FINAL REPORT **YEAR**: 2 of 2

Project Title: Optimizing use of Actigard for post-infection fire blight control

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Budget: **Year 1:** $21,400 **Year 2**: $22,042

Other funding sources

Agency Name: Syngenta Crop Protection ($5K)

WTFRC Collaborative expenses: None

Budget
Organization Name: OSU Agric. Res. Foundation **Contract Administrator:** Russ Karow
Telephone: (541) 737-4066 **Email address:** Russell.Karow@oregonstate.edu

Item	2014-15	2015-16	
Salaries Faculty Res. Assist.	12,000	12360	
Benefits OPE 58%	6,960	7168.8	
Wages undergrads	500	515	
Benefits OPE 12%	60	61.8	
Equipment			
Supplies	880	906.4	
Local Travel	500	515	
Miscellaneous			
Plot Fees	500	515	
Total	**$21,400**	**$22,042**	

OBJECTIVES

Obj. 1: In the field, evaluate the timing of Actigard paints to prevent running fire blight cankers and to suppress canker re-ignition.

Obj. 2: In the greenhouse, re-evaluate the concentration of Actigard in paints applied to slow fire blight canker expansion in pear.

Obj. 3: Evaluate alternative SAR inducers and surfactants.

SIGNIFICANT FINDINGS

- For a 5th season, a paint of concentrated acibenzolar-S-methyl (ASM, Actigard) used in combination with cutting reduced the severity of 're-ignited' fire blight cankers in Bosc and Concorde pear.
- In a greenhouse study, alternative SAR inducers did not suppress fire blight expansion to the same degree as ASM.
- A trial of silicone surfactants mixed with ASM found equivalent performance among surfactants.
- A summary of spray trials conducted in Wenatchee and Corvallis over the past five years demonstrated the addition of ASM to antibiotic sprays enhanced fire blight control over antibiotics alone.

Results

Objective 1: In the field, evaluate the timing of Actigard paints to prevent running fire blight cankers and to suppress canker re-ignition**.**

In 2015, this objective was addressed in two Bosc pear blocks (7-yr-old and a 5-yr-old) located at the Oregon State University Botany and Plant Pathology Field Laboratory near Corvallis, OR. , and in potted Concorde pear trees (3-yr-old in 3-gallon pots) located at the same facility. The experiments were arranged in a randomized complete block design with 20 to 23 replications. On 15 April, a cluster of flowers in three different areas of the trees were mist inoculated with a high dose of the pathogen. (Experimental details are in **Table 1** on the next page.) After running cankers were established in the trees, experimental units (trees) were randomized into blocks and treatments such that each block and each treatment had approximately the same number of strikes per tree. In the Bosc pear blocks, the first ASM treatment was timed to occur at 'most symptoms appeared' (mid-May), and in Concorde pear, the first ASM treatment was timed to occur at 'first symptoms'. The primary cut of fire blight strikes coincided with the first ASM treatment. Cankers were cut 15-20 cm (6-8") below canker margin. Treatments of ASM associated with the primary cut

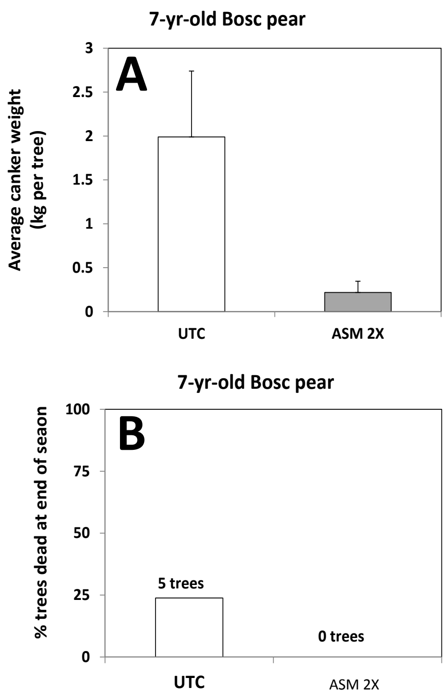
Fig. 1. ASM treatments were 'painted' onto to central leaders of Bosc pear trees with a 1-liter Solo pump sprayer.

were applied to the central leader with a small Solo sprayer (**Fig. 1**); the length of leader treated was approximately 1 m (39 in.) and was located within the branching zone for Bosc trees and the lower trunk region for Concorde trees. In June, a second ASM treatment was applied to the central leader in the 7-yr-old Bosc block and to some of the Concorde pear trees. No secondary cuts were made during the summer. In late September/early October, treatment efficacy was evaluate by measuring length and weight of re-ignited fire blight cankers.

