC 108)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Bright Red'	Greenhouse	Norman	FL	2009	Foliar	No significant control at 12 oz per 100 gal.
27588	Actinovate Soluble (Streptomyc es lydicus WYEC 108)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Red'	Greenhouse	Norman	FL	2006	Foliar	Poor efficacy at 12 oz per 100 gal.
27588	Actinovate Soluble (Streptomyc es lydicus WYEC 108)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Red'	Greenhouse	Norman	FL	2007	Foliar	No efficacy at 12 oz per 100 gal.
30652	Agrimycin 17 (Streptomyci n sulfate)	Agrobacterium sp. (Agr obac teriu m sp.)	Goldenrod (Solidago sp.)	Greenhouse	Chase	CA	2011	Foliar	Did not significantly reduce number and size of galls with 8 oz per 100 gal; significant phytotoxicity.
27957	Alexin (Fruit and vegetable extract)	Xanthomonas sp. (Xan thom	Geranium (Pelargonium sp.) 'Patriot Red'	Greenhouse	Norman	FL	2007	Foliar	Poor efficacy at 50 ml per 100 L.

		onas sp.)							
30071	Aliette WDG (Fosetyl Al)	Erwinia (Erwinia sp.)	Pear, Bradford (Non- Bearing) (Pyrus calleryana) 'Cleveland'	Field	Steddom	тх	2012	Foliar	Did not significantly reduce shoot blight with 12.8 oz per 100 gal applied 7 times (green tip to petal fall).
30071	Aliette WDG (Fosetyl Al)	Erwinia (Erwinia sp.)	Pear, Bradford (Non- Bearing) (Pyrus calleryana) 'Kieffer'	Field	Steddom	TX	2010	Foliar	No effect on a very low disease pressure at 12.8 oz per 100 gal; virtually no injury.
30071	Aliette WDG (Fosetyl Al)	Erwinia (Erwinia sp.)	Pear, Bradford (Non- Bearing) (Pyrus calleryana) 'Kieffer'	Field	Steddom	тх	2011	Foliar	No significant control with 12.8 oz per 100 gal applied 6 times.
30210	Aliette WDG (Fosetyl Al)	Pseudomonas syrin gae bligh t (Pse udo mon as syrin gae)	Maple, Japanese (Acer palmatum) 'Bloodgood'	Field	Pscheidt	OR	2011	Foliar	No disease developed in this trial.

31226	Aliette WDG (Fosetyl Al)	Pseudomonas syrin gae bligh t (Pse udo mon as syrin gae)	Lilac (Syringa sp.) S. vulgaris 'Ellen Willmott'	Field In-	Pscheidt	OR	2010	Foliar	Some reduction in disease incidence and severity with 12.8 oz per 100 gal.
31226	Aliette WDG (Fosetyl Al)	Pseudomonas syrin gae bligh t (Pse udo mon as syrin gae)	Lilac (Syringa sp.) S. vulgaris 'Ellen Willmott'	Field In-	Pscheidt	OR	2012	Foliar	Significantly reduced disease incidence but not severity with 12.8 oz per 100 gal.
29485	Aliette WDG (Fosetyl Al)	Xanthomonas sp. (Xan thom onas sp.)	Ornamental Cabbage, Ornamental Kale (Brassica sp.) Kale 'Nagoya Rose'	Greenhouse	Becker	NY	2009	Foliar	Significantly reduced disease severity at 6.4 and 12.8 oz per 100 gal.
29485	Aliette WDG (Fosetyl Al)	Xanthomonas sp. (Xan thom onas sp.)	Ornamental Cabbage, Ornamental Kale (Brassica sp.) Kale 'White Crane	Greenhouse	Becker	NY	2009	Foliar	Reduced disease severity, but not significantly, at 6.4 and 12.8 oz per 100 gal.
27753	ASAP (Silver)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Red'	Greenhouse	Norman	FL	2007	Foliar	Fair to good efficacy at 5, 10 and 30 ppm.
27962	Bloomtime FD (Pantoea agglomerans strain E325)	Xanthomonas sp. (Xan thom	Geranium (Pelargonium sp.) 'Patriot Red'	Greenhouse	Norman	FL	2007	Foliar	No efficacy at 10.5 oz per 100 gal.

		onas sp.)							
27960	BMJ (Bacillus mycoides isolate J)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Red'	Greenhouse	Norman	FL	2007	Foliar	No efficacy at 100 g per 100 gal.
31444	Camelot (Copper salts of fatty and rosin acids)	Erwinia (Erwinia sp.)	Pear, Bradford (Non- Bearing) (Pyrus calleryana) 'Cleveland'	Field	Steddom	TX	2012	Foliar	Significantly reduced shoot blight with 2 gal per 100 gal applied 6 times (bloom to petal fall).
31305	Camelot (Copper salts of fatty and rosin acids)	Pseudomonas syrin gae bligh t (Pse udo mon as syrin gae)	Lilac (Syringa sp.) S. vulgaris 'Ellen Willmott'	Field In-	Pscheidt	OR	2012	Foliar	Significantly reduced disease incidence but not severity with 2 gal per 100 gal.
27574	Camelot (Copper salts of fatty and rosin acids)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Red'	Greenhouse	Norman	FL	2006	Foliar	Significantly reduced leafspots at 3 pt per 100 gal; equal to Kocide.
27574	Camelot (Copper salts of fatty and rosin acids)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Red'	Greenhouse	Norman	FL	2007	Foliar	Significantly reduced leafspots at 3 pt per 100 gal; equal to Kocide.
27956	Canker Kill (Unknown)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Red'	Greenhouse	Norman	FL	2007	Foliar	Poor efficacy at 1.5 lb per 100 gal.

29089	Cease (Bacillus subtilis strain QST 713)	Pseudomonas syrin gae bligh t (Pse udo mon as syrin gae)	Maple, Japanese (Acer palmatum)	Field	Regan	OR	2008	Foliar	No significant difference from untreated check with 2 % solution.
29486	Cease (Bacillus subtilis strain QST 713)	Xanthomonas sp. (Xan thom onas sp.)	Ornamental Cabbage, Ornamental Kale (Brassica sp.) Kale 'Nagoya Rose'	Greenhouse	Becker	NY	2009	Foliar	Reduced disease severity, but not significantly, at 1 and 2 % V/Very
29486	Cease (Bacillus subtilis strain QST 713)	Xanthomonas sp. (Xan thom onas sp.)	Ornamental Cabbage, Ornamental Kale (Brassica sp.) Kale 'White Crane	Greenhouse	Becker	NY	2009	Foliar	Significantly reduced disease severity at 1 and 2 % V/Very
27582	Cease (Bacillus subtilis strain QST 713)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Bright Red'	Greenhouse	Norman	FL	2009	Foliar	Significantly reduced disease incidence at 1, but not at 2 % dilution; 2 % caused leaf burn.
27582	Cease (Bacillus subtilis strain QST 713)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Red'	Greenhouse	Norman	FL	2006	Foliar	Poor efficacy at 8 qt per 100 gal.
27582	Cease (Bacillus subtilis strain QST 713)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Red'	Greenhouse	Norman	FL	2007	Foliar	Poor efficacy at 0.5 % concentration.
30654	CG100 (Caprylic acid)	Agrobacterium sp. (Agr obac	Goldenrod (Solidago sp.)	Greenhouse	Chase	CA	2011	Foliar	Did not significantly reduce number and size of galls

		teriu m sp.)							with 1.2 pt per 100 gal.
29211	CG100 (Caprylic acid)	Erwinia chry sant hemi (Erw inia chry sant hemi )	Orchid, Dancing Lady (Oncidium sp.)	Greenhouse	Palmeteer	FL	2010	Foliar	Low disease incidence (both inoculated and non-inoculated Checks had 0 disease rating); no significant effect at 0.8 % (v/v).
29201	CG100 (Caprylic acid)	Erwinia (Erwinia sp.)	Orchid, Moth (Phalaenops is sp.)	Greenhouse	Norman	FL	2009	Foliar	Very low disease pressure in inoculated Check; not possible to evaluate efficacy of all treatments.
29201	CG100 (Caprylic acid)	Erwinia (Erwinia sp.)	Orchid, Moth (Phalaenops is sp.)	Greenhouse	Norman	FL	2010	Foliar	Did not significantly reduce leaf lesion size at 0.3 % conc.
28935	CG100 (Caprylic acid)	Erwinia (Erwinia sp.)	Pear, Bradford (Non- Bearing) (Pyrus calleryana) 'Kieffer'	Field	Steddom	TX	2010	Foliar	No effect on a very low disease pressure at 3 % conc.; very minor injury comparable to untreated.
28935	CG100 (Caprylic acid)	Erwinia (Erwinia sp.)	Pear, Bradford (Non- Bearing) (Pyrus calleryana) 'Kieffer'	Field	Steddom	TX	2011	Foliar	No significant control with 0.3 % v:v applied 6 times.

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29577	CG100 (Caprylic acid)	Pseudomonas chic orii (Pse udo mon as chic orii)	Chrysanthemum, Garden (Chrysanthe mum/Dendr anthema sp.)	Field	Norman	FL	2010	Foliar	Did not reduce leaf lesion incidence at 0.3 % conc.
29577	CG100 (Caprylic acid)	Pseudomonas chic orii (Pse udo mon as chic orii)	Chrysanthemum, Garden (Chrysanthe mum/Dendr anthema sp.) 'Shasta Improved'	Field	Norman	FL	2012	Foliar	Did not reduce leaf spots with 38.4 fl oz per 100 gal applied twice.
29605	CG100 (Caprylic acid)	Pseudomonas sp. (Pse udo mon as sp.)	Bolivian Jasmine (Mandevilla boliviensis) 'Alice DuPont'	Greenhouse	Chase	СА	2010	Foliar	Significantly reduced vine infection but not disease severity at 0.3 % solution.
30206	CG100 (Caprylic acid)	Pseudomonas syrin gae bligh t (Pse udo mon as syrin gae)	Maple, Japanese (Acer palmatum) 'Bloodgood'	Field	Pscheidt	OR	2011	Foliar	No disease developed in this trial.
30260	CG100 (Caprylic acid)	Pseudomonas syrin gae bligh t (Pse udo	Mallow, Rose Mallow (Hibiscus sp.) 'Double Red'	Greenhouse	Norman	FL	2011	Foliar	Less lesion development, though not statistically significant, with 1.2 pt per 100 gal applied twice.

		mon as syrin gae)							
32360	CG100 (Caprylic acid)	Pseudomonas syrin gae bligh t (Pse udo mon as syrin gae)	Garden Impatiens (Impatiens walleriana) 'Super Elfin XP Violet Improved'	Greenhouse	Norman	FL	2012	Foliar	Did not reduce number of leaf spots with 38.4 fl oz per 100 gal applied twice.
29571	CG100 (Caprylic acid)	Pseudomonas syrin gae bligh t (Pse udo mon as syrin gae)	Lilac (Syringa sp.) S. vulgaris 'Ellen Willmott'	Field In-	Pscheidt	OR	2010	Foliar	No reduction of disease incidence and severity with 38.4 fl oz per 100 gal.
29571	CG100 (Caprylic acid)	Pseudomonas syrin gae bligh t (Pse udo mon as syrin gae)	Lilac (Syringa sp.) S. vulgaris 'Ellen Willmott'	Field In-	Pscheidt	OR	2012	Foliar	No significant reduction of disease incidence and severity with 38.4 fl oz per 100 gal.
30252	CG100 (Caprylic acid)	Xanthomonas sp. (Xan thom onas sp.)	Poinsettia (Euphorbia pulcherrima ) 'Eckespoint Prestige Red	Greenhouse	Norman	FL	2011	Foliar	Did not significantly reduce number of leaf spots with 1.2 pt per 100 gal applied twice.

28932	CG100 (Caprylic acid)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Maverick Red'	Greenhouse	Reddy	AL	2009	Foliar	Significantly reduced severity of X. campestris at 0.8 % V:V; inferior to non- inoculated Check.
28932	CG100 (Caprylic acid)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Bright Red'	Greenhouse	Norman	FL	2009	Foliar	No control at 0.8 % dilution.
29488	Champ Formula 2F (Copper hydroxide)	Xanthomonas sp. (Xan thom onas sp.)	Ornamental Cabbage, Ornamental Kale (Brassica sp.) Kale 'Nagoya Rose'	Greenhouse	Becker	NY	2009	Foliar	Significantly reduced disease severity at 21 fl oz per 100 gal
29488	Champ Formula 2F (Copper hydroxide)	Xanthomonas sp. (Xan thom onas sp.)	Ornamental Cabbage, Ornamental Kale (Brassica sp.) Kale 'White Crane	Greenhouse	Becker	NY	2009	Foliar	Reduced disease severity, but not significantly, at 21 fl oz per 100 gal.
30655	Citrex (Citrus extraction)	Agrobacterium sp. (Agr obac teriu m sp.)	Goldenrod (Solidago sp.)	Greenhouse	Chase	СА	2011	Foliar	Did not significantly reduce number and size of galls with 1.5 ml per liter.
28038	Citrex (Citrus extraction)	Erwinia chry sant hemi (Erw inia chry sant hemi )	Poinsettia (Euphorbia pulcherrima ) 'Prestige' and 'Autumn Red'	Greenhouse	Chase	СА	2009	Foliar	Did not reduce infection at 1.5 ml per liter

