# Annual Report - 2014

Prepared for the California Cling Peach Advisory Board


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| Title: | *Management of brown rot, powdery mildew, and peach leaf curl diseases of peach in California* |
| Status: | Forth-Year of Four |
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## SUMMARY OF RESEARCH ACCOMPLISHMENTS DURING 2014


We continued our research on major blossom, foliar, and fruit diseases of cling peach in California including leaf curl, brown rot blossom blight and fruit rot, and powdery mildew. Low rainfall during the winter and spring resulted in low disease levels. Still, we focused on the management of these diseases with new fungicides and biological treatments using inoculation studies when possible.

1. Peach leaf curl incidence was low in the spring of 2014. Still, our efficacy trial indicated that Ziram, used at the 6- lb or 8 -lb rate, was the best treatment. Chlorothalonil (e.g., Bravo) as well as Syllit, copper (Badge X2, Kocide 3000), and selected combinations (e.g., Badge X2-Bravo, Kocide 3000-Syllit) were also highly effective. These fungicides represent valuable components of a leaf curl management program and alternatives to copper fungicides.
2. Brown rot blossom blight incidence was low in 2014 – Efficacy data was obtained on cv. Fay Elberta at UC Davis. Three new biological treatments and several fungicides were evaluated. The plant extract Fracture (previously Problad) and the biocontrols Botector (*Aureobasidium pullulans*) and Actinovate (*Streptomyces lydicus*) showed efficacy and significantly reduced the natural incidence of blossom blight from that of the control. The efficacy of Fracture was similar to most of the conventional synthetic fungicides. Of the conventional fungicides, the lowest levels of disease were obtained with the pre-mixtures Quadris Top (FG 7/11 difenoconazole + azoxystrobin), Luna Sensation (FG 7/11 fluopyram + trifloxystrobin), Luna Experience (FG 7/11 fluopyram + tebuconazole), and Merivon (FG 7/11 fluxapyroxad + pyraclostrobin). Rhyme, Quash, and Ph-D + Tebucon also were effective. Blossoms of Fay Elberta peach were used in laboratory tests and all fungicides evaluated demonstrated excellent pre- and post-infection activity; whereas the incidence of infections by the two biological treatments was reduced by 25-75% as compared to the control (50-91% infection). No disease developed in the Kearney Agricultural Research and Extension (KARE) Center trials due to low rainfall. Sixteen treatments were applied on two varieties of peach.
3. Preharvest fungicide applications were evaluated for the management of postharvest brown rot decay on three peach varieties in two orchards. In the UC Davis trial on cv. Fay Elberta where 1-day and 7-day PHI evaluations were done, the most effective fungicides at both timings included the new FG 7 Fontelis (penthiopyrad), and the pre-mixture Luna Experience, and the mixture Exp1+Exp2. Other fungicides such as Ph-D, Quash, and Rhyme, the pre-mixtures Luna Sensation (FG 7/11), Inspire Super (FG3/9), and Merivon (FG 7/11), and tank mixtures of Ph-D + propiconazole worked well when applied just prior to harvest (1 day PHI). In the two peach trials at KARE with 7-day PHI treatments, Merivon, Luna Sensation, Luna Experience, as well as Indar, Quash, Fontelis, and tank mixtures of Ph-D+Tebucon and Fontelis+Tebucon were consistently the best treatments on both cultivars.
4. Evaluation of brown rot blossom blight susceptibility among peach genotypes in the UC Davis breeding program continued with 24 new and previously evaluated genotypes. The Bolinha accession had an the lowest amount of stamen infections but several Bolinha crosses such as accession 89,10-59 also had low disease. Disease incidence for several genotypes including extra late accessions and some peach almond parentage was lower than that of other accessions.

5. In a powdery mildew management field trial, there was no disease detected in the untreated check or any of the 16 treatments that were applied at full bloom, shuck split, and floral tube dehiscence. Field samples from CE farm advisors proved to be hail damage and not powdery mildew.
6. New information on fungicide performance will be incorporated into the UCIPM website – Fungicide Efficacy Tables (http://www.ipm.ucdavis.edu/PDF/PMG/fungicideefficacytiming.pdf).

**INTRODUCTION**

Brown rot caused by the fungal pathogens *Monilinia fructicola* and *M. laxa* is the most important disease of stone fruit in California. The blossom blight stage of the disease cycle continues to be critical in the epidemiology of the disease. Primary inoculum in the form of ascospores produced from apothecia (*M. fructicola*) and conidia from mummified fruit or twig cankers (*M. fructicola* and *M. laxa*) infects blossoms to start the annual disease cycle. Subsequently, diseased blossoms supply secondary inoculum (i.e., conidia) for fruit infections in the current growing season. Due to the dry California climate, fruit rots are not a major problem in most years, but devastating losses may occur with late spring/summer rains and entire crops can be lost. Thus, a considerable effort has been made to increase the number of fungicides available with different modes of action and to develop peach selections less susceptible to brown rot. Thus, the first part of this report will focus on management of brown rot blossom blight and fruit decay.

