Annual Report - 2012

Prepared for the California Cling Peach Advisory Board

Title:	*Management of brown rot, powdery mildew, and peach leaf curl diseases of peach in California*
Status:	Second-Year of Four
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SUMMARY OF RESEARCH ACCOMPLISHMENTS DURING 2012

We continued our research on major preharvest (foliar) and postharvest diseases of cling peach in California. We focused on leaf curl, brown rot blossom blight and fruit rot, and powdery mildew management with new fungicides.

1. For peach leaf curl, two applications of ziram, or chlorothalonil (e.g., Bravo), or mixtures of ziram with copper or dodine (e.g., Syllit) were highly effective when timed properly according to accumulated winter precipitation. Copper (Kocide 2000 6 – 12 lb) or high rates of dodine (48 fl oz) by themselves were also effective. Thus, over the years, Ziram, chlorothalonil, and the 48-oz rate of Syllit performed consistently well and represent alternatives to copper fungicides. Copper compounds are best used when winter precipitation is moderate to low.

2. For brown rot blossom blight management, trials were done on peach cultivars at KARE and UC Davis. With moderate to low rainfall in the spring, disease incidence was moderate in the KARE trial to high in the UCD trial for the untreated control trees, but was significantly reduced by a single application of all fungicide treatments. Several new fungicides were available for evaluation (S-2200 - Fungicide Resistance Action Committee or FRAC group (FG) undisclosed; the FG 3 Mettle (tetraconazole) and Topguard (flutriafol); the FG 7 SDHI Fontelis (penthiopyrad), and the FG 11 YT669 (picoxystrobin), and they were effective in reducing the disease. New fungicide pre-mixtures are continued to be introduced for stone fruit crops that were all highly effective. These include: Luna Sensation (FG 7/11 fluopyram + trifloxystrobin), Merivon (FG 7/11 fluxapyroxad + pyraclostrobin), and Q8Y78 (FG 7/11 penthiopyrad + picoxystrobin). The previously evaluated pre-mixtures Inspire Super (FG 3/9 difenoconazole+ cyprodonil), Adament (FG 3/11 tebuconazole + trifloxystrobin), and Quadris Top (FG 7/11 difenoconazole + azoxystrobin) continued to perform very well. Blossoms of Fay Elberta peach were used in laboratory tests and demonstrated excellent pre- and post-infection activity of all fungicides included. The biological and organic product Problad significantly reduced disease in field and laboratory studies.

3. Preharvest fungicide applications were evaluated for the management of postharvest brown rot decay on five varieties in two orchards. Using a single 7-day PHI application on three varieties, among single active ingredient products, Fontelis, Mettle, YT669, and IKF-5411 were similarly effective as Quash. For the pre-mixtures, all products significantly reduced disease among the cultivars, but overall, treatments with Adament, Luna Sensation, Inspire Super, Quadris Top, or Q8Y78 resulted in the lowest incidence of decay. Pristine and Merivon were highly effective in the KARE trial but less effective in the UCD plot. A higher incidence of decay occurred on two later-maturing varieties even when two fungicide applications (7- and 14-day PHI) were made to the trees. Mettle, Merivon, and Q8Y78 were the most consistent in their performance.

4. Evaluation of brown rot blossom blight susceptibility among peach genotypes in the UC Davis breeding program continued with 16 new and previously evaluated genotypes. The Bolinha accession had an intermediate amount of stamen infections. Disease incidence of several genotypes was statistically lower than that of Bolinha and these included one late and five extra late accessions that soon will be released. We provided this information to the peach breeder.