29212	Citrex (Citrus extraction)	Erwinia chry sant hemi (Erw inia chry sant hemi )	Orchid, Dancing Lady (Oncidium sp.)	Greenhouse	Palmeteer	FL	2010	Foliar	Low disease incidence (both inoculated and non-inoculated Checks had 0 disease rating); no significant effect at 150 ml per 100 L.
29212	Citrex (Citrus extraction)	Erwinia chry sant hemi (Erw inia chry sant hemi )	Orchid, Dancing Lady (Oncidium sp.) 'Wilson's Wicked Qua'	Greenhouse	Chase	СА	2009	Foliar	Higher infection than inoculated Check at 1.5 ml per liter
29195	Citrex (Citrus extraction)	Erwinia (Erwinia sp.)	Orchid, Moth (Phalaenops is sp.)	Greenhouse	Norman	FL	2009	Foliar	Very low disease pressure in inoculated Check; not possible to evaluate efficacy of all treatments.
29195	Citrex (Citrus extraction)	Erwinia (Erwinia sp.)	Orchid, Moth (Phalaenops is sp.)	Greenhouse	Norman	FL	2010	Foliar	Did not significantly reduce leaf lesion size at 150 ml per 100 L.
28799	Citrex (Citrus extraction)	Erwinia (Erwinia sp.)	Pear, Bradford (Non- Bearing) (Pyrus calleryana) 'Cleveland'	Field	Steddom	TX	2012	Foliar	Significantly reduced shoot blight with 150 cc per 100 L applied 7 times (green tip to petal fall).
28799	Citrex (Citrus extraction)	Erwinia (Erwinia sp.)	Pear, Bradford (Non- Bearing) (Pyrus	Field	Steddom	TX	2010	Foliar	No effect on a very low disease pressure at

			calleryana) 'Kieffer'						19.2 oz per 100 gal; very minor injury.
28799	Citrex (Citrus extraction)	Erwinia (Erwinia sp.)	Pear, Bradford (Non- Bearing) (Pyrus calleryana) 'Kieffer'	Field	Steddom	TX	2011	Foliar	No significant control with 150 cc per 100 L + Capsil applied 6 times.
29576	Citrex (Citrus extraction)	Pseudomonas chic orii (Pse udo mon as chic orii)	Chrysanthemum, Garden (Chrysanthe mum/Dendr anthema sp.)	Field	Norman	FL	2010	Foliar	Significantly reduced leaf lesion incidence at 150 ml per 100 L; inferior to CuPro.
29576	Citrex (Citrus extraction)	Pseudomonas chic orii (Pse udo mon as chic orii)	Chrysanthemum, Garden (Chrysanthe mum/Dendr anthema sp.) 'Shasta Improved'	Field	Norman	FL	2012	Foliar	Significantly reduced leaf spots with 1.5 ml per L applied 3 times; comparable to untreated non- inoculated check.
28388	Citrex (Citrus extraction)	Pseudomonas sp. (Pse udo mon as sp.)	Lavender (Lavandula sp.) L. heterophylla 'Patriot Bright Red'	Greenhouse	Chase	СА	2008	Foliar	No efficacy at 1.5 ml per liter + Latron; phytotoxic

29606	Citrex (Citrus extraction)	Pseudomonas sp. (Pse udo mon as sp.)	Bolivian Jasmine (Mandevilla boliviensis) 'Alice DuPont'	Greenhouse	Chase	CA	2010	Foliar	Significantly reduced vine infection but not disease severity at 0.15 ml per L
27567	Citrex (Citrus extraction)	Pseudomonas syrin gae bligh t (Pse udo mon as syrin gae)	Maple, Japanese (Acer palmatum)	Field	Regan	OR	2008	Foliar	No significant difference from untreated check with 150 cc per 100 liters.
27567	Citrex (Citrus extraction)	Pseudomonas syrin gae bligh t (Pse udo mon as syrin gae)	Maple, Japanese (Acer palmatum) 'Bloodgood'	Field	Pscheidt	OR	2011	Foliar	No disease developed in this trial.
30261	Citrex (Citrus extraction)	Pseudomonas syrin gae bligh t (Pse udo mon as syrin gae)	Mallow, Rose Mallow (Hibiscus sp.) 'Double Red'	Greenhouse	Norman	FL	2011	Foliar	Less lesion development, though not statistically significant, with 1.5 ml per L applied 4 times.
32365	Citrex (Citrus extraction)	Pseudomonas syrin gae bligh t	Garden Impatiens (Impatiens walleriana) 'Super Elfin	Greenhouse	Norman	FL	2012	Foliar	Did not reduce number of leaf spots with 1.5 ml/L applied 3 times. Plant

		(Pse udo mon	XP Violet Improved						injury observed.
		as syrin gae)							
29565	Citrex (Citrus extraction)	Pseudomonas syrin gae bligh t (Pse udo mon as syrin gae)	Lilac (Syringa sp.) S. vulgaris 'Ellen Willmott'	Field In-	Pscheidt	OR	2010	Foliar	No reduction of disease incidence and severity with 18.2 fl oz per 100 gal.
28522	Citrex (Citrus extraction)	Xanthomonas sp. (Xan thom onas sp.)	Ornamental Cabbage, Ornamental Kale (Brassica sp.) Kale 'Nagoya Rose'	Greenhouse	Becker	NY	2009	Foliar	Significantly reduced disease severity at 5 fl oz per 100 gal; slight injury (leaf chlorosis).
28522	Citrex (Citrus extraction)	Xanthomonas sp. (Xan thom onas sp.)	Ornamental Cabbage, Ornamental Kale (Brassica sp.) Kale 'White Crane'	Greenhouse	Becker	NY	2009	Foliar	Reduced disease severity, but not significantly, at 5 fl oz per 100 gal
30253	Citrex (Citrus extraction)	Xanthomonas sp. (Xan thom onas sp.)	Poinsettia (Euphorbia pulcherrima ) 'Eckespoint Prestige Red	Greenhouse	Norman	FL	2011	Foliar	Severe leaf burn with 1.5 ml per L applied 4 times.
27748	Citrex (Citrus extraction)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Maverick Red'	Greenhouse	Reddy	AL	2009	Foliar	Significantly reduced severity of X. campestris at 150 ml per 100 L; inferior to non-inoculated Check.

27748	Citrex (Citrus extraction)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) P. x hortorum 'Patriot Bright Red'	Greenhouse	Chase	CA	2008	Foliar	67 % reduction at 1.5 ml per liter + Latron	
27748	Citrex (Citrus extraction)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Bright Red'	Greenhouse	Norman	FL	2009	Foliar	First Trial: Good control at 150 ml/L; comparable to CuPro and non-inoculated Check.	
27748	Citrex (Citrus extraction)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Red'	Greenhouse	Norman	FL	2007	Foliar	Good efficacy at 1.2 ml per L; equal to Firewall	
27589	Companion (Bacillus subtillis GB03)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Red'	Greenhouse	Norman	FL	2006	Foliar	Good efficacy at 2 % concentration	
27589	Companion (Bacillus subtillis GB03)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Red'	Greenhouse	Norman	FL	2007	Foliar	No efficacy at 0.5 and 1 % concentration	
30519	Copper Count N (Copper ammonium complex)	Erwinia chry sant hemi (Erw inia chry sant hemi )	Orchid, Dancing Lady (Oncidium sp.)	Greenhouse	Palmeteer	FL	2010		Low disease incidence (both inoculated and non-inoculated Checks had 0 disease rating)	
32367	CuPro (Copper hydroxide)	Pseudomonas syrin gae bligh t (Pse udo mon	Garden Impatiens (Impatiens walleriana) 'Super Elfin XP Violet Improved'	Greenhouse	Norman	FL	2012	Foliar	Significantly reduced number of leaf spots with 2 lb per 100 gal applied twice; inferior to non- inoculated check.	
			as syrin gae)							
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-	30511	CuPro 2005 (Copper hydroxide)	Erwinia chry sant hemi (Erw inia chry sant hemi )	Poinsettia (Euphorbia pulcherrima ) 'Prestige' and 'Autumn Red'	Greenhouse	Chase	CA	2009	Foliar	Some but not significant reduction in disease severity at 2 lb per 100 gal.
	29225	CuPro 2005 (Copper hydroxide)	Erwinia chry sant hemi (Erw inia chry sant hemi )	Orchid, Dancing Lady (Oncidium sp.) 'Wilson's Wicked Qua'	Greenhouse	Chase	CA	2009	Foliar	Reduced infection, though not statistically significant from inoculated Check, at 2 lb per 100 gal.
	29555	CuPro 2005 (Copper hydroxide)	Erwinia (Erwinia sp.)	Orchid, Moth (Phalaenops is sp.)	Greenhouse	Norman	FL	2009	Foliar	Very low disease pressure in inoculated Check; not possible to evaluate efficacy of all treatments.
	29555	CuPro 2005 (Copper hydroxide)	Erwinia (Erwinia sp.)	Orchid, Moth (Phalaenops is sp.)	Greenhouse	Norman	FL	2010	Foliar	Significantly reduced leaf lesion size at 2 lb per 100 gal; almost comparable to CuPro and non-inoculated check.
7	30072	CuPro 2005 (Copper hydroxide)	Erwinia (Erwinia sp.)	Pear, Bradford (Non- Bearing) (Pyrus calleryana) 'Cleveland'	Field	Steddom	тх	2012	Foliar	Did not significantly reduce shoot blight with 2 lb per 100 gal applied 6 times (green
ŝ										

									tip to petal fall).
30072	CuPro 2005 (Copper hydroxide)	Erwinia (Erwinia sp.)	Pear, Bradford (Non- Bearing) (Pyrus calleryana) 'Kieffer'	Field	Steddom	TX	2010	Foliar	No effect on a very low disease pressure at 2 lb per 100 gal; very minor injury comparable to untreated.
30072	CuPro 2005 (Copper hydroxide)	Erwinia (Erwinia sp.)	Pear, Bradford (Non- Bearing) (Pyrus calleryana) 'Kieffer'	Field	Steddom	TX	2011	Foliar	No significant control with 2 lb per 100 gal applied 6 times.
30320	CuPro 2005 (Copper hydroxide)	Pseudomonas chic orii (Pse udo mon as chic orii)	Chrysanthemum, Garden (Chrysanthe mum/Dendr anthema sp.)	Field	Norman	FL	2010	Foliar	Significantly reduced leaf lesion incidence at 2 lb per 100 gal; almost comparable to non-inoculated check; best product.
30320	CuPro 2005 (Copper hydroxide)	Pseudomonas chic orii (Pse udo mon as chic orii)	Chrysanthemum, Garden (Chrysanthe mum/Dendr anthema sp.) 'Shasta Improved'	Field	Norman	FL	2012	Foliar	Significantly reduced leaf spots with 2 lb per 100 gal applied twice; comparable to untreated non- inoculated check.

31234	CuPro 2005 (Copper hydroxide)	Pseudomonas syrin gae bligh t (Pse udo mon as	Mallow, Rose Mallow (Hibiscus sp.) 'Double Red'	Greenhouse	Norman	FL	2011	Foliar	Less lesion development, though not statistically significant, with 2 lb per 100 gal applied twice.
31231	CuPro 2005 (Copper hydroxide)	Syrin gae) Xanthomonas sp. (Xan thom onas sp.)	Poinsettia (Euphorbia pulcherrima ) 'Eckespoint Prestige Red	Greenhouse	Norman	FL	2011	Foliar	Significantly reduced number of leaf spots with 2 lb per 100 gal applied twice; inferior to non- inoculated check
29546	CuPro 2005 (Copper hydroxide)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Bright Red'	Greenhouse	Norman	FL	2009	Foliar	First Trial: Good control at 2 lb per 100 gal; comparable to non-inoculated Check.
27578	Cuprofix MZ Disperse (Mancozeb + Basic copper sulfate)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Red'	Greenhouse	Norman	FL	2006	Foliar	Significantly reduced leafspots at 8.75 lb per 100 gal; considered one of the best treatments
27578	Cuprofix MZ Disperse (Mancozeb + Basic copper sulfate)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Red'	Greenhouse	Norman	FL	2007	Foliar	Significantly reduced leafspots at 8.75 lb per 100 gal; equal to Kocide
27577	CuproFix Ultra 40 Disperse (Basic copper sulfate)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Red'	Greenhouse	Norman	FL	2006	Foliar	Significantly reduced leafspots at 1.5 lb per 100 gal; considered one of the best treatments
27577	CuproFix Ultra 40 Disperse (Basic	Xanthomonas sp. (Xan thom	Geranium (Pelargonium sp.) 'Patriot Red'	Greenhouse	Norman	FL	2007	Foliar	Excellent efficacy at 1.5 lb per 100 gal; considered one

	copper sulfate)	onas sp.)							of the best treatments
29487	Dithane 75DF Rainshield (Mancozeb)	Xanthomonas sp. (Xan thom onas sp.)	Ornamental Cabbage, Ornamental Kale (Brassica sp.) Kale 'Nagoya Rose'	Greenhouse	Becker	NY	2009	Foliar	Significantly reduced disease severity at 1 lb per 100 gal.
29487	Dithane 75DF Rainshield (Mancozeb)	Xanthomonas sp. (Xan thom onas sp.)	Ornamental Cabbage, Ornamental Kale (Brassica sp.) Kale 'White Crane	Greenhouse	Becker	NY	2009	Foliar	Reduced disease severity, but not significantly, at 1 lb per 100 gal.
31235	EarthTec (Copper)	Pseudomonas syrin gae bligh t (Pse udo mon as syrin gae)	Mallow, Rose Mallow (Hibiscus sp.) 'Double Red'	Greenhouse	Norman	FL	2011	Foliar	Less lesion development, though not statistically significant, with 1.5 and 8 fl oz per 100 gal applied twice: some phytotoxicity at the high rate.
31232	EarthTec (Copper)	Xanthomonas sp. (Xan thom onas sp.)	Poinsettia (Euphorbia pulcherrima ) 'Eckespoint Prestige Red	Greenhouse	Norman	FL	2011	Foliar	Did not significantly reduce number of leaf spots with 1.5 and 8 fl oz per 100 gal applied twice.
27576	Firewall 17WP (Streptomyci n sulfate)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Red'	Greenhouse	Norman	FL	2006	Foliar	Significantly reduced leafspots at 200 ppm; equal to Kocide
27576	Firewall 17WP (Streptomyci n sulfate)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Red'	Greenhouse	Norman	FL	2007	Foliar	Good efficacy at 200 ppm concentration

27959	Flameout (Oxytetracyc line)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Red'	Greenhouse	Norman	FL	2007	Foliar	No efficacy at 200 ppm concentration
30450	Florel (Ethephon)	Erwinia (Erwinia sp.)	Pear, Bradford (Non- Bearing) (Pyrus calleryana) 'Cleveland'	Field In-	Steddom	TX	2012	Foliar	Did not significantly reduce shoot blight with 1 and 2 qt per 10 gal applied 5 times (bloom to petal fall).
30450	Florel (Ethephon)	Erwinia (Erwinia sp.)	Pear, Bradford (Non- Bearing) (Pyrus calleryana) 'Kieffer'	Field In-	Steddom	TX	2011	Foliar	No control with 10 qt per 100 gal applied 4 times.
30656	HM-0736 (aka Physpe) (Laminarin)	Agrobacterium sp. (Agr obac teriu m sp.)	Goldenrod (Solidago sp.)	Greenhouse	Chase	CA	2011	Foliar	Did not significantly reduce number and size of galls with 14.4 oz per 100 gal.
29289	HM-0736 (aka Physpe) (Laminarin)	Erwinia chry sant hemi (Erw inia chry sant hemi )	Poinsettia (Euphorbia pulcherrima ) 'Prestige' and 'Autumn Red'	Greenhouse	Chase	CA	2009	Foliar	Reduced infection, though not statistically significant from inoculated Check, at 14.4 oz per 100 gal.
29213	HM-0736 (aka Physpe) (Laminarin)	Erwinia chry sant hemi (Erw inia chry sant	Orchid, Dancing Lady (Oncidium sp.)	Greenhouse	Palmeteer	FL	2010	Foliar	Low disease incidence (both inoculated and non-inoculated Checks had 0 disease rating); no significant effect at 14.4 fl oz per 100 gal.