Currently fungicide treatments are the most effective and consistent method for brown rot control, and we are continually evaluating the efficacy of new compounds. With the introduction of several new chemical classes and a focus on safer materials (e.g., EPA-classified reduced-risk pesticides), there has been an outpouring of new fungicides. They belong to classes assigned by the Fungicide Resistance Action Committee (FRAC) as distinct FRAC groups (FGs) and include the strobilurins (QoIs; FG 11), DMIs (FG 3), SDHIs (FG 7 - fluopyram, fluxapyroxad, penthiopyrad, and boscalid), anilinopyrimidines (FG 9), hydroxyanilides (FG 17), and polyoxins (FG 19). Currently, most of the new materials are introduced as pre-mixtures. There is a need for more research on the management of foliar and fruit diseases of cling peach with these new chemistries and we continued our studies in 2014 to determine the spectrum of activity, efficacy and its consistency, preventative and post-infection activity, persistence of residues, and resistance characteristics. This information is needed to design management programs that are highly effective under different environmental conditions (i.e., low to high rainfall) and that help to prevent the development of fungicide-resistant populations of the pathogens. For resistance management, ideally, any one fungicide class should only be used once or twice per season. The new SDHI products (FG 7) have activity against brown rot and powdery mildew and thus, these exciting new rotation fungicides to the DMIs (FG 3), APs (FG 9), and QoIs (FG 11) were also included in our studies in 2014.

An additional goal is to evaluate natural products and biocontrols as possible organic alternative treatments. Many previously evaluated products were ineffective, and others such as Actinovate and Regalia were inconsistent in their efficacy in reducing blossom blight and powdery mildew. Under low disease pressure in 2014, three natural products/biocontrols (Botector, Actinovate, Fracture) significantly reduced the incidence of brown rot from that of the control. In 2010, we identified polyoxin-D (Ph-D, Tavano, Oso) as a potential new organic material. In Sept. 2012, the EPA gave this fungicide an "exempt" registration status. It is the best potential organic fungicide that we have ever evaluated and subsequently it should be developed for both conventional and the organic production segments of the cling peach industry. Polyoxin-D again performed very well in some of our trials in 2014 on management of fruit brown rot.

In collaboration with the cling peach breeding program of Dr. Tom Gradziel, evaluation of natural host resistance identified promising new genetic lines with almond and wild almond parentage. Although we are using standardized laboratory methods, levels of susceptibility have sometimes been variable over the years indicating that susceptibility may be dependent on environmental conditions during flower development through regulation of genes involved in susceptibility. Still our data in 2014 showed good consistency with previous evaluations, and Bolinha genotypes showed the lowest incidence of stamen infections. Several other lines also showed lower susceptibility to blossom infection as compared to the commercial standard Dr. Davis. This information will help in the discovery of molecular markers (e.g., major genes or more likely quantitative trait loci or QTLs) that are associated with host susceptibility. These markers then can be used in further breeding programs and they ultimately may reveal the mechanism of resistance.

Peach leaf curl is an ongoing disease problem in peach production and serious outbreaks can occur after wet winters. Because the use of copper in agriculture is currently being reviewed by EPA and the cost of copper fungicides is increasing, alternative treatments, including new formulations of copper that allow lower application rates. Ziram has been consistently highly effective in our evaluations, whereas chlorothalonil and Syllit also showed very good efficacy. Currently we are working on obtaining: 1) a supplemental label for lower rates of ziram; 2) A new labeled rate of 6 pts/A of chlorothalonil to provide consistent efficacy similar to ziram; and 3) a higher usage rate (e.g., 48 oz/A) of dodine for more consistent control of peach leaf curl. Thus, these treatments were evaluated again in the 2013/14 season

Powdery mildew is another important disease of cling peach that can result in high losses, but generally has a sporadic occurrence. We continued our comparative evaluations of registered and new fungicides in 2014. In the past few years, we found that among new treatments FG 7 materials are highly effective against powdery mildew, similar to the DMI fungicides. Unfortunately, disease incidence at our trial site in 2014 was very low and no data could be obtained.

