Annual Report - 2008

Prepared for the California Cling Peach Advisory Board

Title: *Management of Brown Rot and Powdery Mildew Diseases of Peach in California*
Status: Third-Year of Four
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SUMMARY OF RESEARCH ACCOMPLISHMENTS DURING 2008

1) In laboratory inoculation studies with peach blossoms, experimental materials of new single active ingredients (e.g., DPX LEM 17, V-10135) and pre-mixtures (e.g., USF-2016, USF-2017, Inspire Super, A15909, A13703) were evaluated and shown to be highly effective as pre-and post-infection treatments. In addition, two natural products (e.g., MOI-104, and MOI-107) showed promising results in reducing blossom blight. Potentially, these latter materials will be OMRI approved.
2) Preharvest fungicide evaluations were done with an emphasis on new materials and new pre-mixtures. After non-wound inoculation of fruit, all fungicides evaluated including the registered products Pristine, Vangard, Elite, Inspire, and Quash, as well as new pre-mixtures (e.g., Adament, Distinguish, Inspire Super, USF-2016, USF-2017, A8122, A15909, A13703) significantly reduced the incidence of brown rot fruit decay as compared to the control. Except in one trial, the new SBIs Inspire and Quash were similarly highly effective as Elite. The natural products EXP90 and Cerebrocide were only moderately effective.
3) In studies evaluating the susceptibility of peach genotypes to brown rot blossom blight, we continued to coordinate our research with Dr. Tom Gradziel. A range of susceptibilities was present among the genotypes evaluated. Results for several genotypes including D62-193 that previously was found to be less susceptible were inconsistent with last years' data. The Bolinha accession, however, again was among the less susceptible genotypes. With the genetic material currently available, fungicide applications will continue to be critical in the management of blossom blight.
4) In evaluations of peach leaf curl treatments, Ziram was the most effective treatment and a single dormant or delayed dormant application resulted in $\leq$1.3% disease incidence as compared to 37.8% in the control. In a comparison of application timings for Kocide 3000 and Kentan, the two-spray programs with dormant and delayed dormant applications were generally more effective than single delayed dormant treatments that were applied the end of January. The reduced copper use in the Kocide 3000 treatment (as compared to the Kocide 2000 treatment) did not compromise the efficacy of disease management.
5) The trial on management of powdery mildew emphasized on evaluating the efficacy of recently registered and experimental fungicides that are planned for registration, including numerous pre-mixtures. All fungicides and rotations evaluated displayed a similar efficacy in reducing the incidence of disease on leaves. Registration of new powdery mildew fungicides, such as Quintec, and Procure, is being pursued.

INTRODUCTION

In 2008 we continued our research on the efficacy of new fungicides, timing of fungicide applications, and development of fungicide rotation programs as a resistance management strategy. We conducted field and laboratory studies on the management of brown rot blossom blight and fruit decay, powdery mildew, and peach leaf curl. Brown rot caused by the fungal pathogens *M. fructicola* and *M. laxa* is the most important disease of stone fruit in California. In the spring, primary inoculum consisting of ascospores and conidia from mummified fruit infects blossoms and diseased blossoms supply secondary inoculum for fruit infections in the current growing season. In studies on the management of brown rot, two areas were again emphasized: 1) the efficacy of new fungicides in a short-term strategy; and 2) the evaluation of natural host resistance against blossom blight in F1 progeny from crosses between less susceptible selections (e.g., Bolinha and other genotypes) and California varieties in a long-term strategy.

The main goals for the preharvest research are to develop alternative chemistries. In 2008, we emphasized on the evaluation of new pre-mixtures of different fungicide classes that, in addition to fungicide rotations, can provide a resistant management strategy. This is critical because pathogen populations resistant to SBI fungicides, that are still among the most effective brown rot materials, have developed in other stone fruit growing areas. More importantly, in 2007, we found that in a prune orchard in Northern California, a small proportion of isolates of *M. fructicola* obtained from decaying fruit was resistant to cyprodinil (Vangard). This fungicide class, the anilinopyrimidines, is an important component of management programs, and the spread of resistance and development of field resistance has to be prevented by strictly rotating different classes of materials. Thus, evaluations of fungicides were continued in our project using registered and new fungicides or formulations. Pre-mixtures evaluated included Pristine, the newly registered Distinguish, the soon to be registered Adament and Inspire Super, as well as several numbered compounds (i.e., USF2016, USF2017, A13703G, A15909A. and A8122B).

In our research on natural host resistance against blossom blight, we evaluated promising new genetic lines of cling peach developed by Dr. Tom Gradziel. Many of these lines have been evaluated for their resistance to fruit brown rot, but not to blossom blight. Research using the Bolinha genotypes was initiated by myself and the late Dr. Ogawa in the early 1990s. Because breeding programs are continuously generating promising new selections, host resistance in blossoms has to be continued to be evaluated.

In 2008 we also conducted field trials on peach leaf curl and we evaluated several fungicides and compared selected application timings during dormancy and pre-bloom. The main focus of our powdery mildew field trials was the evaluation of new fungicide pre-mixtures and rotation programs.