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29213	HM-0736 (aka Physpe) (Laminarin)	Erwinia chry sant hemi (Erw inia chry sant hemi )	Orchid, Dancing Lady (Oncidium sp.) 'Wilson's Wicked Qua'	Greenhouse	Chase	CA	2009	Foliar	Reduced infection, though not statistically significant from inoculated Check, at 14.4 oz per 100 gal.
29196	HM-0736 (aka Physpe) (Laminarin)	Erwinia (Erwinia sp.)	Orchid, Moth (Phalaenops is sp.)	Greenhouse	Norman	FL	2009	Foliar	Very low disease pressure in inoculated Check; not possible to evaluate efficacy of all treatments.
29196	HM-0736 (aka Physpe) (Laminarin)	Erwinia (Erwinia sp.)	Orchid, Moth (Phalaenops is sp.)	Greenhouse	Norman	FL	2010	Foliar	Did not significantly reduce leaf lesion size at 14.4 fl oz per 100 gal.
28800	HM-0736 (aka Physpe) (Laminarin)	Erwinia (Erwinia sp.)	Pear, Bradford (Non- Bearing) (Pyrus calleryana) 'Cleveland'	Field	Steddom	TX	2012	Foliar	Did not significantly reduce shoot blight with 14.4 fl oz per 100 gal applied 7 times (green tip to petal fall).
28800	HM-0736 (aka Physpe) (Laminarin)	Erwinia (Erwinia sp.)	Pear, Bradford (Non- Bearing) (Pyrus calleryana) 'Kieffer'	Field	Steddom	TX	2010	Foliar	No effect on a very low disease pressure at 14.4 fl oz per 100 gal; virtually no injury.

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28800	HM-0736 (aka Physpe) (Laminarin)	Erwinia (Erwinia sp.)	Pear, Bradford (Non- Bearing) (Pyrus calleryana) 'Kieffer'		Steddom	TX	2011	Foliar	No significant control with 14.4 fl oz per 100 gal applied 6 times.
29895	HM-0736 (aka Physpe) (Laminarin)	Pseudomonas chic orii (Pse udo mon as chic orii)	Chrysanthemum, Garden (Chrysanthe mum/Dendr anthema sp.) 'Shasta Improved'	Field	Norman	FL	2012	Foliar	Did not significantly reduce leaf spots with 14.4 fl oz per 100 gal applied 3 times.
28088	HM-0736 (aka Physpe) (Laminarin)	Pseudomonas chic orii (Pse udo mon as chic orii)	Mallow, Rose Mallow (Hibiscus sp.) H. rosa- sinensis	Field	Strandberg	FL	2006	Foliar	No significant efficacy at 450 ml per 100 L
29607	HM-0736 (aka Physpe) (Laminarin)	Pseudomonas sp. (Pse udo mon as sp.)	Bolivian Jasmine (Mandevilla boliviensis) 'Alice DuPont'	Greenhouse	Chase	CA	2010	Foliar	Significantly reduced disease severity but not vine infection at 14.4 fl fl oz per 100 gal.
27572	HM-0736 (aka Physpe) (Laminarin)	Pseudomonas syrin gae bligh t (Pse udo mon	Maple, Japanese (Acer palmatum) 'Bloodgood'	Field	Pscheidt	OR	2011	Foliar	No disease developed in this trial.

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		as syrin gae)							
30262	HM-0736 (aka Physpe) (Laminarin)	Pseudomonas syrin gae bligh t (Pse udo mon as syrin gae)	Mallow, Rose Mallow (Hibiscus sp.) 'Double Red'	Greenhouse	Norman	FL	2011	Foliar	More lesion development, though not statistically significant, with 14.4 fl oz per 100 gal applied 4 times.
32363	HM-0736 (aka Physpe) (Laminarin)	Pseudomonas syrin gae bligh t (Pse udo mon as syrin gae)	Garden Impatiens (Impatiens walleriana) 'Super Elfin XP Violet Improved'	Greenhouse	Norman	FL	2012	Foliar	Significantly reduced number of leaf spots with 14.4 fl oz per 100 gal applied 3 times; much inferior to non- inoculated check.
29566	HM-0736 (aka Physpe) (Laminarin)	Pseudomonas syrin gae bligh t (Pse udo mon as syrin gae)	Lilac (Syringa sp.) S. vulgaris 'Ellen Willmott'	Field In-	Pscheidt	OR	2010	Foliar	No reduction of disease incidence and severity with 14.4 fl oz per 100 gal.
28093	HM-0736 (aka Physpe) (Laminarin)	Pseudomonas marg inali s (Psu edo mon as	Hydrangea, Oakleaf (Hydrangea quercifolia)	Field	Strandberg	FL	2006	Foliar	No significant efficacy at 450 ml per 100 L

		marg inali s)							
30254	HM-0736 (aka Physpe) (Laminarin)	Xanthomonas sp. (Xan thom onas sp.)	Poinsettia (Euphorbia pulcherrima ) 'Eckespoint Prestige Red	Greenhouse	Norman	FL	2011	Foliar	Significantly reduced number of leaf spots with 14.4 fl oz per 100 gal applied twice; inferior to non- inoculated check.
28083	HM-0736 (aka Physpe) (Laminarin)	Xanthomonas sp. (Xan thom onas sp.)	Wax Myrtle (Myrica cerifera)	Field	Strandberg	FL	2006	Foliar	No significant efficacy at 450 ml per 100 L
27591	HM-0736 (aka Physpe) (Laminarin)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Maverick Red'	Greenhouse	Reddy	AL	2009	Foliar	Significantly reduced severity of X. campestris at 14.4 oz per 100 gal; inferior to non-inoculated Check.
27591	HM-0736 (aka Physpe) (Laminarin)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Bright Red'	Greenhouse	Norman	FL	2009	Foliar	No control at 14.4 fl oz per 100 gal.
27591	HM-0736 (aka Physpe) (Laminarin)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Red'	Greenhouse	Norman	FL	2006	Foliar	No efficacy at 58 oz per 100 gal.
28078	HM-0736 (aka Physpe) (Laminarin)	Xanthomonas sp. (Xan thom onas sp.)	Cherry (Non-Bearing) (Prunus sp.) P. incisa x campanulata 'Okame'	Field	Strandberg	FL	2006	Foliar	No significant efficacy at 450 ml per 100 L

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31443	Inosco (A14658C) (Potassium phosphite)	Erwinia (Erwinia sp.)	Pear, Bradford (Non- Bearing) (Pyrus calleryana) 'Cleveland'	Field	Steddom	TX	2012	Foliar	Did not significantly reduce shoot blight with 2 and 4 pt per 100 gal applied 5 times (green tip to petal fall).
31487	Inosco (A14658C) (Potassium phosphite)	Pseudomonas chic orii (Pse udo mon as chic orii)	Chrysanthemum, Garden (Chrysanthe mum/Dendr anthema sp.) 'Shasta Improved'	Field	Norman	FL	2012	Foliar	Did not significantly reduce leaf spots with 4 pt per 100 gal applied twice.
32359	Inosco (A14658C) (Potassium phosphite)	Pseudomonas syrin gae bligh t (Pse udo mon as syrin gae)	Garden Impatiens (Impatiens walleriana) 'Super Elfin XP Violet Improved'	Greenhouse	Norman	FL	2012	Foliar	Did not reduce number of leaf spots with 4 pt per 100 gal applied twice. Plant injury observed.
31303	Inosco (A14658C) (Potassium phosphite)	Pseudomonas syrin gae bligh t (Pse udo mon	Lilac (Syringa sp.) S. vulgaris 'Ellen Willmott'	Field In-	Pscheidt	OR	2012	Foliar	Some reduction of disease incidence and severity with 64 fl oz per 100 gal.

		as syrin gae)							
30653	Insimmo (Acibenzolar-S- methyl)	Agrobacterium sp. (Agr obac teriu m sp.)	Goldenrod (Solidago sp.)	Greenhouse	Chase	CA	2011	Drench	Did not significantly reduce number and size of galls with 1 oz per 100 gal applied as spray or 0.25 oz per 100 gal drenched.
30653	Insimmo (Acibenzolar-S- methyl)	Agrobacterium sp. (Agr obac teriu m sp.)	Goldenrod (Solidago sp.)	Greenhouse	Chase	CA	2011	Foliar	Did not significantly reduce number and size of galls with 1 oz per 100 gal applied as spray or 0.25 oz per 100 gal drenched.
28037	Insimmo (Acibenzolar-S- methyl)	Erwinia chry sant hemi (Erw inia chry sant hemi )	Poinsettia (Euphorbia pulcherrima ) 'Prestige' and 'Autumn Red'	Greenhouse	Chase	СА	2009	Foliar	Did not reduce infection at 0.75 oz per 100 gal.
29210	Insimmo (Acibenzolar-S- methyl)	Erwinia chry sant hemi (Erw inia chry sant hemi )	Orchid, Dancing Lady (Oncidium sp.)	Greenhouse	Palmeteer	FL	2010	Foliar	Low disease incidence (both inoculated and non-inoculated Checks had 0 disease rating); no significant effect at 1 fl oz per 100 gal.
29210	Insimmo (Acibenzolar-S- methyl)	Erwinia chry sant hemi (Erw	Orchid, Dancing Lady (Oncidium sp.) 'Wilson's	Greenhouse	Chase	CA	2009	Foliar	Reduced infection, though not statistically significant from inoculated

		inia chry sant hemi )	Wicked Qua'						Check, at 0.75 oz per 100 gal.
29194	Insimmo (Acibenzolar-S- methyl)	Erwinia (Erwinia sp.)	Orchid, Moth (Phalaenops is sp.)	Greenhouse	Norman	FL	2009	Foliar	Very low disease pressure in inoculated Check; not possible to evaluate efficacy of all treatments.
29194	Insimmo (Acibenzolar-S- methyl)	Erwinia (Erwinia sp.)	Orchid, Moth (Phalaenops is sp.)	Greenhouse	Norman	FL	2010	Foliar	Did not significantly reduce leaf lesion size at 0.75 oz per 100 gal.
28798	Insimmo (Acibenzolar-S- methyl)	Erwinia (Erwinia sp.)	Pear, Bradford (Non- Bearing) (Pyrus calleryana) 'Cleveland'	Field	Steddom	TX	2012	Drench	Significantly reduced shoot blight with 0.25 oz per 100 gal applied 3 times (dormant and bloom).
28798	Insimmo (Acibenzolar-S- methyl)	Erwinia (Erwinia sp.)	Pear, Bradford (Non- Bearing) (Pyrus calleryana) 'Cleveland'	Field	Steddom	TX	2012	Foliar	Significantly reduced shoot blight with 1 oz per 100 gal applied 7 times (green tip to petal fall).
28798	Insimmo (Acibenzolar-S- methyl)	Erwinia (Erwinia sp.)	Pear, Bradford (Non- Bearing) (Pyrus calleryana) 'Kieffer'	Field	Steddom	TX	2010	Drench	No effect on a very low disease pressure at 0.25 oz per 100 gal; very minor injury comparable to untreated.

28798	Insimmo (Acibenzolar-S- methyl)	Erwinia (Erwinia sp.)	Pear, Bradford (Non- Bearing) (Pyrus calleryana) 'Kieffer'	Field	Steddom	тх	2010	Foliar	No effect on a very low disease pressure at 1 oz per 100 gal; very minor injury comparable to untreated.
28798	Insimmo (Acibenzolar-S- methyl)	Erwinia (Erwinia sp.)	Pear, Bradford (Non- Bearing) (Pyrus calleryana) 'Kieffer'	Field	Steddom	TX	2011	Drench	No significant control with 0.25 oz per 100 gal drench applied twice.
28798	Insimmo (Acibenzolar-S- methyl)	Erwinia (Erwinia sp.)	Pear, Bradford (Non- Bearing) (Pyrus calleryana) 'Kieffer'	Field	Steddom	тх	2011	Foliar	No significant control with 1 oz per 100 gal applied fioliar 6 times.
29575	Insimmo (Acibenzolar-S- methyl)	Pseudomonas chic orii (Pse udo mon as chic orii)	Chrysanthemum, Garden (Chrysanthe mum/Dendr anthema sp.)	Field	Norman	FL	2010	Foliar	Did not significantly reduce leaf lesion incidence at 0.75 oz per 100 gal.
29575	Insimmo (Acibenzolar-S- methyl)	Pseudomonas chic	Chrysanthemum, Garden (Chrysanthe	Field	Norman	FL	2012	Drench	Did not significantly reduce leaf spots with

		orii (Pse udo mon as chic orii)	mum/Dendr anthema sp.) 'Shasta Improved						0.25 oz per 100 gal applied once.
29575	Insimmo (Acibenzolar-S- methyl)	Pseudomonas chic orii (Pse udo mon as chic orii)	Chrysanthemum, Garden (Chrysanthe mum/Dendr anthema sp.) 'Shasta Improved'	Field	Norman	FL	2012	Foliar	Did not significantly reduce leaf spots with 0.5 and 0.75 oz per 100 gal applied 3 times.
28387	Insimmo (Acibenzolar-S- methyl)	Pseudomonas sp. (Pse udo mon as sp.)	Lavender (Lavandula sp.) L. heterophylla 'Patriot Bright Red'	Greenhouse	Chase	СА	2008	Foliar	No efficacy at 0.75 oz per 100 gal; phytotoxic
29604	Insimmo (Acibenzolar-S- methyl)	Pseudomonas sp. (Pse udo mon as sp.)	Bolivian Jasmine (Mandevilla boliviensis) 'Alice DuPont'	Greenhouse	Chase	CA	2010	Drench	No reduction in vine infection when drenched at 0.25 oz per 100 gal.
29604	Insimmo (Acibenzolar-S- methyl)	Pseudomonas sp. (Pse udo mon as sp.)	Bolivian Jasmine (Mandevilla boliviensis) 'Alice DuPont'	Greenhouse	Chase	СА	2010	Foliar	Significantly reduced vine infection sprayed at 1 oz per 100 gal.
27566	Insimmo (Acibenzolar-S- methyl)	Pseudomonas syrin gae bligh t (Pse udo mon	Maple, Japanese (Acer palmatum)	Field	Regan	OR	2008	Foliar	No significant difference from untreated check with 1 oz per 110 gal.