Table 1. Experimental details of 2015 ASM post-infection treatments applied to 7-yr-old and 5-yr-old Bosc pear in orchards near Corvallis, OR

Pear cultivar & year	Tree age (years)	Pathogen inoculation type and date	Treaments	Rate of ASM (a .i.)	Amount of ASM applied	Number of replicate trees	Cankers per tree (± s.e.) at 1° cut	Date(s) cankers removed 1°, 2° and 3° cuts	Cut distance below proximal edge of canker	Date(s) ASM painted	% Canker re-ignition after 1° cut	Cut canker yield 2° cuts kg (± s.e.)/tree	$P \leq 0.05$	Cut canker length 2° cuts m (± s.e.)/tree	$P \leq 0.05$
					On central leader:			Once		Twice		28-Sep		28-Sep	
Bosc	7	Flowers	Cut only	-	-	22	3.2 (0.4)	21-May	15-20 cm	-	24% on 28-Sept	2.0 (0.8)		0.28 (0.11)	
2015		1 x 10^6 CFU/ml on 15-Apr	Cut & Paint (sprayer)	15 g /L 1% Pentrabark	~750 mg in 50 ml	22	3.2 (0.4)	21-May	15-20 cm	21-May, 2-Jun#	7% on 28-Sep	0.2 (0.1)	yes	0.12 (0.06)	no
					On central leader:			Once		Once		8-Oct		8-Oct	
Bosc	5	Flowers	Cut only	-	-	23	3.2 (0.5)	21-May	15-20 cm	-	21% on 8-Oct	1.4 (0.5)		0.34 (0.10)	
2015		1 x 10^6 CFU/ml on 15-Apr	Cut & Paint (sprayer)	15 g /L 1% Pentrabark	~750 mg in 50 ml	23	3.2 (0.5)	21-May	15-20 cm	21-May	3% on 8-Oct	0.1 (0.1)	yes	0.04 (0.03)	yes
Potted					On central leader:			Once		Once or Twice		28-Sep		28-Sep	
Concorde	3	Flowers	Cut only	-	-	20	4.3 (0.6)	6-May	15-20 cm	-	13% on 28-Sept	0.13 (0.04)		0.38 (0.12)	
2015		1 x 10^9 CFU/ml on 15-Apr	Cut & Paint (sprayer)	15 g /L 1% Pentrabark	~60 mg in 4 ml	20	4.3 (0.6)	6-May	15-20 cm	7-May	7% on 28-Sep	0.02 (0.01)	yes	0.01 (0.01)	yes
			Cut & Paint (sprayer)	15 g /L 1% Pentrabark	~60 mg in 4 ml	20	4.3 (0.7)	6-May	15-20 cm	7 May, 22-Jun#	5% on 28-Sep	0.01 (0.1)	yes	0.01 (0.01)	yes

7-yr-old Bosc pear. Weather conditions were cool during pear bloom, which resulted in light infection as a result of the pathogen inoculation at full bloom. An average of 3.2 fire blight cankers developed on each tree (**Table 1**). ASM treatments were made on 21 May and 2 June; the primary cut occurred on 21 May. After cutting, running cankers re-ignited in 81% of non-ASM-treated trees which was 24% of cuts. The final evaluation (2º cut) of re-ignited cankers was made on 28 September. Compared to cut only, the ASM paint treatment significantly reduced ($P \leq 0.05$) severity of the re-ignited fire blight cankers (yield of canker wood) (**Fig. 2**) but did not significantly reduce the lengths of secondary cankers (**Table 1**). Over the summer, 5 non-treated trees died as a result of re-ignited fire blight. Zero trees that received the ASM treatment died.