Objectives

I. Management of brown rot.

A) Efficacy and timing of representative compounds from each of five new classes of fungicides (e.g., strobilurins, anilinopyrimidines, SBI fungicides (including V-10116), hydroxyanilides, carboxyanilides, and other new classes (e.g., V-10135). Selected pre-mixtures of fungicides (Adamant, Distinguish) will also be evaluated. Pre- and post-infection efficacy will be studied for both blossoms and fruit.

B) Persistence of anilinopyrimidine residues under high humidity and temperature.

C) Baseline sensitivities of brown rot fungi to new classes of fungicides.

D) Natural host resistance of peach to blossom blight and fruit decay

II. Management of peach leaf curl

A) Evaluate the timing of ziram and copper treatments for peach leaf curl management.

II. Etiology and management of powdery mildew on cling peach and other stone fruits.

A) Collection of powdery mildew isolates from peach in California and identification of the causal pathogen(s).

B) Efficacy of new powdery mildew fungicides (e.g., quinoxyfen, triflumizole, V-10118), currently registered products, and their use in anti-resistance rotation and mixture programs.

MATERIALS AND METHODS

Evaluation of fungicides for management of brown rot blossom blight and preharvest fruit decay. Laboratory studies were done with cvs. Fay Elberta and Ross peach blossoms obtained from the UC Davis, Plant Pathology field station. For this, pink bud blossoms were collected, allowed to open in the laboratory, and either inoculated with a conidial suspension of *M. fructicola* (20K conidia/ml) and then treated after 24 h with fungicides or natural products using a hand sprayer (post-infection activity), or treated and then inoculated after 24 h (pre-infection activity). Three replications of 7 blossoms were used for each fungicide. Data were analyzed using analysis of variance and least significant difference (LSD) mean separation procedures of SAS 9.1.

Two orchards at the Kearney Agricultural Center (KAC), Parlier, CA, were used for the evaluation of preharvest treatments. Applications were made in the field using an air-blast sprayer (100 gal/A) at 8+1 day PHI to Elegant Lady and July Flame peach and at 8+2 day PHI (two orchards) and 15+8 day PHI (one orchard) to Ryan Sun peach. Fungicides evaluated are indicated in Fig. 6. In the orchard with July Flame and Ryan Sun peach, trees were treated for 8 h with simulated rain at selected times after treatment to create a more conducive environment for brown rot infection. Four boxes of 48 fruit each were harvested for each treatment (one per single-tree replication). Fruit were packed in commercial boxes and stored for approximately 7 days at 1 C. Fruit were then inoculated with *M. fructicola* by spray-inoculation of non-wounded fruit (15,000 conidia/ml). Fruit were then incubated at 20C, >90% RH, for 7 days and evaluated for incidence of decay. In another trial on Fay Elberta peach at UC Davis, fungicides were applied 7 days PHI. Twelve fruit from each of four single-tree replications were harvested and incubated for approximately 7 days at 20 C for development of natural incidence of decay. Data were analyzed using analysis of variance and least significant difference (LSD) mean separation procedures of SAS 9.1.

Host susceptibility of F1- progeny of Bolinha peach and other selections to brown rot blossom blight. Blossoms of parental Bolinha Q, D62-193, and Dr. Davis accessions, additional California varieties, and selected F1 progeny as suggested by Dr. Gradziel were collected at popcorn stage in the spring of 2008. Due to the almost simultaneous bloom of most accessions in 2008, blossoms could only be sampled once. Blossoms were allowed to open in the laboratory, placed in a container with a layer of wet vermiculite, spray-inoculated with a conidial suspension of *M. fructicola* (10^4 spores/ml) and incubated for 4-5 days at 20 C. The incidence of stamen infections was assessed for 7-8 blossoms per each of four replications. There were three sets of blossoms (each set incubated in four separate containers for the four replications). Comparisons among blossoms were done for each set because of possible minor differences in inoculation and incubation conditions that might affect the development of disease. Data were submitted to an analysis of variance and least significant difference mean separation procedures were performed using SAS 9.1.

Evaluation of fungicides for management of peach leaf curl. In a trial on the management of peach leaf curl caused by *Taphrina deformans* on Fay Elbereta peach at UC Davis, copper (i.e., Kocide 2000, Kocide 3000, Kentan 40DF, IRF070) and other fungicides (i.e., Syllit, Ziram) were applied once or twice during dormancy (12-19-07), late dormancy (1-29-08), or at pre-bloom (3-5-08) using an air-blast sprayer at 100 gal/A. Treatments with Kocide 2000, Kocide 3000, and Kentan were in combination with 2% oil. Trees were evaluated for disease in April, 2008. For this, 100 leaves of each tree were rated for the presence of leaf curl. Data were analyzed using analysis of variance and least significant difference (LSD) mean separation procedures of SAS 9.1.