		as syrin gae)							
27566	Insimmo (Acibenzolar-S- methyl)	Pseudomonas syrin gae bligh t (Pse udo mon as syrin gae)	Maple, Japanese (Acer palmatum) 'Bloodgood'	Field	Pscheidt	OR	2011	Foliar	No disease developed in this trial.
30259	Insimmo (Acibenzolar-S- methyl)	Pseudomonas syrin gae bligh t (Pse udo mon as syrin gae)	Mallow, Rose Mallow (Hibiscus sp.) 'Double Red'	Greenhouse	Norman	FL	2011	Foliar	Less lesion development, though not statistically significant, with 0.75 oz per 100 gal applied 4 times.
32358	Insimmo (Acibenzolar-S- methyl)	Pseudomonas syrin gae bligh t (Pse udo mon as syrin gae)	Garden Impatiens (Impatiens walleriana) 'Super Elfin XP Violet Improved'	Greenhouse	Norman	FL	2012	Foliar	Excellent control with 0.5 and 0.75 oz per 100 gal applied 3 times; almost comparable to non-inoculated check; best product in trial. Plant injury observed.
29564	Insimmo (Acibenzolar-S- methyl)	Pseudomonas syrin gae bligh t (Pse udo mon	Lilac (Syringa sp.) S. vulgaris 'Ellen Willmott'	Field In-	Pscheidt	OR	2010	Foliar	No reduction of disease incidence and severity with 1 oz per 100 gal.

		as syrin gae)							
28521	Insimmo (Acibenzolar-S- methyl)	Xanthomonas sp. (Xan thom onas sp.)	Ornamental Cabbage, Ornamental Kale (Brassica sp.) Kale 'Nagoya Rose'	Greenhouse	Becker	NY	2009	Foliar	Significantly reduced disease severity at 0.75 oz per 100 gal; slight injury (leaf chlorosis and necrosis).
28521	Insimmo (Acibenzolar-S- methyl)	Xanthomonas sp. (Xan thom onas sp.)	Ornamental Cabbage, Ornamental Kale (Brassica sp.) Kale 'White Crane	Greenhouse	Becker	NY	2009	Foliar	Reduced disease severity, but not significantly, at 0.75 oz per 100 gal; slight injury (leaf chlorosis and necrosis).
30251	Insimmo (Acibenzolar-S- methyl)	Xanthomonas sp. (Xan thom onas sp.)	Poinsettia (Euphorbia pulcherrima ) 'Eckespoint Prestige Red	Greenhouse	Norman	FL	2011	Foliar	Significantly reduced number of leaf spots with 0.75 oz per 100 gal applied 4 times; inferior to non- inoculated check.
27747	Insimmo (Acibenzolar-S- methyl)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Maverick Red'	Greenhouse	Reddy	AL	2009	Foliar	Significantly reduced severity of X. campestris at 1.25 oz per 100 gal; inferior to non-inoculated Check.
27747	Insimmo (Acibenzolar-S- methyl)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) P. x hortorum 'Patriot Bright Red'	Greenhouse	Chase	CA	2008	Foliar	100 % effective at 0.75 oz per 100 gal; severe injury.
27747	Insimmo (Acibenzolar-S- methyl)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Bright Red'	Greenhouse	Norman	FL	2009	Foliar	Good control at 0.019 oz per 100 gal; almost comparable to CuPro and

									non-inoculated Check
27579	Junction (SePro) (Mancozeb + copper hydroxide)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Red'	Greenhouse	Norman	FL	2006	Foliar	Significantly reduced leafspots at 1.5 lb per 100 gal; considered one of the best treatments
27579	Junction (SePro) (Mancozeb + copper hydroxide)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Red'	Greenhouse	Norman	FL	2007	Foliar	Excellent efficacy at 1.5 lb per 100 gal; considered one of the best treatments
30657	Kasumin (Kasugamycin)	Agrobacterium sp. (Agr obac teriu m sp.)	Goldenrod (Solidago sp.)	Greenhouse	Chase	СА	2011	Foliar	Did not significantly reduce number and size of galls with 45 oz per 100 gal.
28039	Kasumin (Kasugamycin)	Erwinia chry sant hemi (Erw inia chry sant hemi )	Poinsettia (Euphorbia pulcherrima ) 'Prestige' and 'Autumn Red'	Greenhouse	Chase	СА	2009	Foliar	Reduced infection, though not statistically significant from inoculated Check, at 45 oz per 100 gal
29214	Kasumin (Kasugamycin)	Erwinia chry sant hemi (Erw inia chry sant hemi )	Orchid, Dancing Lady (Oncidium sp.)	Greenhouse	Palmeteer	FL	2010	Foliar	Low disease incidence (both inoculated and non-inoculated Checks had 0 disease rating); no significant effect at 45 fl oz per 100 gal.
29214	Kasumin (Kasugamycin)	Erwinia chry sant hemi (Erw	Orchid, Dancing Lady (Oncidium sp.) 'Wilson's	Greenhouse	Chase	CA	2009	Foliar	Higher infection than inoculated Check at 45 oz per 100 gal

		inia chry sant hemi )	Wicked Qua'						
28942	Kasumin (Kasugamycin)	Erwinia (Erwinia sp.)	Orchid, Moth (Phalaenops is sp.)	Greenhouse	Norman	FL	2009	Foliar	Very low disease pressure in inoculated Check; not possible to evaluate efficacy of all treatments.
28942	Kasumin (Kasugamycin)	Erwinia (Erwinia sp.)	Orchid, Moth (Phalaenops is sp.)	Greenhouse	Norman	FL	2010	Foliar	Did not reduce leaf lesion size at 45 fl oz per 100 gal.
28801	Kasumin (Kasugamycin)	Erwinia (Erwinia sp.)	Pear, Bradford (Non- Bearing) (Pyrus calleryana) 'Cleveland'	Field	Steddom	TX	2012	Foliar	Significantly reduced shoot blight with 45 fl oz per 100 gal applied 6 times (green tip to petal fall).
28801	Kasumin (Kasugamycin)	Erwinia (Erwinia sp.)	Pear, Bradford (Non- Bearing) (Pyrus calleryana) 'Kieffer'	Field	Steddom	TX	2010	Foliar	No effect on a very low disease pressure at 45 fl oz per 100 gal; very minor injury comparable to untreated.
28801	Kasumin (Kasugamycin)	Erwinia (Erwinia sp.)	Pear, Bradford (Non- Bearing) (Pyrus calleryana) 'Kieffer'	Field	Steddom	TX	2011	Foliar	No significant control with 45 fl oz per 100 gal applied 6 times.

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29896	Kasumin (Kasugamycin)	Pseudomonas chic orii (Pse udo mon as chic orii)	Chrysanthemum, Garden (Chrysanthe mum/Dendr anthema sp.)	Field	Norman	FL	2010	Foliar	Significantly reduced leaf lesion incidence at 45 fl oz per 100 gal; comparable to CuPro.
29896	Kasumin (Kasugamycin)	Pseudomonas chic orii (Pse udo mon as chic orii)	Chrysanthemum, Garden (Chrysanthe mum/Dendr anthema sp.) 'Shasta Improved'	Field	Norman	FL	2012	Foliar	Significantly reduced leaf spots with 64 fl oz per 100 gal applied twice; comparable to untreated non- inoculated check.
28089	Kasumin (Kasugamycin)	Pseudomonas chic orii (Pse udo mon as chic orii)	Mallow, Rose Mallow (Hibiscus sp.) H. rosa- sinensis	Field	Strandberg	FL	2006	Foliar	No efficacy at 64 oz per 100 gal
28389	Kasumin (Kasugamycin)	Pseudomonas sp. (Pse udo mon as sp.)	Lavender (Lavandula sp.) L. heterophylla 'Patriot Bright Red'	Greenhouse	Chase	CA	2008	Foliar	No efficacy at 45 oz per 100 gal; phytotoxic
29608	Kasumin (Kasugamycin)	Pseudomonas sp. (Pse udo mon as sp.)	Bolivian Jasmine (Mandevilla boliviensis) 'Alice DuPont'	Greenhouse	Chase	CA	2010	Foliar	Excellent control at 45 fl oz per 100 gal; best treatment; significant stunting.

27568	Kasumin (Kasugamycin)	Pseudomonas syrin gae bligh t (Pse udo mon as syrin gae)	Maple, Japanese (Acer palmatum)	Field	Regan	OR	2008	Foliar	No significant difference from untreated check with 45 fl oz per 100 gal.
27568	Kasumin (Kasugamycin)	Pseudomonas syrin gae bligh t (Pse udo mon as syrin gae)	Maple, Japanese (Acer palmatum) 'Bloodgood'	Field	Pscheidt	OR	2011	Foliar	No disease developed in this trial. Some indication of abnormal leaf color with 45 and 64 fl oz per 100 gal.
30263	Kasumin (Kasugamycin)	Pseudomonas syrin gae bligh t (Pse udo mon as syrin gae)	Mallow, Rose Mallow (Hibiscus sp.) 'Double Red'	Greenhouse	Norman	FL	2011	Foliar	Less lesion development, though not statistically significant, with 45 fl oz per 100 gal applied twice.
32366	Kasumin (Kasugamycin)	Pseudomonas syrin gae bligh t (Pse udo mon as syrin gae)	Garden Impatiens (Impatiens walleriana) 'Super Elfin XP Violet Improved'	Greenhouse	Norman	FL	2012	Foliar	Significantly reduced number of leaf spots with 64 fl oz per 100 gal applied twice; much inferior to non- inoculated check.

		Pseudomonas							
29567	Kasumin (Kasugamycin)	syrin gae bligh t (Pse udo mon as syrin gae)	Lilac (Syringa sp.) S. vulgaris 'Ellen Willmott'	Field In-	Pscheidt	OR	2010	Foliar	Significantly reduced disease incidence and severity with 45 and 64 fl oz per 100 gal; comparable to Nu-Cop.
28094	Kasumin (Kasugamycin)	Pseudomonas marg inali s (Psu edo mon as marg inali s)	Hydrangea, Oakleaf (Hydrangea quercifolia)	Field	Strandberg	FL	2006	Foliar	No significant efficacy at 64 oz per 100 gal
28523	Kasumin (Kasugamycin)	Xanthomonas sp. (Xan thom onas sp.)	Ornamental Cabbage, Ornamental Kale (Brassica sp.) Kale 'Nagoya Rose'	Greenhouse	Becker	NY	2009	Foliar	Significantly reduced disease severity at 45 fl oz per 100 gal.
28523	Kasumin (Kasugamycin)	Xanthomonas sp. (Xan thom onas sp.)	Ornamental Cabbage, Ornamental Kale (Brassica sp.) Kale 'White Crane	Greenhouse	Becker	NY	2009	Foliar	Reduced disease severity, but not significantly, at 45 fl oz per 100 gal.
30255	Kasumin (Kasugamycin)	Xanthomonas sp. (Xan thom onas sp.)	Poinsettia (Euphorbia pulcherrima ) 'Eckespoint Prestige Red '	Greenhouse	Norman	FL	2011	Foliar	Did not reduce number of leaf spots with 45 fl oz per 100 gal applied twice.
28084	Kasumin (Kasugamycin)	Xanthomonas sp. (Xan	Wax Myrtle (Myrica cerifera)	Field	Strandberg	FL	2006	Foliar	No significant efficacy at 64 oz per 100 gal

		thom onas sp.)							
26721	Kasumin (Kasugamycin)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Maverick Red'	Greenhouse	Reddy	AL	2009	Foliar	Significantly reduced severity of X. campestris at 45 fl oz per 100 gal; inferior to non- inoculated Check.
26721	Kasumin (Kasugamycin)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) P. x hortorum 'Patriot Bright Red'	Greenhouse	Chase	CA	2008	Foliar	No efficacy at 45 fl oz per 100 gal
26721	Kasumin (Kasugamycin)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Bright Red'	Greenhouse	Norman	FL	2009	Foliar	No significant control at 45 fl oz per 100 gal.
26721	Kasumin (Kasugamycin)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Red'	Greenhouse	Norman	FL	2006	Foliar	Poor efficacy at 2 qt per 100 gal
26721	Kasumin (Kasugamycin)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Red'	Greenhouse	Norman	FL	2007	Foliar	Poor efficacy at 1.5 qt per 100 gal
28079	Kasumin (Kasugamycin)	Xanthomonas sp. (Xan thom onas sp.)	Cherry (Non-Bearing) (Prunus sp.) P. incisa x campanulata 'Okame'	Field	Strandberg	FL	2006	Foliar	No efficacy at 64 oz per 100 gal

30070	Kleengrow (Didecyl dimethyl ammonium chloride)	Erwinia (Erwinia sp.)	Pear, Bradford (Non- Bearing) (Pyrus calleryana) 'Cleveland'	Field	Steddom	TX	2012	Foliar	Significantly reduced shoot blight with 50 fl oz per 100 gal applied 6 times (green tip to petal fall).
30070	Kleengrow (Didecyl dimethyl ammonium chloride)	Erwinia (Erwinia sp.)	Pear, Bradford (Non- Bearing) (Pyrus calleryana) 'Kieffer'	Field	Steddom	TX	2010	Foliar	No effect on a very low disease pressure at 25 fl oz per 100 gal; minor injury.
30070	Kleengrow (Didecyl dimethyl ammonium chloride)	Erwinia (Erwinia sp.)	Pear, Bradford (Non- Bearing) (Pyrus calleryana) 'Kieffer'	Field	Steddom	TX	2011	Foliar	No significant control with 50 fl oz per 100 gal applied 6 times.
31307	Kleengrow (Didecyl dimethyl ammonium chloride)	Pseudomonas syrin gae bligh t (Pse udo mon as syrin gae)	Lilac (Syringa sp.) S. vulgaris 'Ellen Willmott'	Field In-	Pscheidt	OR	2012	Foliar	No significant reduction of disease incidence and severity with 25 fl oz per 100 gal.