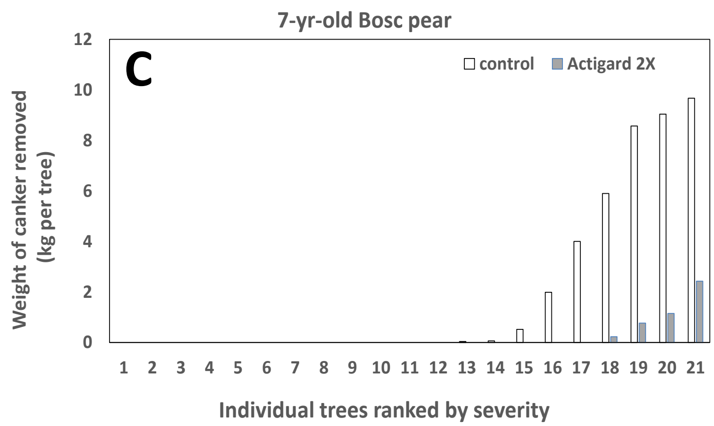
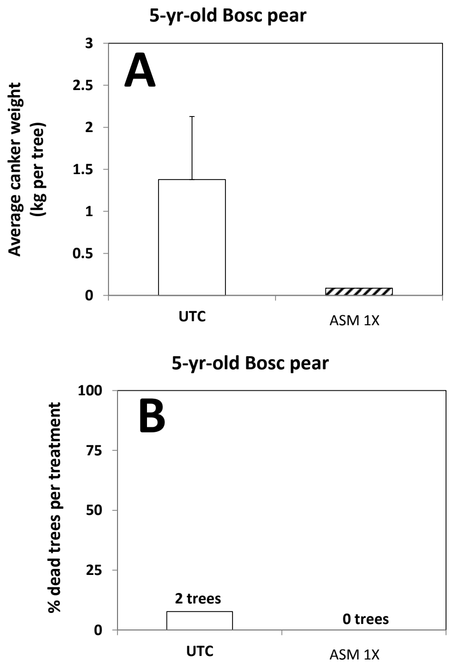


Fig. 2. Effect of the SAR-inducer, ASM, on re-ignited fire blight cankers in 7-yr-old 'Bosc' pear. Trees were inoculated with the fire blight pathogen on 15 April. Fire blight cankers were cut 15-20 cm (6-8") below canker margin on 21 May. ASM was applied by 'paint' to the central leader (Actigard 30g/L in 1% Pentrabark) on 21-May and 2-Jun. Paints were applied to 1 m of central leader in the branch zone. Weight of re-ignited cankered branches removed was assessed on 28 September. A and B: Each bar is the mean and standard error of 21 trees. C: Ranked comparison of the disease severity on individual 'cut and ASM-treated' trees compared to individual

5-yr-old Bosc pear. An average of 3.2 fire blight cankers developed on each tree as a result of the pathogen inoculation at full bloom (**Table 1**). The ASM treatment coincided with the primary cut on 21-May. Running cankers re-ignited in 60% of non-ASM-treated trees which was 21% of cuts. The final evaluation (2º cut) of re-ignited cankers was made on 8 October. Compared to cut only, the ASM paint treatment significantly reduced ($P \leq 0.05$) severity of the re-ignited fire blight cankers (yield of canker wood) (**Fig. 3**) and also reduced the length of secondary cankers (**Table 1**)). Over the summer, 2 non-treated trees died as a result of re-ignited fire blight. Zero trees that received the ASM treatment died.

3-yr-old potted Concorde pear. An average of 4.3 fire blight cankers developed on each tree as a result of the pathogen inoculation at full bloom (**Table 1**). The ASM treatments were made on 7 May and 22 June with the primary cut occurring on 6 May. Running cankers re-ignited in 55% of non-ASM-treated trees, which was 13% of cuts. The final evaluation (2º cut) of re-ignited cankers was made on 28 September. Compared to cut only, the ASM paint treatment significantly reduced ($P \leq 0.05$) severity of the re-ignited fire blight cankers (yield of canker wood) (**Fig. 4**) and also reduced the length of secondary cankers (**Table 1**)). Over the summer, 9 non-treated trees died as a result of re-ignited fire blight. Two trees in each of the ASM treatments died.



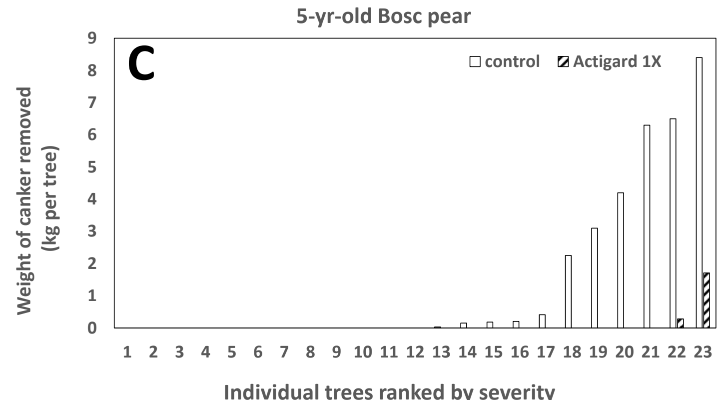
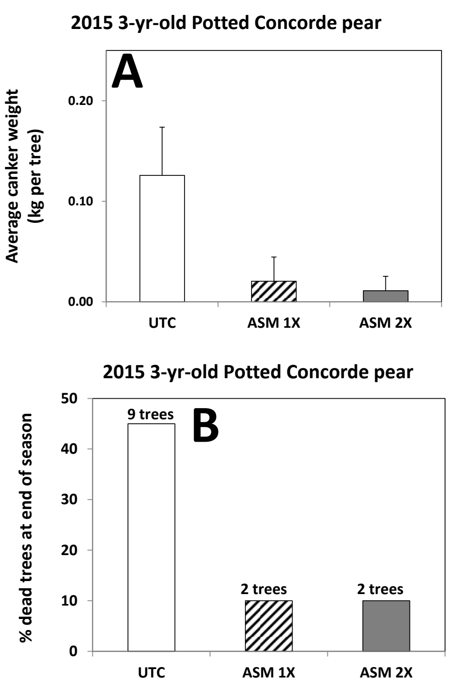