Efficacy of fungicides for management of powdery mildew of cling peach. A trial on the management of powdery mildew caused by *Podosphaera pannosa* was established in a commercial cv. Carson orchard. New single-active ingredient (e.g., Inspire, Quintec, Quash, V-10118) and pre-mixture fungicides (e.g., Adament, Distinguish, Inspire Super, A8122, A15909, A13703) as well as Stylet oil were used either in single-fungicide or rotation programs. Applications were done on 3-3 (full bloom), 3-19 (2 weeks after petal fall, and 4-9-08 (5 weeks after petal fall). Disease was evaluated in June. For this, leaves (the fifth leaf from the tip of the shoot and older leaves) from 20 shoots from each of the five single-tree replications and fruit were rated for disease.

RESULTS AND DISCUSSION

Efficacy of fungicides for management of blossom blight. Due to very low precipitation in the spring of 2008 (49.0 mm between Feb. 1 and April 1, 2008, as compared to 59.4 mm in 2007 and 133.6 mm in 2006 for the same time period) at our trial site at Kearney Ag Center, as in 2007, the incidence of blossom blight was less than 1-2% in the untreated control for all stone fruit cultivars in the two orchards. The single 8-h simulated rain application in one of the orchards did not increase the amount of disease. Thus, no field data could be obtained in 2008 and several laboratory studies on detached blossoms were conducted where treatments were evaluated for their pre- and post-infection activity.

In the comparative laboratory evaluation, all fungicides, including two new compounds (i.e., DPX LEM17 and V-10135) and seven new pre-mixtures, provided good to excellent pre- and post-infection activity (i.e. blossoms were inoculated with conidia of *Monilinia fructicola* 24 h after or before treatment) (Figs. 1,2). Three new natural products were evaluated on cvs. Fay Elberta and Ross blossoms. The incidence of stamen infections on cv. Fay Elberta in the pre-infection studies was reduced from 87.8% in the control to 58.1% by MOI 104 and to 72.0% by MOI 107 (Fig. 3). On cv. Ross, however, MOI 107 when used at 0.5%, effectively reduced the incidence of infection from 76.3% in the control to 11.7% (Fig. 4). MOI 106 was not effective. MOI 104 and MOI 107 also exhibited some post-infection activity. These data with natural products are preliminary and studies need to be repeated to possibly provide treatment options for organic production. Currently, registered fungicides that belong to five different classes, the SBI fungicides Orbit, Elite, Indar (Enable), and Rally (Laredo), the anilinopyrimidines Vangard and Scala, the dicarboximide Rovral/Oil, and the pre-mixtures Pristine (carboxamide-QoI), Adament (SBI-QoI), and Distinguish (anilinopyrimidine+QoI) are highly effective treatments for immediate use in managing brown rot blossom blight. Future registrations include two additional SBI fungicides (difenoconazole - Inspire and metconazole – Quash), a second-generation carboxamide (USF2015), as well as new pre-mixtures (Inspire Super and several numbered compounds).

***Efficacy of preharvest fungicides for management of fruit decays*.** The emphasis of our preharvest field trials was the evaluation of new pre-mixtures. In addition to Pristine, eight recently registered (Adament, Distinguish) or experimental products were included in the studies. Preharvest (7 days PHI) applications on Fay Elberta peaches were evaluated for their efficacy against the natural incidence of brown rot. V-10135, USF2015, and the five evaluated pre-mixtures all performed very well, reducing decay from 75.7% in the untreated control to between 0% (i.e., USF2015) and 11.7% (i.e., Inspire Super) (Fig. 5). Inspire with 33.9% decay incidence was less effective and an experimental compound (EXP90A) was least effective (52.7%).

Two-spray programs were used on three additional peach cultivars and fruit were non-wound inoculated after harvest (Fig. 6). All fungicides significantly reduced the incidence of brown rot fruit decay when applied within 8 days of harvest. Most treatments, including Inspire, performed with a consistent high efficacy and these included Quash, Inspire, USF2015, Adament, and in most cases, all of the numbered pre-mixtures. Earlier applications (15+8 days PHI) that were evaluated on Ryan Sun peach in one orchard were less effective than later applications (8+2 days PHI) for some treatments (e.g., Quash, Vangard, A159909, A13703), but not for others (e.g., Inspire, Adament, USF2016, A8122, Pristine) (Fig. 6B). The natural product Cerebrocide was evaluated in one of the Ryan Sun peach trials. It significantly reduced the incidence of decay from the untreated control by up to 40% at the 8+2 day preharvest application interval, but not at the 15+8 day application interval (Fig. 6B). This indicates that Cerebrocide – as the MOI products in the blossom studies – is not very persistent, but represents a new potential treatment for organic production.

Although simulated rain applications (one or two applications) that were done after preharvest treatments in one of the orchards did not increase the natural incidence of decay, information was obtained on the persistence of the materials. Thus, overall all fungicides were still very efficacious and there was no consistent correlation between efficacy in the non-simulated rain-treated (Elegant Lady and Ryan Sun peach – orchard 1) and simulated rain-treated (July Flame and Ryan Sun peach – orchard 2) orchards.