27673	Kocide 2000 (Dupont) (Copper Hydroxide)	Pseudomonas chic orii (Pse udo mon as chic orii)	Mallow, Rose Mallow (Hibiscus sp.) H. rosa- sinensis	Field	Strandberg	FL	2006	Foliar	No significant efficacy at 1.75 lb per acre
27673	Kocide 2000 (Dupont) (Copper Hydroxide)	Pseudomonas chic orii (Pse udo mon as chic orii)	Mallow, Rose Mallow (Hibiscus sp.) H. rosa- sinensis	Field	Strandberg	FL	2007	Foliar	Slight to moderate disease pressure; no significant efficacy at 2 lb per 100 gal
29088	Kocide 2000 (Dupont) (Copper Hydroxide)	Pseudomonas syrin gae bligh t (Pse udo mon as syrin gae)	Maple, Japanese (Acer palmatum)	Field	Regan	OR	2008	Foliar	No significant difference from untreated check with 2 lb per 100 gal.
27666	Kocide 2000 (Dupont) (Copper Hydroxide)	Pseudomonas marg inali s (Psu edo mon as marg inali s)	Hydrangea, Oakleaf (Hydrangea quercifolia)	Field	Strandberg	FL	2006	Foliar	No significant efficacy at 1.75 lb per acre

27666	Kocide 2000 (Dupont) (Copper Hydroxide)	Pseudomonas marg inali s (Psu edo mon as marg inali s)	Hydrangea, Oakleaf (Hydrangea quercifolia)	Field	Strandberg	FL	2007	Foliar	Moderate to severe disease pressure; no significant differences among treatments
27659	Kocide 2000 (Dupont) (Copper Hydroxide)	Xanthomonas sp. (Xan thom onas sp.)	Wax Myrtle (Myrica cerifera)	Field	Strandberg	FL	2006	Foliar	Statistically significantly suppressed disease at 1.75 lb per acre, but not biologically significant.
27659	Kocide 2000 (Dupont) (Copper Hydroxide)	Xanthomonas sp. (Xan thom onas sp.)	Wax Myrtle (Myrica cerifera)	Field	Strandberg	FL	2007	Foliar	Severe disease pressure; no significant differences among treatments
27573	Kocide 2000 (Dupont) (Copper Hydroxide)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Red'	Greenhouse	Norman	FL	2006	Foliar	Significantly reduced leafspots at 0.75, 1 and 2 lb per 100 gal; considered one of the best treatments
27652	Kocide 2000 (Dupont) (Copper Hydroxide)	Xanthomonas sp. (Xan thom onas sp.)	Cherry (Non-Bearing) (Prunus sp.) P. incisa x campanulata 'Okame'	Field	Strandberg	FL	2006	Foliar	No significant efficacy at 1.75 lb per acre

27652	Kocide 2000 (Dupont) (Copper Hydroxide)	Xanthomonas sp. (Xan thom onas sp.)	Cherry (Non-Bearing) (Prunus sp.) P. incisa x campanulata 'Okame'	Field	Strandberg	FL	2007	Foliar	Severe disease pressure; no significant efficacy at 2 lb per 100 gal
29489	Kocide 3000 (Copper hydroxide)	Xanthomonas sp. (Xan thom onas sp.)	Ornamental Cabbage, Ornamental Kale (Brassica sp.) Kale 'Nagoya Rose'	Greenhouse	Becker	NY	2009	Foliar	Significantly reduced disease severity at 2 lb per 100 gal
29489	Kocide 3000 (Copper hydroxide)	Xanthomonas sp. (Xan thom onas sp.)	Ornamental Cabbage, Ornamental Kale (Brassica sp.) Kale 'White Crane	Greenhouse	Becker	NY	2009	Foliar	Significantly reduced disease severity at 2 lb per 100 gal
31368	Kocide 3000 (Copper hydroxide)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot'	Greenhouse	Norman	FL	2007	Foliar	Good efficacy at 0.75 lb per 100 gal
28091	K-Phite (Phophorus acid salts)	Pseudomonas chic orii (Pse udo mon as chic orii)	Mallow, Rose Mallow (Hibiscus sp.) H. rosa- sinensis	Field	Strandberg	FL	2006	Foliar	No significant efficacy at 5 qt per 100 gal

28096	K-Phite (Phophorus acid salts)	Pseudomonas marg inali s (Psu edo mon as marg inali s)	Hydrangea, Oakleaf (Hydrangea quercifolia)	Field	Strandberg	FL	2006	Foliar	No significant efficacy at 5 qt per 100 gal
28086	K-Phite (Phophorus acid salts)	Xanthomonas sp. (Xan thom onas sp.)	Wax Myrtle (Myrica cerifera)	Field	Strandberg	FL	2006	Foliar	No significant efficacy at 5 qt per 100 gal
27600	K-Phite (Phophorus acid salts)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Red'	Greenhouse	Norman	FL	2007	Foliar	No efficacy at 2 qt per 100 gal
28081	K-Phite (Phophorus acid salts)	Xanthomonas sp. (Xan thom onas sp.)	Cherry (Non-Bearing) (Prunus sp.) P. incisa x campanulata 'Okame'	Field	Strandberg	FL	2006	Foliar	No efficacy at 5 qt per 100 gal
27961	Milsana (now Regalia) (Extract of Reynoutria sachalinensis )	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Red'	Greenhouse	Norman	FL	2007	Foliar	No efficacy at 1 % concentration
30658	NAI-4201 (NAI-4201)	Agrobacterium sp. (Agr obac	Goldenrod (Solidago sp.)	Greenhouse	Chase	CA	2011	Drench	Did not significantly reduce number and size of galls

		teriu m sp.)							with 5 oz per 100 gal.
29215	NAI-4201 (NAI-4201)	Erwinia chry sant hemi (Erw inia chry sant hemi )	Orchid, Dancing Lady (Oncidium sp.)	Greenhouse	Palmeteer	FL	2010	Foliar	Low disease incidence (both inoculated and non-inoculated Checks had 0 disease rating); no significant effect at 5 fl oz per 100 gal.
29197	NAI-4201 (NAI-4201)	Erwinia (Erwinia sp.)	Orchid, Moth (Phalaenops is sp.)	Greenhouse	Norman	FL	2009	Foliar	Very low disease pressure in inoculated Check; not possible to evaluate efficacy of all treatments.
30073	NAI-4201 (NAI-4201)	Erwinia (Erwinia sp.)	Pear, Bradford (Non- Bearing) (Pyrus calleryana) 'Cleveland'	Field	Steddom	ТХ	2012	Foliar	Significantly reduced shoot blight with 5 fl oz per 100 gal applied 6 times (bloom to petal fall).
30073	NAI-4201 (NAI-4201)	Erwinia (Erwinia sp.)	Pear, Bradford (Non- Bearing) (Pyrus calleryana) 'Kieffer'	Field	Steddom	ТХ	2010	Foliar	No effect on a very low disease pressure at 5 fl oz per 100 gal; very minor injury comparable to untreated.
30073	NAI-4201 (NAI-4201)	Erwinia (Erwinia sp.)	Pear, Bradford (Non- Bearing) (Pyrus	Field	Steddom	TX	2011	Foliar	No control with 5 fl oz per 100 gal applied 4 times.

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			calleryana) 'Kieffer'						
			Kiener						
		Pseudomonas		Field					
29581	NAI-4201 (NAI-4201)	chic orii (Pse udo mon as chic orii)	Chrysanthemum, Garden (Chrysanthe mum/Dendr anthema sp.) 'Shasta Improved'		Norman	FL	2012	Drench	Did not significantly reduce leaf spots with 5 fl oz per 100 gal applied twice.
29609	NAI-4201 (NAI-4201)	Pseudomonas sp. (Pse udo mon as sp.)	Bolivian Jasmine (Mandevilla boliviensis) 'Alice DuPont'	Greenhouse	Chase	СА	2010	Foliar	Significantly reduced vine infection but not disease severity at 5 fl oz per 100 gal.
30265	NAI-4201 (NAI-4201)	Pseudomonas syrin gae bligh t (Pse udo mon as syrin gae)	Mallow, Rose Mallow (Hibiscus sp.) 'Double Red'	Greenhouse	Norman	FL	2011	Drench	Slight reduction in lesion development with 5 fl oz per 100 gal applied 3 times.
32364	NAI-4201 (NAI-4201)	Pseudomonas syrin gae bligh t (Pse udo mon as syrin gae)	Garden Impatiens (Impatiens walleriana) 'Super Elfin XP Violet Improved'	Greenhouse	Norman	FL	2012	Foliar	Significantly reduced number of leaf spots with 5 fl oz per 100 gal applied twice; much inferior to non- inoculated check.

30257	NAI-4201 (NAI-4201)	Xanthomonas sp. (Xan thom onas sp.)	Poinsettia (Euphorbia pulcherrima ) 'Eckespoint Prestige Red	Greenhouse	Norman	FL	2011	Drench	Did not significantly reduce number of leaf spots with 5 fl oz per 100 gal applied 3 times.
29203	NAI-4201 (NAI-4201)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Bright Red'	Greenhouse	Norman	FL	2009	Foliar	No significant control at 5 fl oz per 100 gal
31225	Nu-Cop 50DF (Copper Hydroxicide )	Pseudomonas syrin gae bligh t (Pse udo mon as syrin gae)	Maple, Japanese (Acer palmatum) 'Bloodgood'	Field	Pscheidt	OR	2011	Foliar	No disease developed in this trial.
30553	Nu-Cop 50DF (Copper Hydroxicide )	Pseudomonas syrin gae bligh t (Pse udo mon as syrin gae)	Lilac (Syringa sp.) S. vulgaris 'Ellen Willmott'	Field In-	Pscheidt	OR	2010	Foliar	Significantly reduced disease incidence and severity with 1 lb per 100 gal.
27958	Omega Grow Plus (Fish oil)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Red'	Greenhouse	Norman	FL	2007	Foliar	Poor efficacy at 2 % concentration
27580	Penncozeb DF (Mancozeb)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Red'	Greenhouse	Norman	FL	2006	Foliar	Significantly reduced leafspots at 1.5 lb per 100 gal; considered one of the best treatments

27580	Penncozeb DF (Mancozeb)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Red'	Greenhouse	Norman	FL	2007	Foliar	Excellent efficacy at 1.5 lb per 100 gal; considered one of the best treatments
28884	Phyton-27 (Copper sulfate pentahydrate )	Pseudomonas sp. (Pse udo mon as sp.)	Lavender (Lavandula sp.) L. heterophylla 'Patriot Bright Red'	Greenhouse	Chase	CA	2008	Foliar	No efficacy at 50 oz per 100 gal
27590	Phyton-27 (Copper sulfate pentahydrate )	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) P. x hortorum 'Patriot Bright Red'	Greenhouse	Chase	CA	2008	Foliar	76 % reduction at 50 fl oz per 100 gal
27590	Phyton-27 (Copper sulfate pentahydrate )	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Red'	Greenhouse	Norman	FL	2006	Foliar	Good efficacy at 50 oz per 100 gal; equal to Kocide
27590	Phyton-27 (Copper sulfate pentahydrate )	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Red'	Greenhouse	Norman	FL	2007	Foliar	Good efficacy at 50 oz per 100 gal
27667	Phyton-27 New Dimension (Copper sulphate pentahydrate )	Pseudomonas chic orii (Pse udo mon as chic orii)	Mallow, Rose Mallow (Hibiscus sp.) H. rosa- sinensis	Field	Strandberg	FL	2007	Foliar	Slight to moderate disease pressure; no significant efficacy at 25 oz per 100 gal
27660	Phyton-27 New Dimension (Copper sulphate pentahydrate )	Pseudomonas marg inali s (Psu edo mon as	Hydrangea, Oakleaf (Hydrangea quercifolia)	Field	Strandberg	FL	2007	Foliar	Moderate to severe disease pressure; no significant differences among treatments

		marg inali s)							
27653	Phyton-27 New Dimension (Copper sulphate pentahydrate )	Xanthomonas sp. (Xan thom onas sp.)	Wax Myrtle (Myrica cerifera)	Field	Strandberg	FL	2007	Foliar	Severe disease pressure; no significant differences among treatments
27646	Phyton-27 New Dimension (Copper sulphate pentahydrate )	Xanthomonas sp. (Xan thom onas sp.)	Cherry (Non-Bearing) (Prunus sp.) P. incisa x campanulata 'Okame'	Field	Strandberg	FL	2007	Foliar	Severe disease pressure; no significant efficacy at 25 oz per 100 gal
30322	Protect T/O (Mancozeb)	Erwinia (Erwinia sp.)	Orchid, Moth (Phalaenops is sp.)	Greenhouse	Norman	FL	2010	Foliar	Significantly reduced leaf lesion size at 2 lb per 100 gal; almost comparable to non-inoculated check.
30321	Protect T/O (Mancozeb)	Pseudomonas chic orii (Pse udo mon as chic orii)	Chrysanthemum, Garden (Chrysanthe mum/Dendr anthema sp.)	Field	Norman	FL	2010	Foliar	Significantly reduced leaf lesion incidence at 2 lb per 100 gal; almost comparable to CuPro.
29090	Protect T/O (Mancozeb)	Pseudomonas syrin gae bligh	Maple, Japanese (Acer palmatum)	Field	Regan	OR	2008	Foliar	No significant difference from untreated check with 2 lb per 100 gal.

		t (Pse udo mon as syrin gae)							
312.	33 Protect T/O (Mancozeb)	Pseudomonas syrin gae bligh t (Pse udo mon as syrin gae)	Mallow, Rose Mallow (Hibiscus sp.) 'Double Red'	Greenhouse	Norman	FL	2011	Foliar	No lesion development, though not statistically significant, with 2 lb per 100 gal applied twice.
312	30 Protect T/O (Mancozeb)	Xanthomonas sp. (Xan thom onas sp.)	Poinsettia (Euphorbia pulcherrima ) 'Eckespoint Prestige Red	Greenhouse	Norman	FL	2011	Foliar	Significantly reduced number of leaf spots with 2 lb per 100 gal applied twice; comparable to non-inoculated check.
306:	59 Regalia O5 (MOI-10605) (Extract of Reynoutria sachalinensis )	Agrobacterium sp. (Agr obac teriu m sp.)	Goldenrod (Solidago sp.)	Greenhouse	Chase	СА	2011	Foliar	Did not significantly reduce number and size of galls with 1 % conc.
295	Regalia O5 (MOI-10605) (Extract of Reynoutria sachalinensis )	Erwinia chry sant hemi (Erw inia chry sant hemi )	Orchid, Dancing Lady (Oncidium sp.)	Greenhouse	Palmeteer	FL	2010	Foliar	Low disease incidence (both inoculated and non-inoculated Checks had 0 disease rating); no significant effect at 1 % (v/v).