Fig. 3. Effect of the SAR-inducer, ASM, on re-ignited fire blight cankers in 5-yr-old 'Bosc' pear. Trees were inoculated with the fire blight pathogen on 15 April. Fire blight cankers were cut 15-20 cm (6-8") below canker margin on 21 May. Also on 21 May, ASM was applied by 'paint' to the central leader (Actigard 30g/L in 1% Pentrabark). Paints were applied to 1 m of central leader in the branch zone. Weight of re-ignited cankered branches removed was assessed on 8 October. A and B: Each bar is the mean and standard error of 23 trees. C: Ranked comparison of the disease severity on individual 'cut and ASM-treated' trees compared to individual 'cut only' trees.



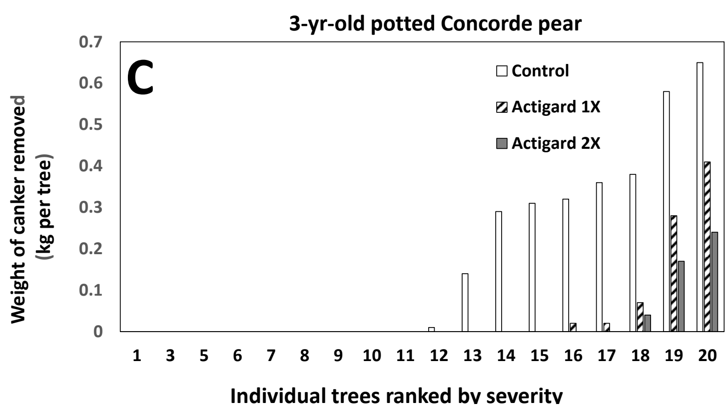


Fig. 4. Effect of the SAR-inducer, ASM, on re-ignited fire blight cankers in 3-yr-old, potted 'Concorde' pear. Trees were inoculated with the fire blight pathogen on 15 April. Fire blight cankers were cut 15-20 cm (6-8") below canker margin on 6 May. ASM was applied by 'paint' to the central leader (Actigard 30g/L in 1% Pentrabark) on 7 May and 22 June (if the tree received a second treatment). Paints were applied to 1-m section of the lower trunk. Weight of re-ignited cankered branches removed was assessed on 28 September. A and B: Each bar is the mean and standard error of 23 trees. C: Ranked comparison of the disease severity on individual 'cut and ASM-treated' trees compared to individual 'cut only' trees.

Discussion Actigard paints to prevent running fire blight cankers and to suppress canker re-ignition. For a 5th season, a paint(s) of concentrated acibenzolar-S-methyl (ASM) used in combination with cutting reduced the severity of 're-ignited' fire blight cankers in Bosc and Concorde pear. In contrast to previous seasons, the number of fire blight strikes on the trees as a result of pathogen inoculation was modest (3 to 5 strikes per tree), but this level of infection is more typical of a commercial orchards. In addition, we made the first ASM treatments within a day of the primary cut of cankers, whereas last year we did not cut until a period of time (12 to 26 days) after the first ASM treatment (see 2014 report). Perhaps for these reasons, the observed effect of ASM on reducing secondary canker re-ignition and expansion was somewhat better than we have observed in previous experiments. The central leader 'paint' of ASM (applied by small sprayer) again provided results consistent with our earlier method of applying the ASM treatment to the 12-18 inches of healthy branch immediately below each cut canker (see previous reports). Treatment of the central leader requires much less time to implement than painting of specific diseased branches. But on larger trees, painting a branch (with a small sprayer) might be more practical.