In summary, selected fungicides have been consistent in their performance over the years and on different stone fruit cultivars, and therefore are reliable preharvest treatments for the stone fruit industry for managing preharvest diseases and reducing brown rot decay. Highly effective preharvest rotational products for the SBIs are still needed other than the anilinopyrimidines (e.g., Scala and Vangard) that break down under high temperature and humidity and are then often not very effective. Pre-mixtures (e.g., Adament), tank mixtures (e.g., Orbit-Vangard), V-10135, and USF2015 potentially may fill this void. There were no grower reports on reduced performance of selected fungicide applications in 2008. This is likely due to the low disease pressure in 2008 and additionally, this may indicate that fungicide resistance in populations of *Monilinia* spp. against the newer fungicides has not been established.

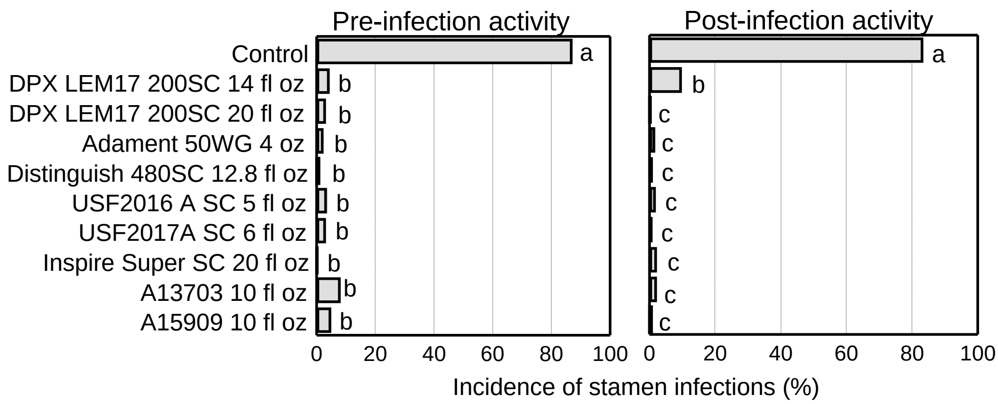
Host susceptibility of F1- progeny of Bolinha peach and other selections to brown rot blossom blight. In studies evaluating the susceptibility of peach genotypes to brown rot blossom blight, we continued to coordinate our research with Dr. Tom Gradziel. Genotypes evaluated included accessions of Bolinha and 34 other genotypes that were compared to cvs. Ross, Dr. Davis, Loadel, 49er, Carson, and White Heath Cling. After laboratory inoculations of freshly opened blossoms, there was a range of susceptibilities present among the genotypes evaluated (Fig. 7). Consistent with most previous studies, the Bolinha accession had a lower incidence of stamen infections than most other genotypes. D62-193, however, that in previous years was among the least susceptible genotypes, had a high incidence of stamen infections in 2008. The spring of 2008 had unusual warm weather and most genotypes were in bloom at about the same time. Thus, as stated previously, environmental conditions in the orchard, pre-disposition of the host, and cultural practices may have a more profound effect on blossom susceptibility than the genetic background of the host and this could explain differences in results over the years. In this year's evaluations, one accession was identified (i.e., DPRU 2243, USDA 12-1) that had the lowest incidence of stamen infections among all accessions used. This genotype was evaluated for the first time and will be of priority in the 2009 evaluations. Although some less susceptible peach genotypes have been identified over the years, breeding of new cling peach varieties is a long-term undertaking and for now, fungicide applications will continue to be critical in the management of blossom blight.

Evaluation of fungicides for management of powdery mildew and peach leaf curl. In the powdery mildew trial, the emphasis was on evaluating the efficacy of recently registered and experimental fungicides that are planned for registration. Again, numerous pre-mixtures were included. All fungicides and rotations evaluated displayed a similar efficacy in reducing the incidence of disease on leaves (Fig. 8). In the fruit evaluations, numerical, but not statistical differences were found among the treatments. No disease was found in the Inspire, Elite, Adament, A8122, A15909, and A13703 treatments and in two of the rotations, whereas in the untreated control 7.5% of the fruit showed powdery mildew symptoms.

In a trial on Fay Elberta peach on the management of peach leaf curl, the efficacy of selected fungicides applied during dormancy, late dormancy, or pre-bloom was compared in one- and two-spray application programs. Because for management of peach leaf curl the label for Syllit recommends an application just before buds swell in the spring, this fungicide was only evaluated as a pre-bloom application. Disease evaluation in the spring showed a numerical reduction of disease after Syllit treatments, but no significant difference as compared to the untreated control (Fig. 9). Overall in this trial as in trials over previous years, Ziram was the most effective treatment and disease incidence was between 0 and 1.3% among the application timings evaluated, as compared to 37.8% in the control. In addition, the two-spray programs with Ziram at the 8-lb or 6-lb rates resulted in no disease.