29202	Regalia O5 (MOI-10605) (Extract of Reynoutria sachalinensis )	Erwinia (Erwinia sp.)	Orchid, Moth (Phalaenops is sp.)	Greenhouse	Norman	FL	2009	Foliar	Very low disease pressure in inoculated Check; not possible to evaluate efficacy of all treatments.
29202	Regalia O5 (MOI-10605) (Extract of Reynoutria sachalinensis )	Erwinia (Erwinia sp.)	Orchid, Moth (Phalaenops is sp.)	Greenhouse	Norman	FL	2010	Foliar	Did not significantly reduce leaf lesion size at 1 % conc.
30451	Regalia O5 (MOI-10605) (Extract of Reynoutria sachalinensis )	Erwinia (Erwinia sp.)	Pear, Bradford (Non- Bearing) (Pyrus calleryana) 'Cleveland'	Field	Steddom	TX	2012	Foliar	Did not reduce shoot blight with 1 qt per 10 gal applied 6 times (bloom to petal fall).
30451	Regalia O5 (MOI-10605) (Extract of Reynoutria sachalinensis )	Erwinia (Erwinia sp.)	Pear, Bradford (Non- Bearing) (Pyrus calleryana) 'Kieffer'	Field	Steddom	TX	2011	Foliar	No significant control with 1 % v:v applied 6 times.
29580	Regalia O5 (MOI-10605) (Extract of Reynoutria sachalinensis )	Pseudomonas chic orii (Pse udo mon as chic orii)	Chrysanthemum, Garden (Chrysanthe mum/Dendr anthema sp.)	Field	Norman	FL	2010	Foliar	Significantly reduced leaf lesion incidence at 1 % conc.; almost comparable to CuPro.
29580	Regalia O5 (MOI-10605) (Extract of	Pseudomonas chic	Chrysanthemum, Garden (Chrysanthe	Field	Norman	FL	2012	Foliar	Did not reduce leaf spots with 1 % v/v

	Reynoutria sachalinensis )	orii (Pse udo mon as chic orii)	mum/Dendr anthema sp.) 'Shasta Improved'						conc. applied twice.
30208	Regalia O5 (MOI-10605) (Extract of Reynoutria sachalinensis )	Pseudomonas syrin gae bligh t (Pse udo mon as syrin gae)	Maple, Japanese (Acer palmatum) 'Bloodgood'	Field	Pscheidt	OR	2011	Foliar	No disease developed in this trial.
30264	Regalia O5 (MOI-10605) (Extract of Reynoutria sachalinensis )	Pseudomonas syrin gae bligh t (Pse udo mon as syrin gae)	Mallow, Rose Mallow (Hibiscus sp.) 'Double Red'	Greenhouse	Norman	FL	2011	Foliar	Less lesion development, though not statistically significant, with 1 % v:v applied twice.
32361	Regalia O5 (MOI-10605) (Extract of Reynoutria sachalinensis )	Pseudomonas syrin gae bligh t (Pse udo mon as syrin gae)	Garden Impatiens (Impatiens walleriana) 'Super Elfin XP Violet Improved'	Greenhouse	Norman	FL	2012	Foliar	Significantly reduced number of leaf spots with 1 gal per 100 gal applied twice; much inferior to non- inoculated check.
30256	Regalia O5 (MOI-10605) (Extract of Reynoutria	Xanthomonas sp. (Xan thom	Poinsettia (Euphorbia pulcherrima )	Greenhouse	Norman	FL	2011	Foliar	Did not reduce number of leaf spots with

	sachalinensis )	onas sp.)	'Eckespoint Red Velvet'						1 % v:v applied twice.
29204	Regalia O5 (MOI-10605) (Extract of Reynoutria sachalinensis )	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Bright Red'	Greenhouse	Norman	FL	2009	Foliar	Good control at 1 % dilution; comparable to CuPro and non-inoculated Check.
28936	Regalia SC (MOI 106) (Extract of Reynoutria sachalinensis )	Erwinia (Erwinia sp.)	Pear, Bradford (Non- Bearing) (Pyrus calleryana) 'Kieffer'	Field	Steddom	TX	2010	Foliar	No effect on a very low disease pressure at 1 % conc.; virtually no injury.
28393	Regalia SC (MOI 106) (Extract of Reynoutria sachalinensis )	Pseudomonas sp. (Pse udo mon as sp.)	Lavender (Lavandula sp.) L. heterophylla 'Patriot Bright Red'	Greenhouse	Chase	CA	2008	Foliar	No efficacy at 1 % + Nu- Film P
29610	Regalia SC (MOI 106) (Extract of Reynoutria sachalinensis )	Pseudomonas sp. (Pse udo mon as sp.)	Bolivian Jasmine (Mandevilla boliviensis) 'Alice DuPont'	Greenhouse	Chase	CA	2010	Foliar	Significantly reduced disease severity and vine infection at 1 % solution.
29572	Regalia SC (MOI 106) (Extract of Reynoutria sachalinensis )	Pseudomonas syrin gae bligh t (Pse udo mon as syrin gae)	Lilac (Syringa sp.) S. vulgaris 'Ellen Willmott'	Field In-	Pscheidt	OR	2010	Foliar	No reduction of disease incidence and severity with 1 gal per 100 gal.
29572	Regalia SC (MOI 106) (Extract of Reynoutria	Pseudomonas syrin gae	Lilac (Syringa sp.) S. vulgaris	Field In-	Pscheidt	OR	2012	Foliar	No significant reduction of disease incidence and
	sachalinensis )	bligh t (Pse udo mon	'Ellen Willmott'						severity with 1 gal per 100 gal.
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		as syrin gae)							
28044	Regalia SC (MOI 106) (Extract of Reynoutria sachalinensis )	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) P. x hortorum 'Patriot Bright Red'	Greenhouse	Chase	СА	2008	Foliar	45 % reduction at 1 % + Nu- Film P
27696	Rotation: Tricon / Phyton New Dimension (Sodium borate decahydrate / copper pentahydrate )	Pseudomonas chic orii (Pse udo mon as chic orii)	Mallow, Rose Mallow (Hibiscus sp.) H. rosa- sinensis	Field	Strandberg	FL	2007	Foliar	Slight to moderate disease pressure; fair efficacy at 0.8 % / 25 oz per 100 gal
27695	Rotation: Tricon / Phyton New Dimension (Sodium borate decahydrate / copper pentahydrate )	Pseudomonas marg inali s (Psu edo mon as marg inali s)	Hydrangea, Oakleaf (Hydrangea quercifolia)	Field	Strandberg	FL	2007	Foliar	Moderate to severe disease pressure; no significant differences among treatments
27694	Rotation: Tricon / Phyton New Dimension (Sodium borate decahydrate / copper pentahydrate )	Xanthomonas sp. (Xan thom onas sp.)	Wax Myrtle (Myrica cerifera)	Field	Strandberg	FL	2007	Foliar	Severe disease pressure; no significant differences among treatments

Γ					Field					
	27693	Rotation: Tricon / Phyton New Dimension (Sodium borate decahydrate / copper pentahydrate )	Xanthomonas sp. (Xan thom onas sp.)	Cherry (Non-Bearing) (Prunus sp.) P. incisa x campanulata 'Okame'		Strandberg	FL	2007	Foliar	Severe disease pressure; no significant efficacy at 0.8 % / 25 oz per 100
	28040	SP2015 (SP2015)	Erwinia chry sant hemi (Erw inia chry sant hemi )	Poinsettia (Euphorbia pulcherrima ) 'Prestige' and 'Autumn Red'	Greenhouse	Chase	CA	2009	Foliar	Reduced infection, though not statistically significant from inoculated Check, at 12 oz per 100 gal.
	29216	SP2015 (SP2015)	Erwinia chry sant hemi (Erw inia chry sant hemi )	Orchid, Dancing Lady (Oncidium sp.)	Greenhouse	Palmeteer	FL	2010	Foliar	Low disease incidence (both inoculated and non-inoculated Checks had 0 disease rating); no significant effect at 12 oz per 100 gal.
	29216	SP2015 (SP2015)	Erwinia chry sant hemi (Erw inia chry sant hemi )	Orchid, Dancing Lady (Oncidium sp.) 'Wilson's Wicked Qua'	Greenhouse	Chase	CA	2009	Foliar	Reduced infection, though not statistically significant from inoculated Check, at 12 oz per 100 gal.
	29198	SP2015 (SP2015)	Erwinia (Erwinia sp.)	Orchid, Moth (Phalaenops is sp.)	Greenhouse	Norman	FL	2009	Foliar	Very low disease pressure in inoculated Check; not possible to

		Frwinia (Frwinia	Orchid, Moth						evaluate efficacy of all treatments. Did not reduce leaf lesion
29198	SP2015 (SP2015)	sp.)	(Phalaenops is sp.)	Greenhouse	Norman	FL	2010	Foliar	size at 12 oz per 100 gal.
28802	SP2015 (SP2015)	Erwinia (Erwinia sp.)	Pear, Bradford (Non- Bearing) (Pyrus calleryana) 'Kieffer'	Field	Steddom	TX	2010	Foliar	No effect on a very low disease pressure at 12 oz per 100 gal; virtually no injury.
29578	SP2015 (SP2015)	Pseudomonas chic orii (Pse udo mon as chic orii)	Chrysanthemum, Garden (Chrysanthe mum/Dendr anthema sp.)	Field	Norman	FL	2010	Foliar	Did not reduce leaf lesion incidence at 12 oz per 100 gal.
28390	SP2015 (SP2015)	Pseudomonas sp. (Pse udo mon as sp.)	Lavender (Lavandula sp.) L. heterophylla 'Patriot Bright Red'	Greenhouse	Chase	CA	2008	Foliar	No efficacy at 12 oz per 100 gal
29611	SP2015 (SP2015)	Pseudomonas sp. (Pse udo mon as sp.)	Bolivian Jasmine (Mandevilla boliviensis) 'Alice DuPont'	Greenhouse	Chase	CA	2010	Foliar	No significant control at 12 oz per 100 gal.
27569	SP2015 (SP2015)	Pseudomonas syrin gae bligh t (Pse	Maple, Japanese (Acer palmatum)	Field	Regan	OR	2008	Foliar	No significant difference from untreated check with 12 oz per 100 gal.

		udo mon as syrin gae)							
28524	SP2015 (SP2015)	Xanthomonas sp. (Xan thom onas sp.)	Ornamental Cabbage, Ornamental Kale (Brassica sp.) Kale 'Nagoya Rose'	Greenhouse	Becker	NY	2009	Foliar	Significantly reduced disease severity at 12 oz per 100 gal.
28524	SP2015 (SP2015)	Xanthomonas sp. (Xan thom onas sp.)	Ornamental Cabbage, Ornamental Kale (Brassica sp.) Kale 'White Crane	Greenhouse	Becker	NY	2009	Foliar	Reduced disease severity, but not significantly, at 12 oz per 100 gal.
27750	SP2015 (SP2015)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Maverick Red'	Greenhouse	Reddy	AL	2009	Foliar	Significantly reduced severity of X. campestris at 12 fl oz per 100 gal; inferior to non- inoculated Check.
27750	SP2015 (SP2015)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) P. x hortorum 'Patriot Bright Red'	Greenhouse	Chase	CA	2008	Foliar	No efficacy at 12 oz per 100 gal
27750	SP2015 (SP2015)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Bright Red'	Greenhouse	Norman	FL	2009	Foliar	No control at 12 oz per 100 gal.
28041	Taegro (Bacillus subtilis var amyloliquefa ciens strain FZB24)	Erwinia chry sant hemi (Erw inia chry	Poinsettia (Euphorbia pulcherrima ) 'Prestige' and 'Autumn Red'	Greenhouse	Chase	CA	2009	Foliar	Significantly reduced infection at 12 oz per 100 gal; comparable to uninoculated Check.

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29217	Taegro (Bacillus subtilis var amyloliquefa ciens strain FZB24)	Erwinia chry sant hemi (Erw inia chry sant hemi )	Orchid, Dancing Lady (Oncidium sp.)	Greenhouse	Palmeteer	FL	2010	Foliar	Low disease incidence (both inoculated and non-inoculated Checks had 0 disease rating); no significant effect at 3.5 oz per 100 gal.
29217	Taegro (Bacillus subtilis var amyloliquefa ciens strain FZB24)	Erwinia chry sant hemi (Erw inia chry sant hemi )	Orchid, Dancing Lady (Oncidium sp.) 'Wilson's Wicked Qua'	Greenhouse	Chase	CA	2009	Drench	Higher infection than inoculated Check at 3.5 oz per 100 gal
29199	Taegro (Bacillus subtilis var amyloliquefa ciens strain FZB24)	Erwinia (Erwinia sp.)	Orchid, Moth (Phalaenops is sp.)	Greenhouse	Norman	FL	2009	Foliar	Very low disease pressure in inoculated Check; not possible to evaluate efficacy of all treatments.
29199	Taegro (Bacillus subtilis var amyloliquefa ciens strain FZB24)	Erwinia (Erwinia sp.)	Orchid, Moth (Phalaenops is sp.)	Greenhouse	Norman	FL	2010	Foliar	Did not significantly reduce leaf lesion size at 3.5 oz per 100 gal.
28803	Taegro (Bacillus subtilis var amyloliquefa ciens strain FZB24)	Erwinia (Erwinia sp.)	Pear, Bradford (Non- Bearing) (Pyrus calleryana) 'Kieffer'	Field	Steddom	TX	2010	Foliar /	No effect on a very low disease pressure at 3.5 oz per 100 gal; very minor injury comparable to untreated.

29579	Taegro (Bacillus subtilis var amyloliquefa ciens strain FZB24)	Pseudomonas chic orii (Pse udo mon as chic orii)	Chrysanthemum, Garden (Chrysanthe mum/Dendr anthema sp.)	Field	Norman	FL	2010	Foliar	Significantly reduced leaf lesion incidence at 3.5 oz per 100 gal but much inferior to CuPro.
28391	Taegro (Bacillus subtilis var amyloliquefa ciens strain FZB24)	Pseudomonas sp. (Pse udo mon as sp.)	Lavender (Lavandula sp.) L. heterophylla 'Patriot Bright Red'	Greenhouse	Chase	СА	2008	Drench	No efficacy at 3.5 oz per 100 gal
29612	Taegro (Bacillus subtilis var amyloliquefa ciens strain FZB24)	Pseudomonas sp. (Pse udo mon as sp.)	Bolivian Jasmine (Mandevilla boliviensis) 'Alice DuPont'	Greenhouse	Chase	CA	2010	Foliar /	No significant control at 3.5 oz per 100 gal.
27570	Taegro (Bacillus subtilis var amyloliquefa ciens strain FZB24)	Pseudomonas syrin gae bligh t (Pse udo mon as syrin gae)	Maple, Japanese (Acer palmatum)	Field	Regan	OR	2008	Foliar /	No significant difference from untreated check with 3.5 oz per 100 gal.
28525	Taegro (Bacillus subtilis var amyloliquefa ciens strain FZB24)	Xanthomonas sp. (Xan thom onas sp.)	Ornamental Cabbage, Ornamental Kale (Brassica sp.) Kale 'Nagoya Rose'	Greenhouse	Becker	NY	2009	Foliar	Significantly reduced disease severity at 3.5 oz per 100 gal.

28525	Taegro (Bacillus subtilis var amyloliquefa ciens strain FZB24)	Xanthomonas sp. (Xan thom onas sp.)	Ornamental Cabbage, Ornamental Kale (Brassica sp.) Kale 'White Crane'	Greenhouse	Becker	NY	2009	Foliar	Reduced disease severity, but not significant, at 3.5 oz per 100 gal.
27749	Taegro (Bacillus subtilis var amyloliquefa ciens strain FZB24)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Maverick Red'	Greenhouse	Reddy	AL	2009	Foliar	Significantly reduced severity of X. campestris at 3.5 oz per 100 gal; inferior to non-inoculated Check.
27749	Taegro (Bacillus subtilis var amyloliquefa ciens strain FZB24)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) P. x hortorum 'Patriot Bright Red'	Greenhouse	Chase	CA	2008	Drench /	No efficacy at 3.5 oz per 100 gal
27749	Taegro (Bacillus subtilis var amyloliquefa ciens strain FZB24)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Bright Red'	Greenhouse	Norman	FL	2009	Foliar	First Trial: No control at 3.5 oz per 100 gal.
28092	Tank Mix: Actinovate + Tricon (Streptomyc es lydicus WYEC 108 + Sodium tetraborahyd rate deceahydrate )	Pseudomonas chic orii (Pse udo mon as chic orii)	Mallow, Rose Mallow (Hibiscus sp.) H. rosa- sinensis	Field	Strandberg	FL	2006	Foliar	Significantly suppressed disease at 3.4 g + 15 ml per gal; the only effective treatment at about 50% control.
28097	Tank Mix: Actinovate + Tricon (Streptomyc es lydicus WYEC 108 + Sodium tetraborahyd rate	Pseudomonas chic orii (Pse udo mon as	Hydrangea, Oakleaf (Hydrangea quercifolia)	Field	Strandberg	FL	2006	Foliar	Significantly suppressed disease at 3.4 g + 15 ml per gal; the only effective treatment at about 50 % efficacy.