5. In powdery mildew management in a field trial with low disease pressure, all treatments reduced the disease similarly including the biological Problad, and DMI (FG 3), QoI (FG 11), SDHI/QoI (FG 7/11), DMI/QoI (FG 3/11), DMI/AP (3/9) fungicides. Merivon in rotation with Vivando (FG U8) or Rovral (FG 2) mixed and rotated with Quintec (FG13) were also very effective. Fontelis at 14 oz/A numerically was the least effective in this trial. Some of these materials are highly specific against powdery mildews (Quintec and Vivando), others are also used extensively in blossom and fruit brown rot programs. Vivando was accepted into the IR-4 program in 2010. Thus, powdery mildew-specific compounds should be used at timings in rotations when brown rot is not a target for management (e.g., early fruit development) to reduce the overall use of DMI fungicides.

INTRODUCTION

In an integrated approach for the management of fungal diseases of peach, the use of fungicides is currently the most effective control component. We are developing new products with new modes of action and new pre-mixtures as well as application strategies (e.g., timing, rotation programs) for the control of brown rot blossom blight and fruit decay, powdery mildew, and peach leaf curl. This will ensure that highly effective and safe materials will always be available to the peach industry and that mixture and rotation programs can be designed to help prevent the selection of resistant populations to any given class of fungicide.

Brown rot caused by *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. Thus, removal of mummies from trees is a strategy to eradicate the pathogen from the orchard and minimize primary inoculum in the spring. Cultural practices also include nutrient and water management. High nitrogen and over-watering can increase host susceptibility and create favorable environments for disease. To prevent infections from occurring, fungicides are most effectively used. For blossom protection, we have shown that many of the newer fungicides have pre-infection (protective - effective when applied before infection) and post-infection (suppressive - effective when applied up to 24 h after infection) activity. Thus, a single, properly timed fungicide application can reduce blossom blight to zero or near zero levels. For managing brown rot of fruit, many fungicides (FG 7, 11, 7/11, etc.) only provide protection and must be applied before infection periods; whereas other fungicides have local systemic action (FG 1, 3, 3/9, etc.) and can suppress established infections. Understanding the epidemiology of brown rot and the properties of fungicides will lead to optimization of management programs.

In 2012, we continued our blossom and preharvest efficacy studies with registered and new fungicide treatments. Single-active ingredient fungicides evaluated included materials in the following classes: FG 3 - demethylation inhibitors or DMIs (Tilt – propiconazole, Quash – metconazole, Mettle – tetraconazole, Topguard – flutriafol), FR 11- strobilurins or QoIs (YT669 - picoxystrobin), FG 9 - anilinopyrimidines (Vangard - cyprodinil, Scala - pyrimethanil), and FG 7 - succinate dehydrogenase inhibitors or SDHIs (Fontelis - penthiopyrad). Fungicide pre-mixtures included the previously evaluated FG 7/11 Pristine (pyraclostrobin + boscalid), FG 3/9 Inspire Super (difenoconazole+cyprodonil), FG 3/11 Quadris Top (azoxystrobin + difenoconazole), and FG 3/11 Adament (tebuconazole + trifloxystrobin), as well as the new FG 7/11 products Luna Sensation (fluopyram + trifloxystrobin), Merivon (fluxapyroxad + pyraclostrobin), and Q8Y78 (penthiopyrad + picoxystrobin). Fontelis was registered in 2012 on stone fruit and other crops; whereas Luna Sensation and Merivon are expected in the spring of 2014. Additionally, we continue to evaluate organic materials (biological and natural products) such as Problad. Our research supports the registration of these products both federally and in the state of California.

In a long-term strategy for the management of brown rot blossom blight, we are assessing the natural host resistance in F1 progeny from crosses between less susceptible selections (e.g., Bolinha and other genotypes) and California varieties. Most of the promising genetic lines are being tested for their resistance to brown rot blossom blight and fruit rot and this information is being utilized in the breeding program. Blossom and fruit assays are based on standardized laboratory protocols. We initiated tests to potentially find a less labor-intense procedure for fruit evaluation that is done directly in the field. Blossom and fruit field assays have proven to be difficult tasks, however, because host susceptibility is determined by stage of blossom development or fruit maturity and therefore, standardization is easily compromised in comparing genotypes. Additionally, fluctuating temperatures in the spring and high temperatures and low relative humidity in the summer make standardization difficult, and often experiments cannot be exactly reproduced. Still, field methods to evaluate F2 selections of peach where a greater number of blossoms and fruit are available would be advantageous in the development of new cultivars.