**Objectives**

I. Management of brown rot.

A) Efficacy and timing of representative compounds from each of five classes of fungicides: QoIs, APs, DMIs (e.g., Quash, Topguard, Mettle), hydroxyanilides (e.g., Protexio), and SDHIs (e.g., fluopyram, fluxapyroxad, penthiopyrad), potentially organic treatments such as Ph-D, Oso, Botector, and Fracture, as well as selected pre-mixtures (e.g., Quadris Top, Inspire Super, Pristine, Luna Sensation, and Merivon).
- Pre- and post-infection efficacy will be studied for both blossoms and fruit.

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

C) Natural host resistance of new peach genotypes to blossom blight and fruit decay
- Flower assays will be done using our standard laboratory procedure with detached blossoms collected at pink bud stage
- Fruit assays will be done using standard laboratory methods

II. Management of peach leaf curl

A) Evaluate higher rates of chlorothalonil (Bravo) and dodine (Syllit), new copper formulations, and tank mixtures of these products.

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, metrafenone, fluopyram, fluxapyroxad, penthiopyrad, and pre-mixtures), potentially organic treatments such as BLAD and polyoxin-D (Fracture and Ph-D respectively), as well as currently registered products, and their use in anti-resistance rotation and mixture programs.

**PROCEDURES**

***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 Elberta peach at UC Davis, selected rates of ziram, copper products (i.e., Kocide 3000, Badge X2), dodine (Syllit), or chlorothalonil (Bravo) were applied in combination with 3.5% Omni oil on Dec. 6, 2013 and/or pre-bloom on March 3, 2014. In addition, Syllit/Kocide and Bravo/Badge tank mixtures were also evaluated. Rates are indicated in Fig. 1. Applications were done using an air-blast sprayer at 100 gal/A. Trees were evaluated for disease in May 2014. For this, the number of infected shoots for a total of 100 shoots for each single-tree replication was determined.

***Evaluation of fungicides for management of brown rot blossom blight and preharvest fruit decay.*** Trials were established to evaluate fungicides for control of brown rot blossom blight and fruit rot on the following cultivars and locations: Fay Elberta peach at the UC Davis orchard; July Flame, Summer Flare, and

Ryan Sun peach, and Summer Fire nectarine at the Kearney Agricultural Research and Extension Center (KARE) in Parlier, CA. Fungicides that were applied to trees using an air-blast sprayer calibrated for 100 gal/A are found in Fig. 2. Incidence of brown rot blossom blight was recorded in April 2014. For this, 200 blossoms were evaluated for blight for each of the four single-tree replications per treatment.

Laboratory studies were done with cv. Fay Elberta 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 biological products as indicated in Fig. 3 using a hand sprayer (post-infection activity), or treated and then inoculated after 19 h (pre-infection activity). Three replications of 8 blossoms were used for each fungicide. The incidence of stamen infection was determined for each blossom after 4 to 5 days at 20 C.

For fruit rot studies at UC Davis, treatments were applied to Fay Elberta peach at 1- and 7-days PHI. In the KARE trials, treatments were applied to July Flame, Summer Flare, and Summer Fire at 7-days PHI and to Ryan Sun at 14- and 7-days PHI. Four single-tree replications for each treatment were randomized in four complete blocks. Fungicides evaluated are indicated in Figs. 4-5. Twelve fruit each were harvested for each treatment for the Fay Elberta trial and 48 fruit each for the trials at KARE. Fruit were spray-inoculated with *M. fructicola* (20,000 spores/ml) and incubated for 5-10 days at 20-25C, >95% RH. The incidence of fruit infection was expressed as a percentage of infected fruit per total fruit incubated for each replication.

***Host susceptibility of F1- progeny of Bolinha peach and other selections to brown rot blossom blight and fruit decay***. Blossoms of advanced breeding lines with almond and wild almond parentage were evaluated and compared to industry (e.g., Dr. Davis) and internal standards (e.g., Bolinha) this year. Genotypes as suggested by Dr. Gradziel (*see* Fig. 6) were collected at popcorn stage in the spring of 2014. Due to the environmental conditions and simultaneous flowering of many accessions in 2014, 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* ($2 \times 10^4$ spores/ml) and incubated for 4-6 days at 20 C. The incidence of stamen infections was assessed for 8-10 blossoms per each of four replications.

***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 in Butte Co. Seventeen treatments with single-fungicides, mixtures, pre-mixtures, and rotation programs were applied at full bloom, 2-weeks, and 4-weeks after petal fall. Disease was evaluated on May 28, 2014. For this, 100 fruit of each of the four single-tree replications were rated for disease.

***Statistical analysis of data.*** Data for disease incidence (percentage data) were arcsin transformed before analysis. Data were analyzed using analysis of variance and least significant difference (LSD) mean separation procedures of SAS 9.4.