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28087	Tank Mix: Actinovate + Tricon (Streptomyc es lydicus WYEC 108 + Sodium tetraborahyd rate deceahydrate )	Xanthomonas sp. (Xan thom onas sp.)	Wax Myrtle (Myrica cerifera)	Field	Strandberg	FL	2006	Foliar	Statistically significantly suppressed disease at 3.4 g + 15 ml per gal, but not biologically significant.
28082	Tank Mix: Actinovate + Tricon (Streptomyc es lydicus WYEC 108 + Sodium tetraborahyd rate deceahydrate )	Xanthomonas sp. (Xan thom onas sp.)	Cherry (Non-Bearing) (Prunus sp.) P. incisa x campanulata 'Okame'	Field	Strandberg	FL	2006	Foliar	Statistically significantly suppressed disease at 3.4 g + 15 ml per gal but not biologically significant.
27671	Tank Mix: BioPhos + Chelated Copper (Phosphorus acid + chelated copper)	Pseudomonas chic orii (Pse udo mon as chic orii)	Mallow, Rose Mallow (Hibiscus sp.) H. rosa- sinensis	Field	Strandberg	FL	2006	Foliar	No efficacy at 2 % concentration + 0.1 lb ai per acre
27671	Tank Mix: BioPhos + Chelated Copper (Phosphorus acid + chelated copper)	Pseudomonas chic orii (Pse udo mon as chic orii)	Mallow, Rose Mallow (Hibiscus sp.) H. rosa- sinensis	Field	Strandberg	FL	2007	Foliar	Slight to moderate disease pressure; no significant efficacy at 2 % + 0.1 lb ai per 100 gal

27664	Tank Mix: BioPhos + Chelated Copper (Phosphorus acid + chelated copper)	Pseudomonas marg inali s (Psu edo mon as marg inali s)	Hydrangea, Oakleaf (Hydrangea quercifolia)	Field	Strandberg	FL	2006	Foliar	Poor efficacy at 2 % concentration + 0.1 lb ai per acre
27664	Tank Mix: BioPhos + Chelated Copper (Phosphorus acid + chelated copper)	Pseudomonas marg inali s (Psu edo mon as marg inali s)	Hydrangea, Oakleaf (Hydrangea quercifolia)	Field	Strandberg	FL	2007	Foliar	Moderate to severe disease pressure; no significant differences among treatments
27657	Tank Mix: BioPhos + Chelated Copper (Phosphorus acid + chelated copper)	Xanthomonas sp. (Xan thom onas sp.)	Wax Myrtle (Myrica cerifera)	Field	Strandberg	FL	2006	Foliar	No significant efficacy at 2 % concentration + 0.1 lb ai per acre
27657	Tank Mix: BioPhos + Chelated Copper (Phosphorus acid + chelated copper)	Xanthomonas sp. (Xan thom onas sp.)	Wax Myrtle (Myrica cerifera)	Field	Strandberg	FL	2007	Foliar	Severe disease pressure; no significant differences among treatments
27650	Tank Mix: BioPhos + Chelated	Xanthomonas sp. (Xan	Cherry (Non-Bearing) (Prunus sp.)	Field	Strandberg	FL	2006	Foliar	No significant efficacy at 2 %

	Copper (Phosphorus acid + chelated copper)	thom onas sp.)	P. incisa x campanulata 'Okame'						concentration + 0.1 lb ai per acre
27650	Tank Mix: BioPhos + Chelated Copper (Phosphorus acid + chelated copper)	Xanthomonas sp. (Xan thom onas sp.)	Cherry (Non-Bearing) (Prunus sp.) P. incisa x campanulata 'Okame'	Field	Strandberg	FL	2007	Foliar	Severe disease pressure; no significant efficacy at 2 % + 0.1 lb ai per 100 gal
29226	Tank Mix: Cease + Milstop (Bacillus subtilis + potassium bicarbonate)	Erwinia chry sant hemi (Erw inia chry sant hemi )	Orchid, Dancing Lady (Oncidium sp.)	Greenhouse	Palmeteer	FL	2010	Foliar	Low disease incidence (both inoculated and non-inoculated Checks had 0 disease rating); no significant effect at 1 % (v/v) + 2.5 lb per 100 gal.
28937	Tank Mix: Cease + Milstop (Bacillus subtilis + potassium bicarbonate)	Erwinia (Erwinia sp.)	Pear, Bradford (Non- Bearing) (Pyrus calleryana) 'Cleveland'	Field	Steddom	TX	2012	Foliar	Did not significantly reduce shoot blight with 4 qt + 3 lb per 100 gal applied 6 times (bloom to petal fall).
28937	Tank Mix: Cease + Milstop (Bacillus subtilis + potassium bicarbonate)	Erwinia (Erwinia sp.)	Pear, Bradford (Non- Bearing) (Pyrus calleryana) 'Kieffer'	Field	Steddom	ТХ	2011	Foliar	No significant control with 4 qt + 3 lb per 100 gal applied 5 times.

27668	Tank Mix: Kasumin + Kocide (Kasugamyc in + copper hydroxide)	Pseudomonas chic orii (Pse udo mon as chic orii)	Mallow, Rose Mallow (Hibiscus sp.) H. rosa- sinensis	Field	Strandberg	FL	2007	Foliar	Slight to moderate disease pressure; poor efficacy at 1 gal + 2 lb per 100 gal
27661	Tank Mix: Kasumin + Kocide (Kasugamyc in + copper hydroxide)	Pseudomonas marg inali s (Psu edo mon as marg inali s)	Hydrangea, Oakleaf (Hydrangea quercifolia)	Field	Strandberg	FL	2007	Foliar	Moderate to severe disease pressure; no significant differences among treatments
27654	Tank Mix: Kasumin + Kocide (Kasugamyc in + copper hydroxide)	Xanthomonas sp. (Xan thom onas sp.)	Wax Myrtle (Myrica cerifera)	Field	Strandberg	FL	2007	Foliar	Severe disease pressure; no significant differences among treatments
27581	Tank Mix: Kasumin + Kocide (Kasugamyc in + copper hydroxide)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Red'	Greenhouse	Norman	FL	2006	Foliar	Significantly reduced leafspots at 2 qt + 2 lb per 100 gal; considered one of the best treatments
27647	Tank Mix: Kasumin + Kocide	Xanthomonas sp. (Xan	Cherry (Non-Bearing) (Prunus sp.)	Field	Strandberg	FL	2007	Foliar	Severe disease pressure; no significant

	(Kasugamyc in + copper hydroxide)	thom onas sp.)	P. incisa x campanulata 'Okame'						efficacy at 1 gal + 2 lb per 100 gal
31445	Tank Mix: Kocide + Kleengrow (Copper Hydroxide + Didecyl dimethyl ammonium chloride)	Erwinia (Erwinia sp.)	Pear, Bradford (Non- Bearing) (Pyrus calleryana) 'Cleveland'	Field	Steddom	TX	2012	Foliar	Significantly reduced shoot blight with 50 fl oz + 2 lb per 100 gal applied 5 times (green tip to petal fall).
27670	Tank Mix: K-Phite + Tricon (Phophorus acid salts + Sodium tetraborahyd rate deceahydrate )	Pseudomonas chic orii (Pse udo mon as chic orii)	Mallow, Rose Mallow (Hibiscus sp.) H. rosa- sinensis	Field	Strandberg	FL	2007	Foliar	Slight to moderate disease pressure; no significant efficacy at 2 qt + 0.4 % per 100 gal
27663	Tank Mix: K-Phite + Tricon (Phophorus acid salts + Sodium tetraborahyd rate deceahydrate )	Pseudomonas marg inali s (Psu edo mon as marg inali s)	Hydrangea, Oakleaf (Hydrangea quercifolia)	Field	Strandberg	FL	2007	Foliar	Moderate to severe disease pressure; no significant differences among treatments
27656	Tank Mix: K-Phite + Tricon (Phophorus acid salts + Sodium	Xanthomonas sp. (Xan thom onas sp.)	Wax Myrtle (Myrica cerifera)	Field	Strandberg	FL	2007	Foliar	Severe disease pressure; no significant differences among treatments

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	tetraborahyd rate deceahydrate )								
27649	Tank Mix: K-Phite + Tricon (Phophorus acid salts + Sodium tetraborahyd rate deceahydrate )	Xanthomonas sp. (Xan thom onas sp.)	Cherry (Non-Bearing) (Prunus sp.) P. incisa x campanulata 'Okame'	Field	Strandberg	FL	2007	Foliar	Severe disease pressure; no significant efficacy at 2 qt + 0.4 % per 100 gal
27595	Tank Mix: K-Phyte + Kocide 2000 (Phophorus acid salts + copper hydroxide)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Red'	Greenhouse	Norman	FL	2006	Foliar	Significantly reduced leafspots at 2 qt + 2 lb per 100 gal; considered one of the best treatments
27596	Tank Mix: K-Phyte + Penncozeb (Phophorus acid salts + mancozeb)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Red'	Greenhouse	Norman	FL	2006	Foliar	Significantly reduced leafspots at 2 qt + 1.5 lb per 100 gal; considered one of the best treatments
27597	Tank Mix: K-Phyte + Phyton (Phophorus acid salts + copper sulfate pentahydrate )	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Red'	Greenhouse	Norman	FL	2006	Foliar	Significantly reduced leafspots at 2 qt + 50 oz per 100 gal; equal to Kocide T-M
27592	Tank Mix: Physpe + Kocide 2000 (Laminarin + copper hydroxide)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Red'	Greenhouse	Norman	FL	2006	Foliar	Significantly reduced leafspots at 58 oz + 2 lb per 100 gal; considered one of the best treatments

27594	Tank Mix: Physpe + Penncozeb (Laminarin + mancozeb)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Red'	Greenhouse	Norman	FL	2006	Foliar	No efficacy at 58 oz + 1.5 lb per 100 gal
27593	Tank Mix: Physpe + Phyton (Laminarin + copper sulfate pentahydrate )	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Red'	Greenhouse	Norman	FL	2006	Foliar	Significantly reduced leafspots at 58 + 50 oz per 100 gal; equal to Kocide T-M
30512	Tank Mix: Rezist + Sett (Chelated Copper/Man ganese/Zinc + Calcium/Bor on + surfactant)	Erwinia chry sant hemi (Erw inia chry sant hemi )	Poinsettia (Euphorbia pulcherrima ) 'Prestige' and 'Autumn Red'	Greenhouse	Chase	CA	2009	Foliar	At 32 oz for both products, disease was significanly less than the inoculated control.
27586	Tank Mix: Rhapsody + Actinovate (Bacillus subtilis + Streptomyce s lydicus WYEC 108)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Red'	Greenhouse	Norman	FL	2006	Foliar	No efficacy at 8 qt + 12 oz per 100 gal
27583	Tank Mix: Rhapsody + Kocide (Bacillus subtilis + copper hydroxide)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Red'	Greenhouse	Norman	FL	2006	Foliar	Significantly reduced leafspots at 8 qt + 2 lb per 100 gal; considered one of the best treatments
28090	Tank Mix: Rhapsody + Kocide 2000 + Vital (Bacillus subtilis + Copper hydroxide + phosphite)	Pseudomonas chic orii (Pse udo mon as	Mallow, Rose Mallow (Hibiscus sp.) H. rosa- sinensis	Field	Strandberg	FL	2006	Foliar	No significant efficacy at 1 % concentration + 1.5 lb + 4 pt per acre

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28095	Tank Mix: Rhapsody + Kocide 2000 + Vital (Bacillus subtilis + Copper hydroxide + phosphite)	OTII) Pseudomonas marg inali s (Psu edo mon as marg inali s)	Hydrangea, Oakleaf (Hydrangea quercifolia)	Field	Strandberg	FL	2006	Foliar	No significant efficacy at 1 % concentration + 1.5 lb + 4 pt per acre
28085	Tank Mix: Rhapsody + Kocide 2000 + Vital (Bacillus subtilis + Copper hydroxide + phosphite)	Xanthomonas sp. (Xan thom onas sp.)	Wax Myrtle (Myrica cerifera)	Field	Strandberg	FL	2006	Foliar	Statistically significantly suppressed disease at 1 % concentration + 1.5 lb + 4 pt per acre, but not biologically significant.
28080	Tank Mix: Rhapsody + Kocide 2000 + Vital (Bacillus subtilis + Copper hydroxide + phosphite)	Xanthomonas sp. (Xan thom onas sp.)	Cherry (Non-Bearing) (Prunus sp.) P. incisa x campanulata 'Okame'	Field	Strandberg	FL	2006	Foliar	No significant efficacy at 1 % concentration + 1.5 lb + 4 pt per acre
27585	Tank Mix: Rhapsody + K- Phyte (Bacillus subtilis + phosphorus acid salts)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Red'	Greenhouse	Norman	FL	2006	Foliar	Poor efficacy at 8 qt + 2 qt per 100 gal
27584	Tank Mix: Rhapsody + Penncozeb (Bacillus subtilis + mancozeb)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Red'	Greenhouse	Norman	FL	2006	Foliar	Significantly reduced leafspots at 8 qt + 1.5 lb per 100 gal; considered one