We also continued our evaluations of fungicide treatments for peach leaf curl and powdery mildew management. Powdery mildew research on peach has been difficult due to the sporadic occurrence of the disease with generally low disease incidence levels. Still, several highly effective products have been identified and were evaluated under low disease pressure again in 2012. Although organic treatments that we have evaluated in the last several years have been either not effective or inconsistent in their efficacy, we continue to evaluate potential products for disease control. Goals of field trials on peach leaf curl management included the identification of highly effective non-copper based materials such as ziram (FG M3), chlorothalonil (FG M5), and dodine (FG U12) and timing of applications.

OBJECTIVES

I. Management of brown rot.

A) Efficacy and timing of representative compounds from each of four classes of fungicides: QoIs, APs, DMI fungicides (including Quash, Topguard, Mettle), and SDHIs (fluopyram, fluxapyroxad, Fontelis - penthiopyrad), and selected pre-mixtures (Pristine, Adamant, Luna Sensation, Merivon, Quadris Top), as well as potentially organic treatments such as Ph-D or Problad.
  - 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 peach to blossom blight and fruit decay
  - Flower assays will be done using our standard laboratory procedure with detached pink bud blossoms
  - Field assays for evaluating fruit susceptibility will be developed

II. Management of peach leaf curl

A) Evaluate the timing of Ziram (lower rates), Bravo, Syllit, and new copper formulations.

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

MATERIALS AND METHODS

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 materials (i.e., Kocide 3000, Badge X2), dodine (Syllit), or chlorothalonil (Bravo) were applied in combination with 4% Omni oil on Dec. 6, 2011 and Jan. 27, 2012. In addition, a ziram-dodine and ziram-copper tank mixture program was done. Rates are indicated in Fig. 1. Applications were done using an air-blast sprayer at 100 gal/A. Trees were evaluated for disease on April 2012. For this, the number of infected leaves for a total of 100 leaves 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 indicated in the Results (*see* Figs. 1-3 for blossom blight and Figs 4-6 for fruit rot). Randomized sub-plots of four single-tree replications for each treatment were used. Applications of each fungicide were done at 20% bloom on Fay Elberta, 55% bloom (Summer Fire), or 20% bloom (Ryan Sun). Incidence of brown rot blossom blight was recorded in April 2012. 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 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. The incidence of stamen infection was determined for each blossom after 3 to 5 days at 20 C.

For fruit rot studies at UC Davis, treatments were applied to Fay Elberta peach at a 14-day PHI. In the KARE trials, treatments were applied to July Flame and Summer Flare at a 7-day PHI, and to Summer Fire and Ryan Sun at 7- and 14-day PHI. Four single-tree replications for each treatment were randomized in four complete blocks. Fungicides evaluated are indicated in Figs. 6-8. Four boxes of 24 to 48 fruit each were harvested for each treatment (one per single-tree replication). Fruit were packed in commercial boxes and stored for approximately 5 to 7 days at 1 C and then for 5 to 7 days at 20 C, >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 parental lineages 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. 5) were collected at popcorn stage in the spring of 2012. Due to the environmental conditions and simultaneous flowering of many accessions in 2012, 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 x 104 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.

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. In addition to the biocontrol Problad, five single-fungicides, six pre-mixtures, two tank mixes, and two rotation programs were evaluated (see Fig. 9). Applications were done on March 1 (full bloom), March 20 (2 weeks after petal fall), and April 9, 2012 (6 weeks after petal fall). Disease was evaluated on June 6, 2012. For this, 100 fruit of each of the four single-tree replications were rated for disease and the incidence was expressed as a percentage of infected fruit.