## RESULTS AND DISCUSSION

***Evaluation of fungicides for management of peach leaf curl.*** Due to low rainfall during the winter and spring of 2014, disease incidence in our cv. Fay Elberta orchard at UC Davis was very low. Only 3.8% of shoots on untreated control trees showed symptoms of leaf curl. At this low disease pressure, all treatments applied were statistically similarly highly effective and reduced the incidence of disease (Fig. 1). No disease was found in any of the Ziram treatments, using two rates (6 and 8 lb) and two timings (i.e., mid-dormant and pre-bloom). Chlorothalonil (e.g., Bravo) as well as Syllit, copper (Badge X2, Kocide 3000), and selected combinations (e.g., Badge X2-Bravo, Kocide 3000-Syllit) were also highly effective.

Ziram, Chlorothalonil, and Syllit represent valuable components of a leaf curl management program and alternatives to copper fungicides. Over several years of trials, Ziram was always the most effective treatment evaluated. These three fungicides are currently registered for use in California. Thus, several options are available for growers to manage the disease.

***Efficacy of fungicides for management of blossom blight***. For brown rot blossom blight management, trials were done at KARE and UC Davis. With low rainfall in late winter/early spring at UC KARE, disease incidence was very low on untreated control trees and no data could be obtained. At the UC

Davis plot, blossom blight incidence also was very low with 6.6% incidence in the untreated control. Three new biological treatments and several fungicides were evaluated in this trial. The plant extract Fracture (previously Problad), and the biocontrols Botector (*Aureobasidium pullulans*) and Actinovate (*Streptomyces lydicus*) showed efficacy and significantly reduced the natural incidence of blossom blight from that of the control (Fig. 2). The efficacy of Fracture was similar to most of the conventional synthetic fungicides. Among conventional fungicides, the lowest levels of disease were obtained using the pre-mixtures Quadris Top (FG 7/11 difenoconazole + azoxystrobin), Luna Sensation (FG 7/11 fluopyram + trifloxystrobin), Luna Experience (FG 7/11 fluopyram + tebuconazole), and Merivon (FG 7/11 fluxapyroxad + pyraclostrobin). Rhyme, Quash, and Ph-D + Tebucon were also effective.

Blossoms of Fay Elberta peach were used in laboratory tests and all fungicides evaluated demonstrated very good to excellent pre- and post-infection activity (Fig. 3). The two biological treatments used reduced the incidence of stamen infections by 25% (Fracture) or 75% (Botector) as compared to the control (50-91% infection).

***Efficacy of preharvest fungicides for management of fruit decays.*** In the trial at UC Davis on Fay Elberta, 1-day and 7-day timings of 15 treatments were compared. All fungicides, including the exempt-from-tolerance polyoxin-D, significantly reduced the incidence of brown rot of non-wound-inoculated fruit treated 1 day before harvest (Fig. 4). There was no significant difference between most treatments, but numerically, the pre-mixtures Luna Sensation (FG 7/11), Luna Experience (FG 3/7), and Merivon (FG 7/11) resulted in the lowest incidence of fruit rot. All treatments were much less effective when applied 7 days before harvest, indicating their low persistence under hot, humid orchard conditions in the summer. The lowest disease incidence was found on fruit treated with Fontelis, Luna Experience, or the Exp1+Exp2 experimental mixture (Fig. 4). Although overall efficacy of all treatments was not very high in the 7-day PHI timings, these treatments will likely be still very effective under orchard conditions unless rain occurs during this time. This is because under orchard conditions, inoculation of fruit will occur throughout fruit ripening as opposed to our fruit inoculation with a high concentration of inoculum that was done 7 days after fungicide application. If rain does occur before harvest, it is advised that a fungicide application be done immediately before or as soon after the rain. In this case a fungicide should be used that has good post-infection activity, such as the FG 3 DMIs.

At KARE, only 7-day and 14+7-day PHI applications were done. In contrast to the UC Davis trial, most treatments were very effective using a 7-day PHI timing and these treatments included Merivon, Luna Sensation, Luna Experience, as well as Indar, Quash, Fontelis, and tank mixtures of Ph-D+Tebucon and Fontelis+Tebucon (Fig. 5). Ph-D by itself was not effective at this timing and Rhyme was among the least effective fungicides.