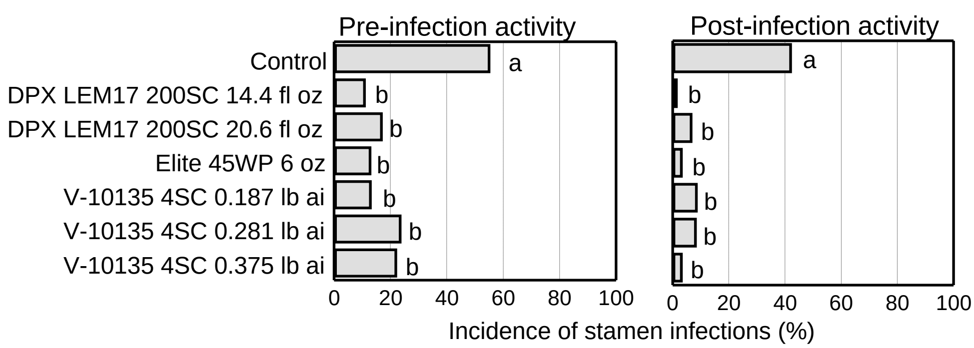
In a comparison of application timings for Kocide 3000, Kentan, and Ziram, the two-spray programs with dormant and delayed dormant applications were generally more effective than single delayed dormant treatments that were applied the end of January (Fig. 9). For Kocide 3000 the dormant application was numerically more effective than the delayed dormant application, whereas for Kentan it was the opposite. Thus, for these treatments there was no consistency in what was the better dormant timing, although a considerable amount of rain was observed between the two timings. In previous years' trials, however, pre-bloom treatments were not as effective and possibly, Syllit could be more effective when applied at an earlier timing. A similar efficacy was observed for Kocide 2000 (applied at 8 lb/A), Kocide 3000 (applied at 5 lb/A), and the numbered copper product IRF070 in the two-spray programs, indicating that reduced copper use does not compromise the efficacy of disease management. Our results indicate, that highly effective treatments are available for the management of peach leaf curl that when properly timed can reduce disease incidence to very low levels.

Fig. 1 Evaluation of the pre- and post-infection activity of new fungicides against brown rot blossom blight of Fay Elberta peach



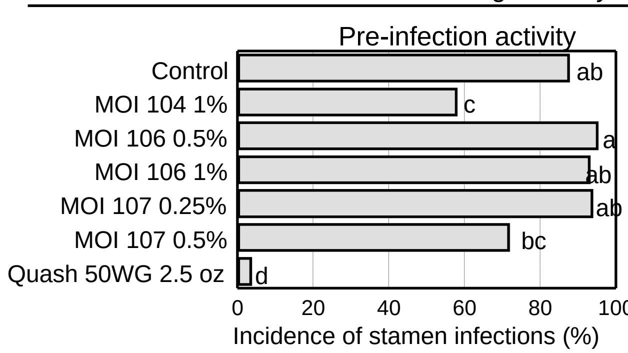
Blossoms at popcorn stage were collected in the field and allowed to open in the laboratory. Blossoms were then either treated using an air-nozzle sprayer 24 h before (pre-infection activity) or after (post-infection activity) inoculation with conidia of *M. fructicola* (15,000 conidia/ml). Blossoms were incubated at 20C for 4-5 days and were then evaluated for stamen infections.

Fig. 2 Evaluation of the pre- and post-infection activity of new fungicides against brown rot blossom blight of Fay Elberta peach



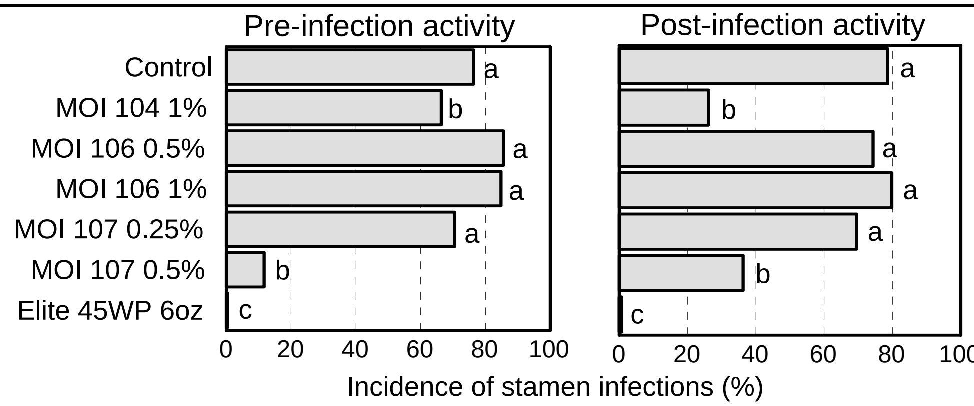
Blossoms at popcorn stage were collected in the field and allowed to open in the laboratory. Blossoms were then either treated using an air-nozzle sprayer 24 h before (pre-infection activity) or after (post-infection activity) inoculation with conidia of *M. fructicola* (15,000 conidia/ml). Blossoms were incubated at 20C for 4-5 days and were then evaluated for stamen infections.