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 9.3.

RESULTS AND DISCUSSION

Evaluation of fungicides for management of peach leaf curl. In a trial on cv. Fay Elberta peach on the management of peach leaf curl, the efficacy of two applications of selected fungicides applied alone or in mixtures during dormancy and late dormancy was evaluated. Under very high disease pressure with 90% of the leaves infected in the untreated control, all treatments significantly reduced the incidence of disease (Fig. 1). The incidence among treatments ranged from 2.0% (chlorothalonil treatments) to 65% (dodine 32 oz/A). Incidence of disease was very low for ziram, chlorothalonil, and ziram mixed with copper (e.g., Kocide 3000 or Badge X2) or dodine. Ziram, chlorothalonil, and dodine are currently registered for use in CA. Ziram was equally highly effective when used at the lower than label rates of 6 lb/A (when used alone) or 4 lb/A (when used in mixtures). The high rate of Syllit (48 oz) significantly improved the performance of the fungicide over the lower rate. Thus, ziram, chlorothalonil, high rates of dodine, and mixtures of copper or dodine with a reduced rate of ziram were effective and 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 on peach cultivars at KARE and UC Davis. With high rainfall (3.5 inches) and cool temperatures (low 41.2 °F, mean 51.4 °F, high 61.8 °F) during March 2012 at UC Davis, disease incidence was moderate to high in the untreated control trees with 14% infection, but was significantly reduced by a single application of all fungicide treatments (Fig. 2). A single application of the biological Problad significantly reduced blossom blight to 9%. Several new fungicides such as Mettle (FG 3 – tetraconazole), Topguard (FG 3 – flutriafol), S-2200 (class not revealed), Fontelis (FG 7 - penthiopyrad), and YT669 (FG 11- picoxystrobin) reduced the disease incidence to less than 5%. S-2200 was the least effective fungicide evaluated. Fontelis and the pre-mixtures (FG 3/9 - Inspire Super; FG3/11 - Adament, Quadris Top; FG 7/11 - Luna Sensation, Pristine, Merivon, Q8Y78), and a tank mixture (FG 3/Unknown - Quash/S2200 – high rates) were highly effective and reduced disease incidence to less than 2.5%. Overall, the pre-mixtures had 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 pathogen, and powdery mildew pathogens and thus, provided protection against multiple diseases.

Blossoms of Fay Elberta peach were used in laboratory tests and demonstrated excellent pre- and post-infection activity of all fungicides evaluated (Fig. 3). Stamen infection of the untreated control blossoms was 85% and 70% in the post- and pre-infection activity assays, respectively. Most fungicides provided 100% control (no stamen infections observed). Problad and YT669 had the least pre- and post-infection activity of the fungicides evaluated (Fig. 3). Still, the biological Problad showed considerable activity in these laboratory studies with some post-infection activity (39% stamen infection) and high pre-infection activity (11% stamen infection).

During bloom in the last week of Feb. and the first two weeks of March (until March 16) there was almost no precipitation (total 0.02 in). With low rainfall (1.9 inches) and warm temperatures (low 41.6 °F, mean 53.7 °F, high 66.2 °F) during March 2012 at UC KARE, disease incidence was low in the untreated control trees with 1.25% in Ryan Sun peach and ca. 1% blossom blight in Summer Fire nectarine. Still, significant differences among treatments were detected when only one application of was made of each material being evaluated. On Ryan Sun peach, all fungicides evaluated reduced blossom blight to less that 0.5% with most treatments having 0% incidence (Fig. 4). For Summer Fire, the low rates of YT669 and Fontelis were the least effective. All other materials were very effective with 0 to 0.25% incidence of blight. This variety was treated at 55% bloom and perhaps the protective treatments could not reduce already established infections. In our delayed bloom strategy, fungicides are applied at 20-40% bloom when less favorable environments occur. Still, many treatments including FG 3 - DMI, FG 9 – AP, and FG 7 - SDHI fungicides and FG 7/11 pre-mixtures were highly effective even when applied at this late stage of bloom (Fig. 4).