In summary, numerous highly effective fungicides are currently available for the management of brown rot blossom blight and fruit decay. Although Fontelis was very effective, it has a high risk for resistance development and should be used in a mixture with propiconazole or tebuconazole (FG 3) with a minimal additional expense when generic materials are used. The FG 3/11 and 7/11 pre-mixtures were consistently very effective on all cultivars. Overall, pre-mixtures have improved efficacy and have built-in resistance management with both active ingredients inhibitory to the brown rot pathogens. Additionally, all of the pre-mixtures evaluated are also effective against *Botrytis cinerea* (the green fruit rot and gray mold pathogen) and powdery mildew and thus, provide protection against multiple diseases. Applications are best done within 7 days of harvest, so high residue levels are still present at harvest when many of the infections occur. On later maturing fruit, a two-spray program (two sprays within 14 days of harvest) may be beneficial because of a higher disease pressure due to more quiescent infections and higher inoculum levels in the orchard later in the season.

Polyoxin-D was not approved as an organic fungicide in 2013 for stone fruit and other crops but will be reconsidered when additional information is provided to the National Organic Standards Board (NOSB). The US-EPA has designated this fungicide as exempt from tolerance (i.e., no MRL requirement for U.S. markets). In our field studies on brown rot fruit decay, polyoxin-D was effective as a 1-day PHI treatment on non-wound inoculated fruit, but had little or no efficacy when applied using a 7-day PHI application. This compound should be evaluated using a two-spray application program (within 7 days of harvest). We plan to conduct additional research on this product in 2015 for several reasons: 1) the material was inconsistently effective; 2) the EPA gave exempt status for fungicide residues and thus, new formulations can be evaluated; and 3) the material was submitted to NOSB as a future organic treatment. Two formulations (Ph-D, Oso) of the fungicide that are provided by two registrants (Arysta, Certis) will need to be evaluated. We consider this compound as mainly a contact material with moderate persistence. Thus, multiple applications close to harvest should prove to be consistent and effective.

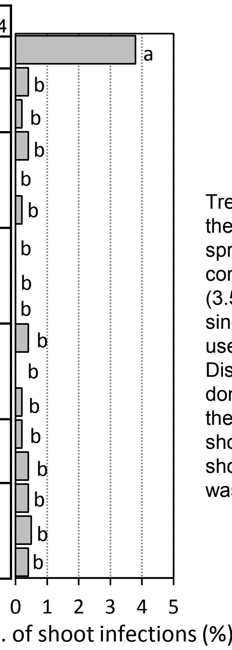
***Host susceptibility of F1- progeny of Bolinha peach and other selections to brown rot blossom blight.*** Evaluation of brown rot blossom blight susceptibility among peach genotypes in the UC Davis breeding program continued with 24 new and previously evaluated genotypes. The Bolinha accession had the lowest amount of stamen infections, but several Bolinha crosses, such as accession 89,10-59, as well as Extra Late accessions and some peach almond parentage lineages were also less susceptible. As in previous years, we found that some lines were consistent and others were inconsistent in their susceptibility. This may be due to environmental conditions that pre-dispose the host to infections by the pathogen but it may also be due to the genetics of blossom susceptibility because all of the advanced lines were from an orchard in the Wolfskill facility and were grown under the same horticultural practices.

***Evaluation of fungicides for management of powdery mildew.*** In the powdery mildew trial in Butte Co., very low levels of disease developed in the untreated control. Thus, no efficacy data could be obtained for the 17 treatments with single-fungicides, mixtures, pre-mixtures, and rotation programs that were applied at full bloom, 2-weeks, and 4-weeks after petal fall. Field samples from CE farm advisors proved to be hail damage and not powdery mildew.

In previous years' trials we identified numerous highly effective fungicides for management of powdery mildew. Among new treatments, fungicides containing FG 7 materials are highly effective against powdery mildew, similar to the DMI fungicides. For organic growers, 'softer chemistries' have been identified with activity against powdery mildew and these include Ph-D, Fracture, and Serenade Optimum. Serenade Optimum is already approved for organic production and gives organic growers a new options for the management of powdery mildew.

Fig. 1. Efficacy of fungicides applied during dormancy for management of peach leaf curl of Fay Elberta peach in a field trial at UC Davis 2013/14

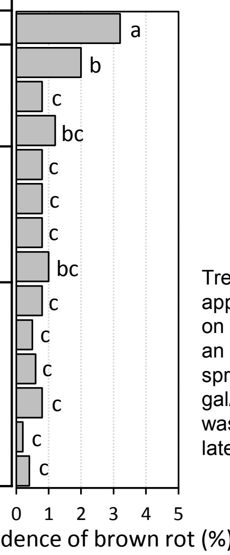
| Treatments | Rate/A | 12-6-13 | 3-3-14 |
|---|---|---|---|
| Control | --- | --- | --- |
| Syllit 65WG | 24 oz | @ | --- |
| Syllit 65WG | 32 oz | @ | --- |
| Bravo Weather-Stick | 4 pt | @ | --- |
| Bravo Weather-Stick | 6 pt | @ | --- |
| Bravo Weather-Stick | 6 pt | --- | @ |
| Ziram 76DF | 6 lb | @ | --- |
| Ziram 76DF | 8 lb | @ | --- |
| Ziram 76DF | 8 lb | --- | @ |
| Badge X2 | 5 lb | @ | --- |
| Badge X2 | 7 lb | @ | --- |
| Badge X2 | 7 lb | @ | @ |
| Kocide 3000 | 5 lb | @ | --- |
| Kocide 3000 | 7 lb | @ | --- |
| Syllit + Kocide 3000 | 24 oz + 3.5 lb | @ | --- |
| Syllit + Kocide 3000 | 24 oz + 3.5 lb | @ | @ |
| Badge X2 + Bravo | 3.5 lb + 3 pt | @ | --- |