Fig. 3 Evaluation of the pre-infection activity of new natural products against brown rot blossom blight of Fay Elberta peach



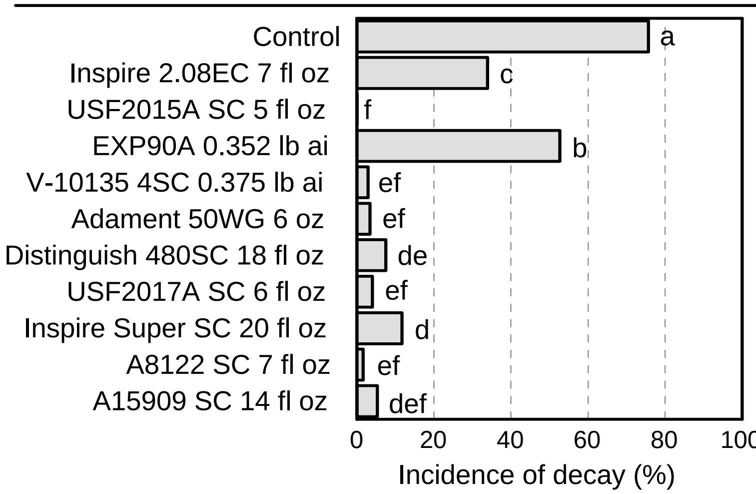
Blossoms at popcorn stage were collected in the field and allowed to open in the laboratory. Blossoms were then treated using an air-nozzle sprayer 24 h before inoculation with conidia of *M. fructicola* (15,000 conidia/ml). Blossoms were incubated at 20C for 4-5 days and were then evaluated for stamen infections.

Fig. 4 Evaluation of the pre- and post-infection activity of natural products against brown rot blossom blight of cv. Ross cling peach



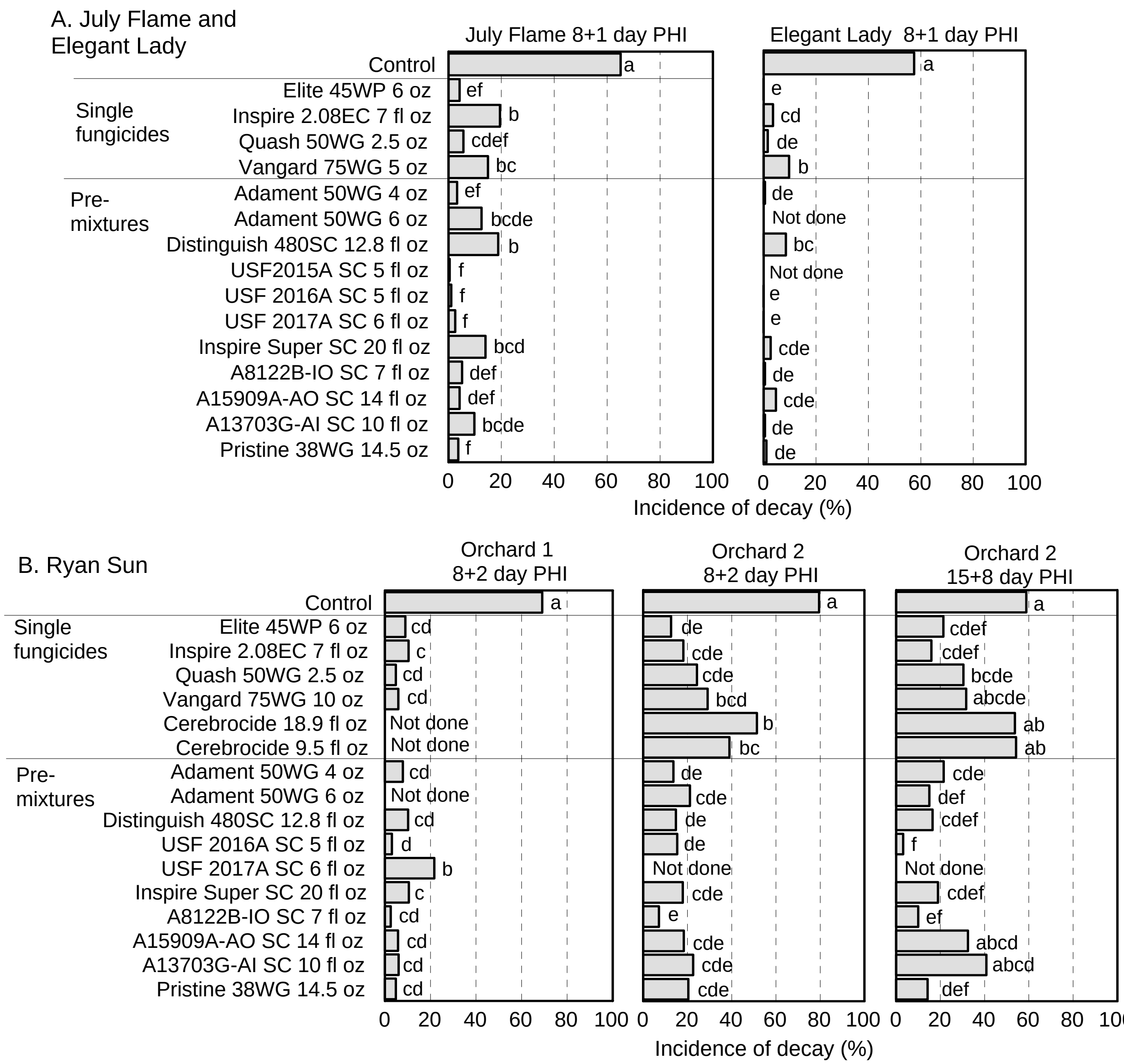
Blossoms at popcorn stage were collected in the field and allowed to open in the laboratory. Blossoms were then either treated using an air-nozzle sprayer 24 h before (pre-infection activity) or after (post-infection activity) inoculation with conidia of *M. fructicola* (15,000 conidia/ml). Blossoms were incubated at 20C for 4-5 days and were then evaluated for stamen infections.