The results we have had over the course of this research suggest that ASM therapy will be useful in commercial orchards after a fire blight infection event, especially during early years after orchard establishment (ages 2- to 10-yr-old) when clean-up from this disease has proven difficult to manage with therapeutic pruning only. The ASM treatment induces SAR in the living cylinder of non-symptomatic parenchyma and cambial tissues near the leading edge of the expanding canker. Personnel cutting fire blight cankers in commercial orchards also commonly use a disinfesting solution (e.g., bleach) to clean pruning tools between cuts, and therefore, could easily adopt the additional practice of painting a trunk or branch with ASM as cankers are removed. In fact, based on years of experience in inoculating the pathogen and cutting blight, we believe most secondary cankers that develop at the location of a primary cut are the result of inoculum that originated inside the tree and not from inoculum spread canker-to-canker by cutting tools. **Consequently, for young trees at risk of developing secondary (re-ignited) cankers, it is our opinion that treatment of the cut trees with ASM will provide greater benefits than disinfestation of tools between cuts.**

In the translation of results from small plot trials to commercial orchards, there are several caveats/issues that may only be resolved after commercial orchardists have gained experience with the ASM material and the painting technique. One issue is that trees in commercial orchards typically grow faster than our plot trees because of higher inputs of nitrogen fertilizers. Nitrogen is a known risk factor contributing to the susceptibility of the trees and development of secondary fire blight cankers. Consequently, we are concerned there may be an interaction between ASM-paint treatment efficacy and nutritional status of the tree (we are attempting to address this in 2016). A second caveat is that in order to obtain a reasonable amount of re-ignited cankers to work with, our primary cuts were 'short' (6 to 8" below the canker edge) compared to standard recommendations for cutting fire blight cankers (12 to 14 inches below the canker edge). Thus, our rate of re-ignition may be higher is typical with a good blight cutting crew, which could de-value an ASM treatment in marginal situations. [But note that the first two caveats potentially cancel each other out.] A last issue is the rate of ASM in a paint suspension compared to the amount that is legal to apply acre per day and per season (see label below **Fig. 5**). After a severe infection event, it would be easy to exceed these amounts if every tree in the orchard was diseased and painted with ASM. Therefore, this technique

Fig. 5. 2015 EPA section 3 registration for Actigard 50W outlining paint application after canker cut-out.

Crop	Pest	Rate per Application	Remarks
Apples **Pears**	Suppression of: Fire Blight *(Erwinia amylovra)*	Per Acre 0.5 - 3.2 oz/A 1 oz/1 quart of 1% penetrant	**<u>Foliar Application</u>:** Apply in a tank mix with a fire blight treatment (generally an antibiotic) that is standard in your area. This is generally 2-3 applications between 20% bloom and petal fall depending on the environmental conditions. Do not apply closer than a 7 day interval. **<u>Paint application after canker cut-outs or grafts:</u>** * Mix 1 oz Actigard in 1 quart of 1% Pentrabark or similar penetrant. Apply to the branch area immediately below canker after cutting to an area extending 1 – 1 1/2 feet. One quart will treat approximately 500 cuts. Do not apply within 60 days of harvest.
Pome Crop Group 11-10: Apple; azarole; crabapple; loquat; mayhaw; medlar; pear; pear, Asian; quince; quince, Chinese; quince, Japanese; tejocote; cultivars, varieties, and/or hybrids of these.			
Specific Use Restrictions: (1) Do not apply more than 3.2 oz (0.1 lb ai) Actigard 50WG per acre per application. (2) Do not apply more than 12.8 oz (0.4 lb ai) of Actigard 50WG per acre per season. (4) Do not apply within 60 days of harvest (60-day PHI).			

will be most useful in a well-managed commercial orchards (i.e., those with spring fire blight preventative program) where it is implemented by orchard workers pruning out fire blight at the level of the more sporadically distributed, individual diseased tree.

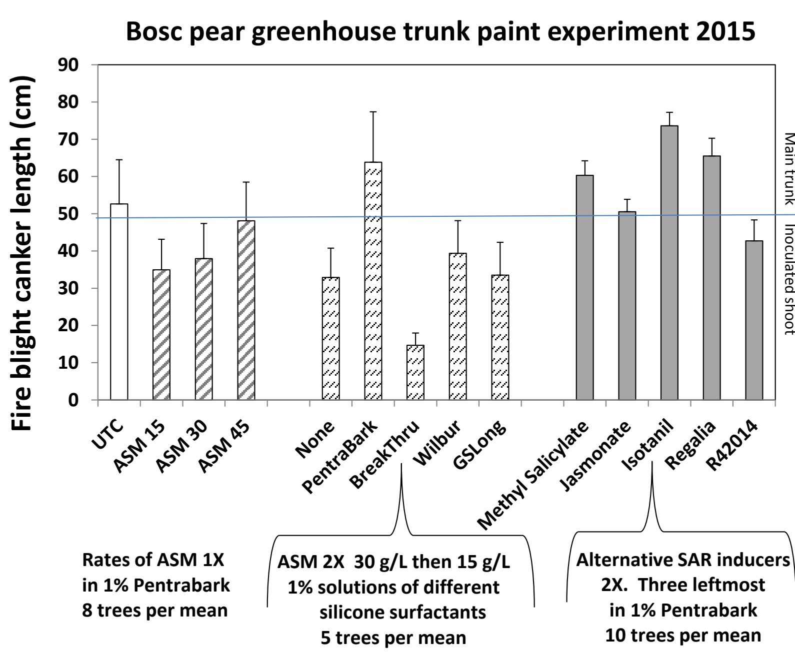
Obj. 2: In the greenhouse, re-evaluate the concentration of Actigard in paints applied to slow fire blight canker expansion in pear, and **Obj. 3:** Evaluate alternative SAR inducers and surfactants.