Treatments were applied in the field using an air-blast sprayer (100 gal/A) in combination with a spray oil (3.5% Omni oil). Five single-tree replications were used for each treatment. Disease evaluation was done on 5-5-14. For this, the number of infected shoots for a total of 100 shoots for each replication was determined.

Fig. 2. Efficacy of biologicals and fungicides for management of brown rot blossom blight of Fay Elberta peach in a field trial at UC Davis 2014

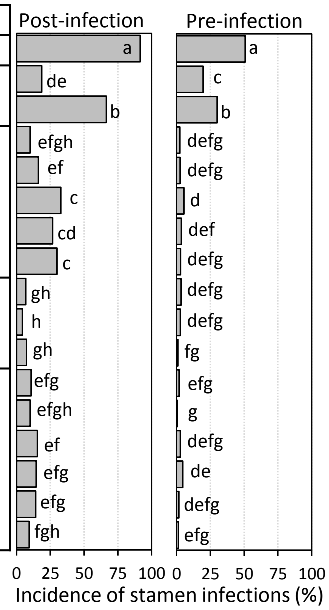
| | Treatments | Rate/A |
|---|---|---|
| | Control | --- |
| Biologicals | Botector + BioStick | 10 oz + 8 fl oz |
| | Fracture + DyneAmic | 24 + 16 fl oz |
| | Actinovate + Buffer | 12 oz + 8 lb |
| Single | Rhyme | 5 fl oz |
| | Rhyme | 7 fl oz |
| | Quash | 3 oz |
| | Fontelis + Breakthru | 14 fl oz |
| Mixtures, Pre-mixtures | Ph-D + Tebucon | 6.2 + 4 oz |
| | Luna Experience | 5 fl oz |
| | Luna Sensation | 5 fl oz |
| | Inspire Super + DyneAmic | 20 + 16 fl oz |
| | Quadris Top + DyneAmic | 14 + 16 fl oz |
| | Merivon | 5.5 fl oz |




Treatments were applied in the field on 3-7-14 using an air-blast sprayer at 100 gal/A. Disease was evaluated in late April.

Fig. 3. Efficacy of pre- and post-infection treatments for management of brown rot blossom blight of Fay Elberta peach in the laboratory 2014

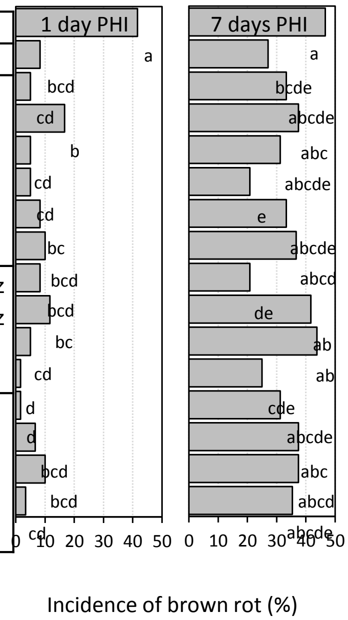
| | Treatments | Rate/A |
|---|---|---|
| | Control | --- |
| Biolo-gicals | Botector + Breakthru | 10 oz + 16 fl oz |
| | Fracture + Breakthru | 30 + 16 fl oz |
| Single | Rhyme | 5 fl oz |
| | Quash | 3 oz |
| | Indar 2F + Breakthru | 6 + 8 fl oz |
| | Fontelis + NIS | 20 + 8 fl oz |
| | Exp1 | 5.14 fl oz |
| Mixtures | Expt1 + Headline | 3.43 + 5.48 fl oz |
| | Exp1 + Exp2 | 3.43 + 4.57 fl oz |
| | Ph-D + Tebuzol | 6 + 4 oz |
| Pre-mixtures | Luna Experience + Breakthru | 6 + 8 fl oz |
| | Luna Sensation + Breakthru | 5 + 8 fl oz |
| | Inspire Super + DyneAmic | 20 + 16 fl oz |
| | Quadris Top + DyneAmic | 14 + 16 fl oz |
| | Pristine | 14.5 oz |
| | Merivon | 5.5 fl oz |




For evaluation of the pre-infection activity, closed blossoms were collected in the field, allowed to open, and treated in the laboratory using a hand sprayer. After 19 h blossoms were inoculated with spores of *M. fructicola* (20K/ml). For post-infection activity, blossoms were inoculated, incubated at 22C, and treated after 24 h. Blossoms were evaluated for stamen infections after 4-5 days of incubation at 20 C.