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 of Dr. Tom Gradziel continued with 14 advanced breeding lines. Genotypes evaluated had parents with almond and wild almond lineage and these were compared to industry (e.g., Dr. Davis) and internal standards (e.g., Bolinha). Disease incidence of several genotypes was statistically lower than that of Bolinha (Fig. 5). These included one late and five extra late accessions that soon will be released. Some of the less susceptible genotypes were also rated less susceptible in previous years' evaluations, whereas others have been variable over the years. This is presumably due to environmental conditions in the orchard, pre-disposition of the host, and cultural practices (e.g., soil fertility, nitrogen levels, etc.) that may have a more profound effect on blossom susceptibility than the genetic background of the host. Still, all of the advanced lines were from an orchard in the Wolfskill facility and were grown under the same horticultural practices.

Efficacy of preharvest fungicides for management of fruit decays. In the trial at UC Davis on Fay Elberta using a 7-day PHI treatment all of the fungicides reduced the incidence of brown rot and there were significant differences among some of the treatments (Fig. 6). Quash-S2200 mixtures and the premixture Q8Y78 completely prevented brown rot; whereas Quadris Top, Inspire Super, Fontelis, and Quash were less than 1% as compared to 25% natural incidence in the untreated control. Mettle (8 and 10 fl oz), Luna Sensation (5 fl oz), and YT669 (8 fl oz) outperformed Topguard (14 fl oz) and Merivon (6.5 fl oz). Overall, high efficacy was observed for most treatments in the low-rainfall summer. In previous years, Inspire Super did not perform as well as other treatments. The addition of a non-ionic surfactant (NIS) adjuvant such as Breakthru improved the performance and kept the formulation in suspension. The formulation is unstable in high-agitation sprayers and thus, an NIS is required.

At KARE, 7-day (Fig. 7) or 7- and 14-day (Fig. 8) PHI applications were done. All treatments significantly reduced the incidence of brown rot on the mid-season peach cultivars July Flame and Summer Flare. All treatments were at zero or near zero incidence levels on Summer Flare; whereas differences among treatments were observed on July Flame. A trend for slightly higher incidence of brown rot was observed for S2200 (both rates) and the low rate of Quash (2.5 oz). On the later-maturing Ryan Sun peach and Summer Fire nectarine, the overall performance was greatly reduced even when two preharvest applications were made (7- and 14-day PHI). Still, on Summer Fire, all treatments significantly reduced brown rot as compared to the untreated control (79% incidence). The low rate of Topguard was the least effective (43% brown rot incidence); whereas Tilt, YT669, and Merivon had the lowest levels of disease (<8% incidence). On Ryan Sun, the untreated control had 85% incidence of brown rot. Topguard (14 oz rate) and Pristine had the highest level of disease (>60%); whereas Merivon and Q8Y78 had the lowest level of decayed fruit (<20% incidence). With late season varieties, brown rot becomes more difficult to control due to accumulated inoculum and quiescent infections over the season. Still, the performance of the fungicides was better on the late season nectarine as compared to the late season peach. A closer PHI is advised for highly susceptible varieties harvested in or after August.

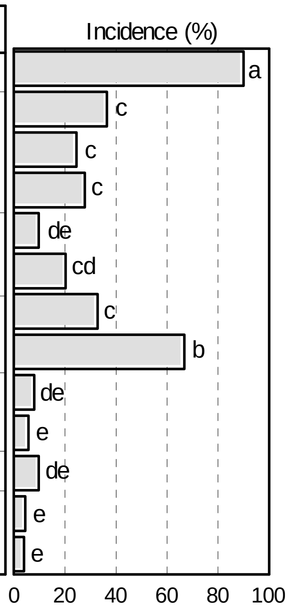
Among single-active-ingredient fungicide products, the new materials Fontelis, IKF-5411, YT669, and S2200 were effective against brown rot of fruit. In general we suggest that anti-resistance strategies be initiated at the introduction of these products. Strict rotations or tank mixtures with products that have a different active ingredient or FRAC numbers is the best strategy. For example, Fontelis (FG 7) can be mixed with propiconazole or tebuconazole (FG 3) with a minimal additional expense when generic materials are used. Among pre-mixtures evaluated, most were exceptional or performed well. Treatments such as Adament, Inspire Super, Quadris Top, Luna Sensation, Merivon, or Q8Y78 resulted in the lowest incidence of decay.