In 2014, greenhouse experiments under this objective failed because the 200 Bosc pear trees we purchased to address these objectives apparently had been frozen after digging in the nursery. In 2015, the nursery from whom purchased pear trees could fill only 60% of our order, which left us with too few trees to obtain sufficient replication in the experiments. Nonetheless, we conducted all treatments with reduced tree replicates, which resulted in higher than usual variability in the treatment means.

In conducting the greenhouse trials, we went back to experimental protocols first used in 2009. One-year-old trees pear cv. 'Bosc' were potted into 2 gallon containers containing growth medium and maintained in a greenhouse (70-85°F). Treatments were arranged onto experimental tree; 5 to 10 single-tree replicates per treatment. At inoculation (23 April), terminal shoots were ~48 cm (20 in.) in length; terminal shoots were inoculated by splitting the meristematic tip and mid-veins on the two youngest leaves longitudinally with a surgical scissors to distances of 1 to 2 cm. Wounded tissues were dipped into freeze-dried cells of *E. amylovora* strain Ea153N resuspended in distilled water (1 x 10^9 CFU/ml). After inoculation, a plastic bag was wrapped over the cut end and left in place for one week. Length of cankers on inoculated trees were measured every 6 weeks. Treatments included one to two paint treatments of ASM or another SAR inducer in combination with PentraBark or an alternative surfactant. These treatments were applied with a foam brush to a 60-cm length of trunk with the proximal edge of the treated area located just above the graft union.

Treatment effects are best viewed by distinguishing if mean canker length expanded into the woody trunk tissue (upper half of **Fig. 6**) or mean canker length was limited to the green shoot tissue produced earlier in the spring (lower half of **Fig. 6**). Using this criterion, treatments that included

Fig. 6. Effect trunk paints of SAR-inducers and silicone surfactants on expansion of fire blight cankers in 1-yr-old Bosc pear. All trees were inoculated on 23 April 2015. Trunk paint treatments were made on 27 April and if a tree received a second treatment, 29 May. Each bar is the mean and standard error of the number of trees indicated in the legend.



ASM generally did not expand into woody trunk tissue. The exception was ASM with PentraBark, which has been our standard surfactant in SAR field trials (i.e., we know ASM mixed with PentraBark is an effective treatment). In contrast, ASM with the surfactant BreakThru yielded the smallest cankers. For the alternative SAR inducers, most of the mean cankers lengths extended into woody tissue which was also the case with the untreated control (UTC). For the 50 trees that received an alternative SAR inducer, mean canker length was 59 cm, and cankers, on average, extended into woody tissue. For the 49 trees that received an ASM treatment, mean canker length was 41 cm, and cankers, on average, did not extend into woody tissue.

Discussion of greenhouse SAR and surfactant experiments. Without benefit of multiple years of experiments, the greenhouse results indicate that ASM is the best (known) SAR inducer for post-infection therapy of pear and apple after a fire blight infection. Again, as mentioned above, there are too few replications for the individual treatments, and therefore, the result for any one specific treatment should be viewed cautiously. Nonetheless, results with ASM and alternative surfactants yielded a few surprises. For example, ASM with no surfactant performed similarly to the average of ASM with a surfactant, and ASM with PentraBark was a poor performer relative to ASM with BreakThru. Consequently, in field experiments in 2016, in at least one trial we will compare ASM with BreakThru and ASM with no surfactant to ASM with PentraBark.

Supplemental Results: ASM foliar spray trial research in 2010 to 2015.