Fig. 4. Efficacy of biologicals and fungicides as preharvest treatments for management of postharvest brown rot of Fay Elberta peach in a field trial at UC Davis 2014

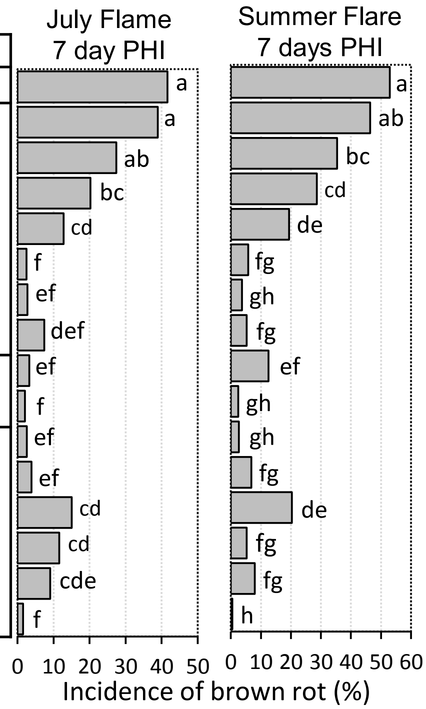
| | Treatments | Rate/A |
|---|---|---|
| | Control | --- |
| Single | Ph-D | 6 oz |
| | Rhyme | 5 fl oz |
| | Rhyme | 7 fl oz |
| | Quash | 3 oz |
| | Fontelis + NIS | 14 fl oz |
| | Exp1 | 5.14 fl oz |
| Mixtures | Exp1 + Headline | 3.43 + 5.48 fl oz |
| | Exp1 + Exp2 | 3.43 + 4.57 fl oz |
| | Ph-D + Tebucon | 6 + 4 oz |
| | Ph-D + Bumper | 6 oz + 2 fl oz |
| Pre-mixtures | Luna Experience | 5 fl oz |
| | Luna Sensation | 5 fl oz |
| | Inspire Super + DyneAmic | 20 + 16 fl oz |
| | Quadris Top + DyneAmic | 14 + 16 fl oz |
| | Merivon | 5.5 fl oz |



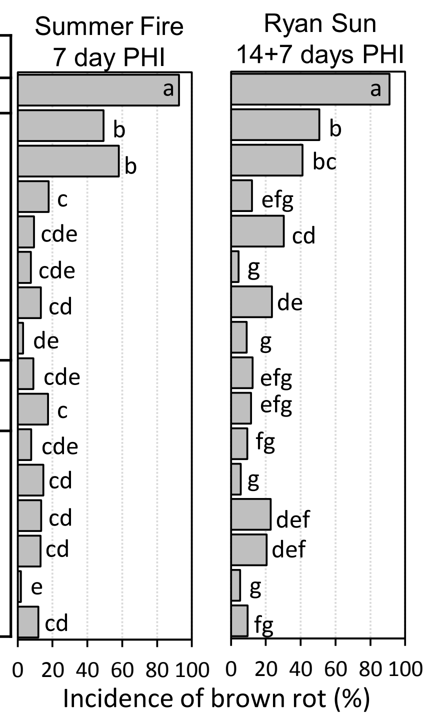

Treatments were applied in the field on 7-10-14 using an air-blast sprayer at 100 gal/A. Fruit were harvested (12 fruit from each of four single-tree replications), spray-inoculated with *M. fructicola* (30,000 spores/ml) and incubated for 10 days at 20-25C.