An organic formulation of polyoxin-D (Ph-D) was registered in 2012 for stone fruit and other crops. In 2010 this compound was effective in some trials; however, the material did not perform well on two cultivars in 2011 (possibly due to the high summer rainfall). We plan to conduct additional research on this product in 2013 for several reasons: 1) the material was inconsistently effective; 2) the EPA gave exempt status for fungicide residues and thus higher rates can now be evaluated; and 3) the material was submitted to OMRI as a future organic treatment. The current labeled rate of Ph-D is low at 6.2 oz of the 11.2 DF formulation. The new product called Oso will have an unrestricted label and higher rates can be used. We consider this fungicide as mainly a contact material with high persistence. Thus, multiple applications close to harvest should prove to be consistent and effective.

Evaluation of fungicides for management of powdery mildew. In the powdery mildew trial in Butte Co., we evaluated single-fungicides, new pre-mixtures, as well as the biocontrol Problad. Disease pressure in the test plot was low with an incidence of 4.3% in the untreated control. All fungicides significantly reduced the disease (Fig. 9). The least effective was Fontelis at 14 oz, followed by the low rates of Topguard and Quash/S2200, Luna Sensation, and Merivon/Vivando rotations. Adament, Quadris Top (FG 3/11) Inspire Super (FG 3/9), Merivon, Pristine, Q8478 (FG 7/11), Topguard (14 oz) and Quash (FG 3), YT669 (FG 11), and Vivando (FG U8), as well as rotations of Iprodione and Quintec (FG 2 and 13) were all very effective (Fig. 9). Some of these materials are highly specific against powdery mildews (Quintec and Vivando), others can also be used effectively in blossom and fruit brown rot programs. Higher rates of Fontelis have been evaluated in other trials and shown to be effective against powdery mildew. In this trial, Problad did exceptionally well for a natural product and the performance was comparable to conventional fungicides (Fig. 9). This is an exciting development and additional trials should be done in the coming year. Thus, a natural product and powdery mildew-specific compounds (e.g., Vivando), along with new conventional fungicides were identified. Single-site mode of action compounds and pre-mixtures should be used in rotations and when possible, single materials should be tank mixed as an anti-resistance management strategy (as discussed above).

Fig. 1. Efficacy of fungicide treatments applied during dormancy against peach leaf curl of Fay Elberta peaches in a field trial at UC Davis

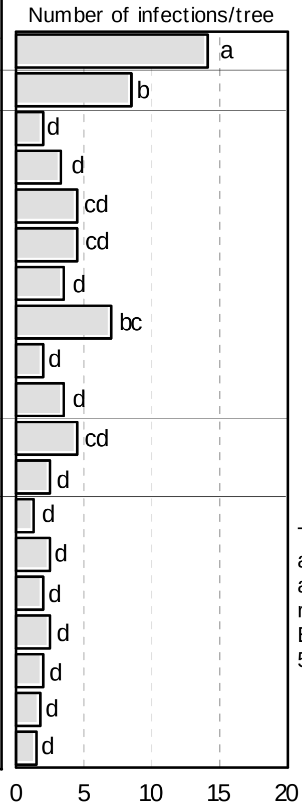
No.	Treatment	12-6-11	1-27-12
1	Control	---	---
2	Kocide 2000 6 lb	@	@
3	Kocide 2000 9 lb	@	@
4	Kocide 2000 12 lb	@	@
5	Kocide 3000 5 lb + Ziram 4 lb	@	@
6	Badge X2 5 lb + Ziram 4 lb	@	@
7	Syllit 400SC 48 fl oz	@	@
8	Syllit 400SC 32 fl oz	@	@
9	Ziram 76DF 6 lb	@	@
10	Ziram 76DF 8 lb	@	@
11	Ziram 4 lb + Syllit 32 oz	@	@
12	Bravo 4 pt	@	@
13	Bravo 6 pt	@	@