Fig. 5 Efficacy of 7-day PHI fungicide applications for management of postharvest brown rot of Fay Elberta peach at UC Davis 2008
- Natural incidence of decay -



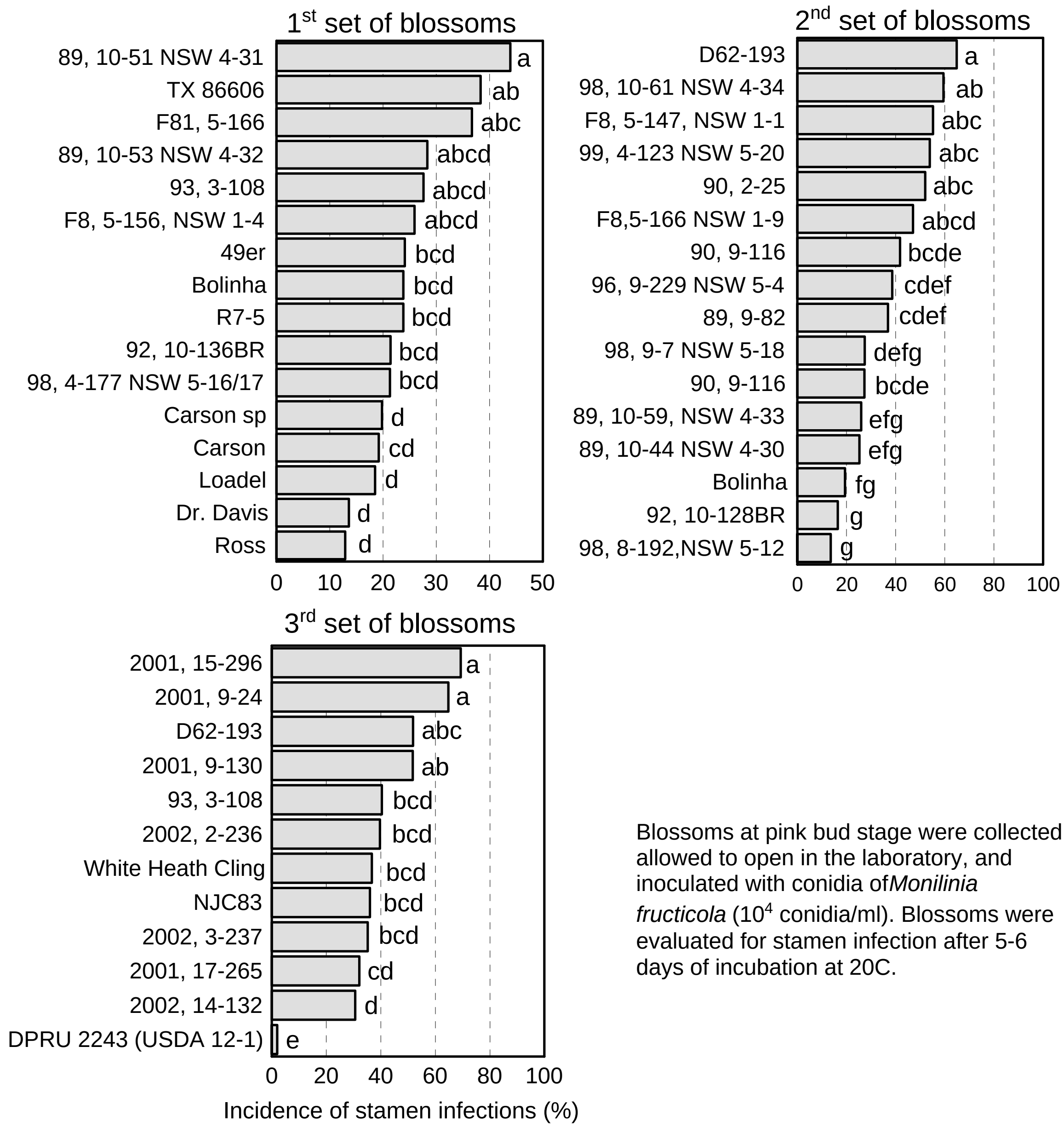
Applications were made in the field using an air-blast sprayer (100 gal/A) on 7-28-08. Fruit were harvested and incubated at 20C for 7 days. There were four single-tree replications for each treatment.

Fig. 6. Efficacy of preharvest fungicide treatments for management of brown rot of peach fruit at the Kearney Agricultural Center
- Spray inoculation of non-wounded fruit -



Applications were made in the field on 7-2 and 7-9-08 for July Flame, on 7-7 and 7-14-08 for Elegant Lady, and on 8-5 and 8-12-08 (orchard 1) or 8-6 and 8-13-08 (orchard 2) for Ryan Sun peach using an air blast sprayer at 100 gal/A. Fruit were harvested and stored at 1C for 7 days. Non-wounded fruit were spray-inoculated with *M. fructicola* (15,000 conidia/ml) and incubated at 20C for 7 days.