Fig. 5. Efficacy of biologicals and fungicides as preharvest treatments for management of postharvest brown rot in field trials at KARE 2014

| | Treatments | Rate/A |
|---|---|---|
| | Control | --- |
| Single | Ph-D | 6 oz |
| Single | Rhyme | 3.5 fl oz |
| Single | Rhyme | 7 fl oz |
| Single | Mettle | 10 fl oz |
| Single | Indar 2F | 6 fl oz |
| Single | Quash | 3 oz |
| Single | Fontelis + NIS | 14 fl oz |
| Mixtures | Ph-D + Tebucon | 6 oz + 4 oz |
| Mixtures | Fontelis (+NIS) + Tebucon | 14 fl oz + 8 oz |
| Pre-mixtures | Luna Experience | 5 fl oz |
| Pre-mixtures | Luna Sensation | 5 fl oz |
| Pre-mixtures | Inspire Super + DynAmic | 20 + 16 fl oz |
| Pre-mixtures | Quadris Top + DynAmic | 14 + 16 fl oz |
| Pre-mixtures | Pristine 38WG | 14.5 oz |
| Pre-mixtures | Merivon | 5.5 fl oz |

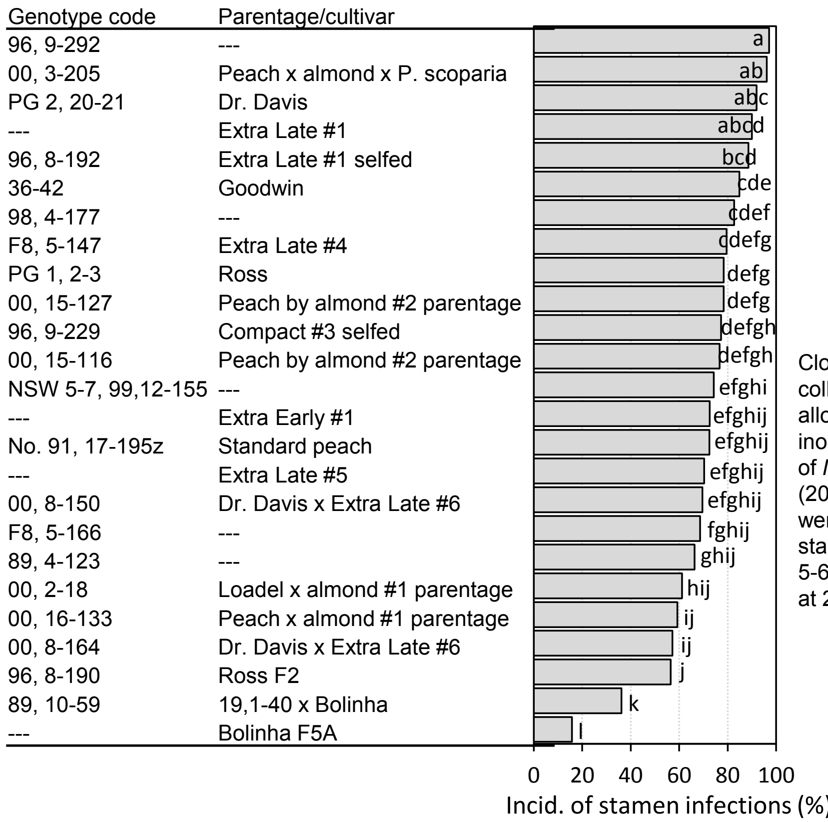



| | Treatments | Rate/A |
|---|---|---|
| | Control | --- |
| Single | Botector + Buffer | 10 oz + 10 lb |
| Single | Rhyme | 3.5 fl oz |
| Single | Rhyme | 7 fl oz |
| Single | Indar 2F | 6 fl oz |
| Single | Quash | 3 oz |
| Single | Fontelis + NIS | 14 fl oz |
| Single | PH-D + Viathon | 6 oz + 64 fl oz |
| Mixtures | Fontelis (+NIS) + Tebucon | 14 fl oz + 8 oz |
| Mixtures | Luna Experience | 5 fl oz |
| Pre-mixtures | Luna Sensation | 5 fl oz |
| Pre-mixtures | Inspire Super + DynAmic | 20 + 16 fl oz |
| Pre-mixtures | Quadris Top + DynAmic | 14 + 16 fl oz |
| Pre-mixtures | Pristine 38WG | 14.5 oz |
| Pre-mixtures | Merivon | 5.5 fl oz |
| Pre-mixtures | Viathon | 64 fl oz |




Treatments were applied in the field on 6-13-14 (July Flame and Summer Flare), 7-14-14 (Summer Fire) or 7-25 and 8-1-14 (Ryan Sun) using an air-blast sprayer at 100 gal/A. NIS = Non-inonic surfactant. Fruit were harvested (48 fruit from each of four single-tree replications), spray-inoculated with *M. fructicola* (20,000 spores/ml) and incubated for 5-7 days at 20C.

Fig. 6. Host susceptibility of standard and advanced cling peach genotypes with almond and wild almond parentage to brown rot blossom blight 2014




Closed blossoms were collected in the field, allowed to open, and inoculated with conidia of *M. fructicola* (20K/ml). Blossoms were evaluated for stamen infections after 5-6 days of incubation at 20 C.