Orchard studies on the integration of acibenzolar-S-methyl (ASM) with antibiotics for protection of pear and apple from fire blight have conducted in the west coast region (OSU, Corvallis and WSU, Wenatchee) for the last 5 years. In 11 pathogen-inoculated trials, a single treatment of

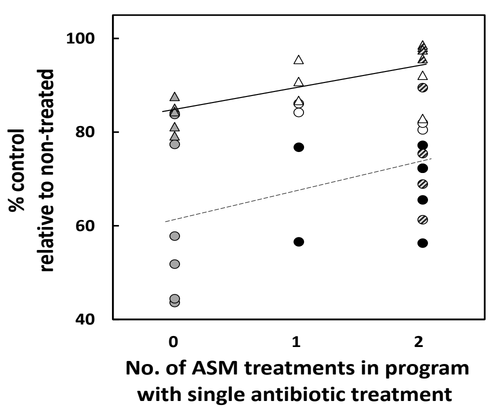


Fig. 7. Percent control of fire blight infection by one antibiotic treatment in combination with one or two applications of acibenzolar-S-methyl (2 oz. per 100 gallons). Points are from 11 orchard trials conducted in Wenatchee, WA (T. Smith) and Corvallis, OR (K. Johnson) from 2010 to 2014. In leftmost column, the shapes indicate the antibiotic used in each trial: triangle = streptomycin, and circle = oxytetracycline. In center and rightmost columns, color of the shapes indicate timing of ASM treatment(s): black = late bloom, white = early bloom, and striped = before and after the antibiotic treatment. Lines are regression of relative % control on number of ASM treatments.

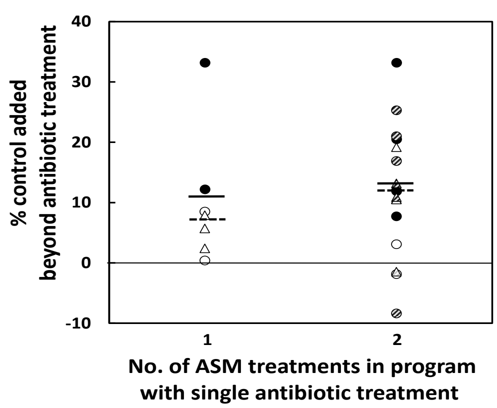
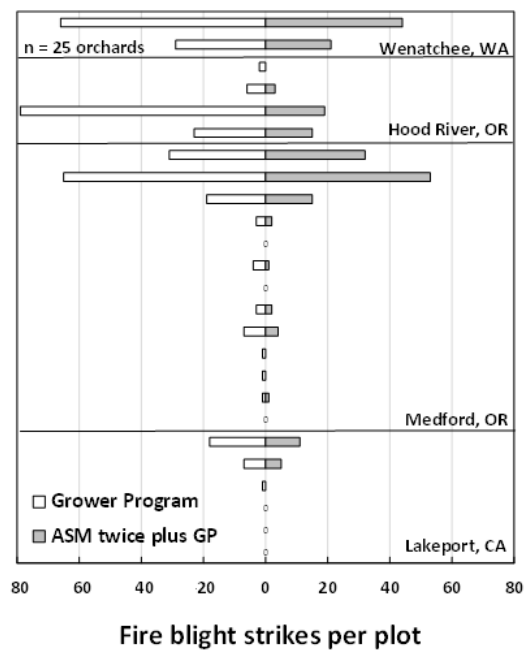


Fig. 8. Fig. 2. Percent added control of fire blight from one or two applications of acibenzolar-S-methyl (2 oz. per 100 gallons) beyond that achieved by one antibiotic treatment. Points are from 10 orchard trials conducted in Wenatchee, WA and Corvallis, OR from 2010 to 2014. In the columns, the shape used for each data point indicate the antibiotic used in the trial: triangle = streptomycin, and circle = oxytetracycline. Colors of the shapes indicate timing of ASM treatment(s): black = late bloom, white = early bloom, and striped = before and after the antibiotic treatment. Short horizontal bars in each column are the mean (solid) and median (dashed) responses.

streptomycin or oxytetracycline provided an average of 83 and 61% disease control, respectively. The addition of one or two treatments of acibenzolar-S-methyl (ASM) to the single antibiotic program contributed an additional 6 and 12% disease control, respectively, for both antibiotic materials. Among trials, ASM treatment timings were varied from early to late bloom but an effect of timing on disease control could not be determined. In commercial pear orchards, ASM treatments at full bloom and petal fall were superimposed onto the antibiotic program used in each orchards. For the 14 orchards that developed fire blight, the ASM-treated plots showed 38% fewer infections than an adjoining plots that received antibiotic program only. When integrated with antibiotics, ASM provides added disease suppression to fire blight control programs, but the modest degree of protection provided will likely limit its use to high disease risk situations, which includes orchards with a previous disease history, and those planted recently to highly susceptible cultivars.