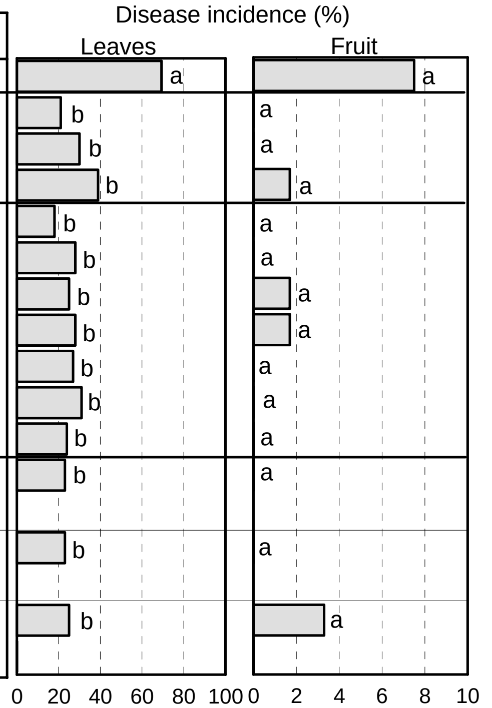
Fig. 7 Host susceptibility of different peach genotypes and their F1-progeny to brown rot blossom blight



Blossoms at pink bud stage were collected, allowed to open in the laboratory, and inoculated with conidia of *Monilinia fructicola* (10^4 conidia/ml). Blossoms were evaluated for stamen infection after 5-6 days of incubation at 20C.

Fig. 8 Efficacy of fungicide treatments for management of powdery mildew of cv. Carson peach in Butte Co.

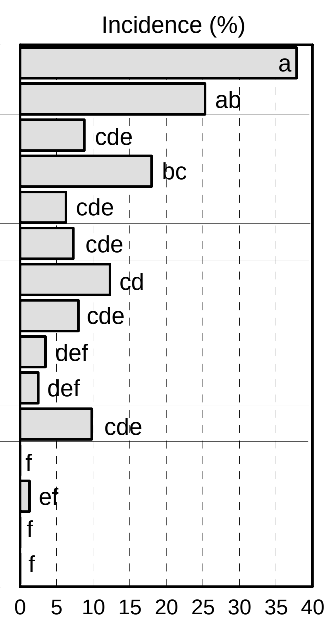
Program	Treatment	3-6	3-19	4-9
---	Control	---	---	---
Single treatments	Inspire 2.08EC 7 fl oz	@	@	@
	Elite 45WP 6 oz	@	@	@
	StyletOil 2%	@	@	@
Pre-mixtures	Adament 50WG 4 oz	@	@	@
	Adament 50WG 8 oz	@	@	@
	Distinguish 480SC 18 fl oz	@	@	@
	Inspire Super SC 20 fl oz	@	@	@
	A8122B-IO SC 7 fl oz	@	@	@
	A15909A-AO SC 14 fl oz	@	@	@
	A13703G-AI SC 10 fl oz	@	@	@
Rotations	Rovral 4F 32 fl oz	@		
	V-10118 9.38 fl oz	@	@	@
	Rovral 4F 32 fl oz	@		
	Quintec 2L 7 fl oz	@	@	@
	Quash 50WDG 2.5 oz	@		
	V-10118 6.2 fl oz	@	@	@



Treatments were applied using an air-blast sprayer at a rate of 100 gal/A on 3-3 (full bloom), 3-19 (2 weeks after petal fal and 4-9-08 (5 weeks after petal fall). Evaluation was done on 6-23-08. For this, leaves (the fifth leaf from the tip of the sho and older leaves) and fruit were rated for disease.

Fig. 9 Efficacy of fungicide treatments applied during dormancy and pre-bloom against peach leaf curl of Fay Elberta peaches in a field trial at UC Davis

Treatment*	12-19-07	1-29-08	3-5-08
Control	---	---	---
Syllit 2 pts	---	---	@
Kocide 3000 5 lb + 2% oil	@	---	---
Kocide 3000 5 lb + 2% oil	---	@	---
Kocide 3000 5 lb + 2% oil	@	@	---
Kocide 2000 8 lb + 2% oil	@	@	---
Kentan 40DF 6 lb + 2% oil	@	---	---
Kentan 40DF 6 lb + 2% oil	---	@	---
Kentan 40DF 6 lb+ 2% oil	@	@	---
Kentan 40DF 4 lb + 2% oil	@	@	---
IRF070 28DF 4 lb	@	@	---
Ziram 76DF 8 lb	@	---	---
Ziram 76DF 8 lb	---	@	---
Ziram 76DF 8 lb	@	@	---
Ziram 76DF 6 lb	@	@	---



Treatments were applied in the field using an air-blast sprayer (100 gal/A) on 12-19-07 (dormant), 1-29-08 (delayed dormant), and 3-5-08 (pre-bloom). Both Kocide treatments are 66% of maximum rate on the label; whereas Ziram at 6 lb is 75% of maximum rate on the label.