									of the best treatments
27587	Tank Mix: Rhapsody + Phyton (Bacillus subtilis + copper sulfate pentahydrate )	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Red'	Greenhouse	Norman	FL	2006	Foliar	Significantly reduced leafspots at 8 qt + 50 oz per 100 gal; equal to Kocide T- M's
28042	Tank Mix: SP2015 + CuPRO 2005 (Famoxadon e + Cymoxanil + Copper)	Erwinia chry sant hemi (Erw inia chry sant hemi )	Poinsettia (Euphorbia pulcherrima ) 'Prestige' and 'Autumn Red'	Greenhouse	Chase	CA	2009	Foliar	Reduced infection, though not statistically significant from inoculated Check, at 8 oz + 2 lb per 100 gal.
29218	Tank Mix: SP2015 + CuPRO 2005 (Famoxadon e + Cymoxanil + Copper)	Erwinia chry sant hemi (Erw inia chry sant hemi )	Orchid, Dancing Lady (Oncidium sp.)	Greenhouse	Palmeteer	FL	2010	Foliar	Low disease incidence (both inoculated and non-inoculated Checks had 0 disease rating); no significant effect at 8 oz + 2 lb per 100 gal.
29218	Tank Mix: SP2015 + CuPRO 2005 (Famoxadon e + Cymoxanil + Copper)	Erwinia chry sant hemi (Erw inia chry sant hemi )	Orchid, Dancing Lady (Oncidium sp.) 'Wilson's Wicked Qua'	Greenhouse	Chase	CA	2009	Foliar	Reduced infection, though not statistically significant from inoculated Check, at 8 oz + 2 lb per 100 gal.
29200	Tank Mix: SP2015 + CuPRO 2005 (Famoxadon	Erwinia (Erwinia sp.)	Orchid, Moth (Phalaenops is sp.)	Greenhouse	Norman	FL	2009	Foliar	Very low disease pressure in inoculated Check; not possible to

	e + Cymoxanil + Copper)								evaluate efficacy of all treatments.
29200	Tank Mix: SP2015 + CuPRO 2005 (Famoxadon e + Cymoxanil + Copper)	Erwinia (Erwinia sp.)	Orchid, Moth (Phalaenops is sp.)	Greenhouse	Norman	FL	2010	Foliar	Significantly reduced leaf lesion size at 8 oz + 2 lb per 100 gal; almost comparable to CuPro and non-inoculated check.
28804	Tank Mix: SP2015 + CuPRO 2005 (Famoxadon e + Cymoxanil + Copper)	Erwinia (Erwinia sp.)	Pear, Bradford (Non- Bearing) (Pyrus calleryana) 'Kieffer'	Field	Steddom	TX	2010	Foliar	No effect on a very low disease pressure at 8 oz + 2 lb per 100 gal; very minor injury comparable to untreated.
29900	Tank Mix: SP2015 + CuPRO 2005 (Famoxadon e + Cymoxanil + Copper)	Pseudomonas chic orii (Pse udo mon as chic orii)	Chrysanthemum, Garden (Chrysanthe mum/Dendr anthema sp.)	Field	Norman	FL	2010	Foliar	Significantly reduced leaf lesion incidence at 8 oz + 2 lb per 100 gal; comparable to CuPro.
27672	Tank Mix: SP2015 + CuPRO 2005 (Famoxadon e + Cymoxanil + Copper)	Pseudomonas chic orii (Pse udo mon as chic orii)	Mallow, Rose Mallow (Hibiscus sp.) H. rosa- sinensis	Field	Strandberg	FL	2006	Foliar	No efficacy at 8 oz + 1.5 lb per acre
27672	Tank Mix: SP2015 + CuPRO 2005	Pseudomonas chic orii	Mallow, Rose Mallow (Hibiscus	Field	Strandberg	FL	2007	Foliar	Slight to moderate disease pressure; no significant

	(Famoxadon e + Cymoxanil + Copper)	(Pse udo mon as chic orii)	sp.) H. rosa- sinensis						efficacy at 8 oz + 2 lb per 100 gal
28392	Tank Mix: SP2015 + CuPRO 2005 (Famoxadon e + Cymoxanil + Copper)	Pseudomonas sp. (Pse udo mon as sp.)	Lavender (Lavandula sp.) L. heterophylla 'Patriot Bright Red'	Greenhouse	Chase	CA	2008	Foliar	Only treatment that significantly reduced disease incidence at 8 + 32 oz per 100 gal
29613	Tank Mix: SP2015 + CuPRO 2005 (Famoxadon e + Cymoxanil + Copper)	Pseudomonas sp. (Pse udo mon as sp.)	Bolivian Jasmine (Mandevilla boliviensis) 'Alice DuPont'	Greenhouse	Chase	CA	2010	Foliar	Good control at 8 oz + 2 lb per 100 gal.
27571	Tank Mix: SP2015 + CuPRO 2005 (Famoxadon e + Cymoxanil + Copper)	Pseudomonas syrin gae bligh t (Pse udo mon as syrin gae)	Maple, Japanese (Acer palmatum)	Field	Regan	OR	2008	Foliar	No significant difference from untreated check with 8 oz + 2 lb per 100 gal.
27665	Tank Mix: SP2015 + CuPRO 2005 (Famoxadon e + Cymoxanil + Copper)	Pseudomonas marg inali s (Psu edo mon as marg inali s)	Hydrangea, Oakleaf (Hydrangea quercifolia)	Field	Strandberg	FL	2006	Foliar	No significant efficacy at 8 oz + 1.5 lb per acre

27665	Tank Mix: SP2015 + CuPRO 2005 (Famoxadon e + Cymoxanil + Copper)	Pseudomonas marg inali s (Psu edo mon as marg inali s)	Hydrangea, Oakleaf (Hydrangea quercifolia)	Field	Strandberg	FL	2007	Foliar	Moderate to severe disease pressure; no significant differences among treatments
28526	Tank Mix: SP2015 + CuPRO 2005 (Famoxadon e + Cymoxanil + Copper)	Xanthomonas sp. (Xan thom onas sp.)	Ornamental Cabbage, Ornamental Kale (Brassica sp.) Kale 'Nagoya Rose'	Greenhouse	Becker	NY	2009	Foliar	Significantly reduced disease severity at 8 oz + 2 lb per 100 gal.
28526	Tank Mix: SP2015 + CuPRO 2005 (Famoxadon e + Cymoxanil + Copper)	Xanthomonas sp. (Xan thom onas sp.)	Ornamental Cabbage, Ornamental Kale (Brassica sp.) Kale White Crane	Greenhouse	Becker	NY	2009	Foliar	Reduced disease severity, but not significantly, at 8 oz + 2 lb per 100 gal.
27658	Tank Mix: SP2015 + CuPRO 2005 (Famoxadon e + Cymoxanil + Copper)	Xanthomonas sp. (Xan thom onas sp.)	Wax Myrtle (Myrica cerifera)	Field	Strandberg	FL	2006	Foliar	No significant efficacy at 8 oz + 1.5 lb per acre
27658	Tank Mix: SP2015 + CuPRO 2005 (Famoxadon e + Cymoxanil + Copper)	Xanthomonas sp. (Xan thom onas sp.)	Wax Myrtle (Myrica cerifera)	Field	Strandberg	FL	2007	Foliar	Severe disease pressure; no significant differences among treatments

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26722	Tank Mix: SP2015 + CuPRO 2005 (Famoxadon e + Cymoxanil + Copper)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Maverick Red'	Greenhouse	Reddy	AL	2009	Foliar	Significantly reduced severity of X. campestris at 8 oz + 2 lb per 100 gal; best treatment; comparable to non-inoculated Check.
26722	Tank Mix: SP2015 + CuPRO 2005 (Famoxadon e + Cymoxanil + Copper)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) P. x hortorum 'Patriot Bright Red'	Greenhouse	Chase	CA	2008	Foliar	90 % reduction at 8 + 32 oz per 100 gal
26722	Tank Mix: SP2015 + CuPRO 2005 (Famoxadon e + Cymoxanil + Copper)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Bright Red'	Greenhouse	Norman	FL	2009	Foliar	Good control at 8 oz + 2 lb per 100 gal; comparable to CuPro and non-inoculated Check.
26722	Tank Mix: SP2015 + CuPRO 2005 (Famoxadon e + Cymoxanil + Copper)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Red'	Greenhouse	Norman	FL	2006	Foliar	Significantly reduced leafspots at 8 oz + 1 lb per 100 gal; considered one of the best treatments
27651	Tank Mix: SP2015 + CuPRO 2005 (Famoxadon e + Cymoxanil + Copper)	Xanthomonas sp. (Xan thom onas sp.)	Cherry (Non-Bearing) (Prunus sp.) P. incisa x campanulata 'Okame'	Field	Strandberg	FL	2006	Foliar	No significant efficacy at 8 oz + 1.5 lb per acre
27651	Tank Mix: SP2015 + CuPRO	Xanthomonas sp. (Xan	Cherry (Non-Bearing) (Prunus sp.)	Field	Strandberg	FL	2007	Foliar	Severe disease pressure; no significant

	2005 (Famoxadon e + Cymoxanil + Copper)	thom onas sp.)	P. incisa x campanulata 'Okame'						efficacy at 8 oz + 2 lb per 100 gal
27599	Tank Mix: Vital + Rhapsody (Phosphite + Bacillus subtilis)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Red'	Greenhouse	Norman	FL	2006	Foliar	Poor efficacy at 2 qt + 8 qt per 100 gal
27955	Tanos (Famoxadone + Cymoxanil)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Red'	Greenhouse	Norman	FL	2007	Foliar	No efficacy at 8 oz per 100 gal
27669	TriCon (BW 420) (Sodium tetraborahyd rate decahydrate)	Pseudomonas chic orii (Pse udo mon as chic orii)	Mallow, Rose Mallow (Hibiscus sp.) H. rosa- sinensis	Field	Strandberg	FL	2007	Foliar	Slight to moderate disease pressure; no significant efficacy at 0.8 %
27662	TriCon (BW 420) (Sodium tetraborahyd rate decahydrate)	Pseudomonas marg inali s (Psu edo mon as marg inali s)	Hydrangea, Oakleaf (Hydrangea quercifolia)	Field	Strandberg	FL	2007	Foliar	Moderate to severe disease pressure; no significant differences among treatments
27655	TriCon (BW 420) (Sodium tetraborahyd rate decahydrate)	Xanthomonas sp. (Xan thom onas sp.)	Wax Myrtle (Myrica cerifera)	Field	Strandberg	FL	2007	Foliar	Severe disease pressure; no significant differences among treatments

27954	TriCon (BW 420) (Sodium tetraborahyd rate decahydrate)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Red'	Greenhouse	Norman	FL	2007	Foliar	No efficacy at 0.8 % concentration
27648	TriCon (BW 420) (Sodium tetraborahyd rate decahydrate)	Xanthomonas sp. (Xan thom onas sp.)	Cherry (Non-Bearing) (Prunus sp.) P. incisa x campanulata 'Okame'	Field	Strandberg	FL	2007	Foliar	Severe disease pressure; no significant efficacy at 0.8 %
27598	Vital 4L (Potassium phosphite)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Red'	Greenhouse	Norman	FL	2006	Foliar	Good efficacy at 2 qt per 100 gal; equal to Kocide
27598	Vital 4L (Potassium phosphite)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Red'	Greenhouse	Norman	FL	2007	Foliar	Poor efficacy at 2 qt per 100 gal
29556	Vitalonil (Potassium phosphite + chlorothalon il)	Erwinia (Erwinia sp.)	Orchid, Moth (Phalaenops is sp.)	Greenhouse	Norman	FL	2009	Foliar	Very low disease pressure in inoculated Check; not possible to evaluate efficacy of all treatments.
29547	Vitalonil (Potassium phosphite + chlorothalon il)	Xanthomonas sp. (Xan thom onas sp.)	Geranium (Pelargonium sp.) 'Patriot Bright Red'	Greenhouse	Norman	FL	2009	Foliar	Good control at 5 pt per 100 gal; almost comparable to CuPro and non-inoculated Check; caused

									significant injury.
30651	ZeroTol (Hydrogen dioxide)	Agrobacterium sp. (Agr obac teriu m sp.)	Goldenrod (Solidago sp.)	Greenhouse	Chase	CA	2011	Foliar	Did not significantly reduce number and size of galls with 1 % conc.
31488	ZeroTol (Hydrogen dioxide)	Pseudomonas chic orii (Pse udo mon as chic orii)	Chrysanthemum, Garden (Chrysanthe mum/Dendr anthema sp.) 'Shasta Improved'	Field	Norman	FL	2012	Foliar	Significantly reduced leaf spots with 128 fl oz per 100 gal applied once post- inoculation; inferior to untreated non- inoculated check.
30266	ZeroTol (Hydrogen dioxide)	Pseudomonas syrin gae bligh t (Pse udo mon as syrin gae)	Mallow, Rose Mallow (Hibiscus sp.) 'Double Red'	Greenhouse	Norman	FL	2011	Foliar	More lesion development, though not statistically significant, with 128 fl oz per 100 gal applied twice.
32362	ZeroTol (Hydrogen dioxide)	Pseudomonas syrin gae bligh t (Pse udo mon as syrin gae)	Garden Impatiens (Impatiens walleriana) 'Super Elfin XP Violet Improved'	Greenhouse	Norman	FL	2012	Foliar	Did not significantly reduce number of leaf spots with 128 fl oz per 100 gal applied once.
31306	ZeroTol (Hydrogen dioxide)	Pseudomonas syrin gae bligh	Lilac (Syringa sp.) S. vulgaris 'Ellen Willmott'	Field In-	Pscheidt	OR	2012	Foliar	Significantly reduced disease incidence but not severity

		t (Pse udo mon as syrin gae)							with 128 fl oz per 100 gal.
30258	ZeroTol (Hydrogen dioxide)	Xanthomonas sp. (Xan thom onas sp.)	Poinsettia (Euphorbia pulcherrima ) 'Eckespoint Prestige Red	Greenhouse	Norman	FL	2011	Foliar	Did not reduce number of leaf spots with 128 fl oz per 100 gal applied twice.

## **Appendix 1: Contributing Researchers**

**BAAR Scientific LLC** Dr. Chris Becker 6374 Rt. 89 Romulus, NY 14541 Dr. James Buck University of Georgia Department of Plant Pathology 243 Redding Bldg Georgia Experiment Station Griffin, GA 30223 Dr. Ann Chase Chase Horticultural Research 8031 Mount Aukum Rd Ste F PO Box 529 Mt Aukum, CA 95656-0529 Dr. Kerry Cox Cornell University NYSAES 630 West Norh Street Geneva, NY 14456 University of Florida Dr. Dave Norman IFAS/MREC 2725 Binion Road Apopka, FL 32779 University of Florida Dr. Aaron Palmateer Tropical Research & Education Center 18905 SW 280 Street Homestead, FL 33031 Dr. Jay. W. Pscheidt Oregon State University Department of Botany and Plant Pathology 2082 Cordley Hall Corvallis, OR 97331 Dr. M.S. Reddy Auburn University Department of Entomology & Plant Pathology 209 Life Sciences Bldg. Auburn University, AL 36849 Mr. Rich Regan Oregon State University North Willamette Res. & Ext. Ctr. 15210 NE Miley Rd. Aurora, OR 97002

## Dr. Karl Steddom

P. O. Box 38

Texas AgriLife Extension Service

1710 N Hwy 3053 Overton, TX 75684

## Dr. Jim Strandberg

University of Florida

IFAS/MREC 2725 Binion Road Apopka, FL 32779

Dr. Keith. Yoder

Virginia Tech Ag Res. & Ext. Center

595 Laurel Grove Road Winchester, VA 22602