Fig. 9. Number of fire blight infections in 4-acre plots of commercial pear orchards located in northern California, southern and northern Oregon, and northern Washington as affected by grower's antibiotic program alone or grower's program plus two additional treatments of acibenzolar-S-methyl (ASM, 70 g a.i./ha). Trials were conducted in commercial orchards of cultivar 'Bartlett' located near the cities shown. ASM treatments were applied at full bloom and near petal fall with fire blight infections scored 3 to 5 week after full boom.



Discussion. ASM is a new addition to the toolbox for fire blight management. In spray trials, it continues to show value as program partner with antibiotics during bloom, which could prove to be cost effective in high risk/high value orchards. We speculate that the suppression achieved by ASM sprays in conjunction with antibiotics is due to a longer residual time (7-10 days) compared to antibiotics (~3 days). This property may extend its usefulness to suppression of rattail and shoot infection (see 2014 report), and of trauma blight (infection from storm-induced wounds), which is difficult to suppress with antibiotics only. The EPA section 3 registration of Actigard 50W for use on pome fruit was granted in late 2015; first commercial use in Washington State will occur in 2016.

Publications:

Johnson, K. B., and Temple, T. N. 2016. Comparison of methods of acibenzolar-S-methyl application for post-infection fire blight suppression in pear and apple. Plant Dis. 100: doi:10.1094/PDIS-09-15-1062-RE.

Johnson, K.B., Smith, T. J., Temple, T. N., Gutierrez, E., Elkins, R. E., and Castagnoli, S. 2016. Integration of acibenzolar-S-methyl with antibiotics for protection of pear and apple from fire blight caused by *Erwinia amylovora.* Crop Protect. (in review).

EXECUTIVE SUMMARY

Project Title: **Optimizing use of Actigard for post-infection fire blight control**
Investigator: Ken Johnson, Oregon State University

Significant findings:

- For a 5th season, a paint of concentrated acibenzolar-S-methyl (ASM, Actigard) used in combination with cutting reduced the severity of 're-ignited' fire blight cankers in Bosc and Concorde pear.
- In a greenhouse study, alternative SAR inducers did not suppress fire blight expansion to the same degree as ASM.
- A trial of silicone surfactants mixed with ASM found equivalent performance among surfactants.
- A summary of spray trials conducted in Wenatchee and Corvallis over the past five years demonstrated the addition of ASM to antibiotic sprays enhanced fire blight control over antibiotics alone.

Industry implications: Over the last six years, the goal of this project has been to identify a material and method(s) to induce systemic acquired resistance (SAR) in pear and apple trees as an aid to the restoration of tree health after fire blight infection. The need for an improved therapy arises because the current method of cutting fire blight cankers out of trees in late spring and early summer frequently fails to restore health, especially in the first 10 years after orchard establishment (i.e., multiple rounds of cutting are required and frequently, the trees die). We found that in conjunction with cutting blight, acibenzolar-S-methyl (ASM) applied as a branch or trunk paint induces SAR in a tree for a prolonged period (at least 2 months), places the material near where it is most needed in the tree, and is potentially adaptable to specific fire blight management situations in the orchard.

Based on our data, trunk paints were most effective at restoring tree health when applied at the time of cutting. The result of an ASM paint is that fewer cankers re-ignite and those cankers that do re-ignite are smaller than on non-ASM treated trees. Personnel cutting fire blight cankers in orchards commonly use a disinfesting solution (e.g., bleach) to clean pruning tools between cuts, and therefore, could easily adopt the additional practice of painting a trunk or branch with ASM as cankers are removed. In fact, based on years of experience in inoculating the pathogen and cutting blight, we believe most secondary fire blight cankers that develop at the location of a primary cut are the result of inoculum that originated inside the tree and not from inoculum spread canker-to-canker by cutting tools. Consequently, for young trees at risk of developing secondary (re-ignited) cankers, it is our opinion that treatment of the cut trees with ASM will provide greater benefits than disinfestation of tools between cuts.

In addition to post-infection treatments, we also have found that ASM provides value as program partner with antibiotics sprayed during bloom, which could prove to be cost effective in high risk/high value orchards. We speculate that suppression achieved by ASM sprays in conjunction with antibiotics is due to a longer residual time (7-10 days) compared to antibiotics (3 days). This property also may extend its usefulness to suppression of rattail and shoot infection (see 2014 report), and of trauma blight (infection from storm-induced wounds), which is difficult to suppress with antibiotics.

The EPA section 3 registration of Actigard 50W (ASM) for use on pome fruit was granted in September 2015; first registered uses in Washington and Oregon orchards will occur in 2016. All methods of application discussed in this report are on the section 3 label.