Treatments were applied in the field in combination with a spray oil (4% Omni oil) using an air-blast sprayer (100 gal/A). Disease evaluation was done on in April 2012. For this, the number of infected leaves for a total of 100 leaves for each replication was determined.

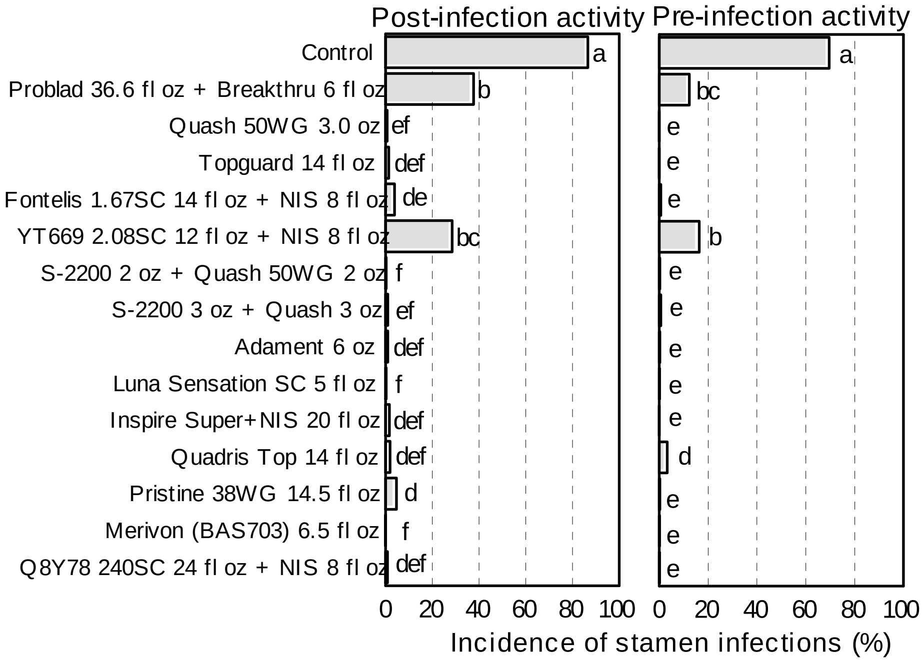
Fig. 2. Evaluation of new fungicides against brown rot blossom blight of Fay Elberta peach at UC Davis

Program	Treatment	Rate/A	60-70% bloom 3-7-12
---	Control	---	---
Biological	Problad+NIS	36.6 fl oz	@
Single	Quash 50WG	3.0 oz	@
	Mettle	8 fl oz	@
	Mettle	10 fl oz	@
	TopGuard	7 fl oz	@
	TopGuard	14 fl oz	@
	S2200	3 oz	@
	Fontelis + NIS	14 fl oz	@
	YT669	8 fl oz	@
Mixtures	Quash + S2200	2 oz + 2 oz	@
	Quash + S2200	3 oz + 3 oz	@
Pre-mixtures	Adament	6 oz	@
	Luna Sensation 500SC	5 fl oz	@
	Inspire Super + NIS	20 fl oz	@
	Quadris Top	14 fl oz	@
	Pristine 38WG	14.5 oz	@
	Merivon	6.5 fl oz	@
	Q8Y78	18 fl oz	@



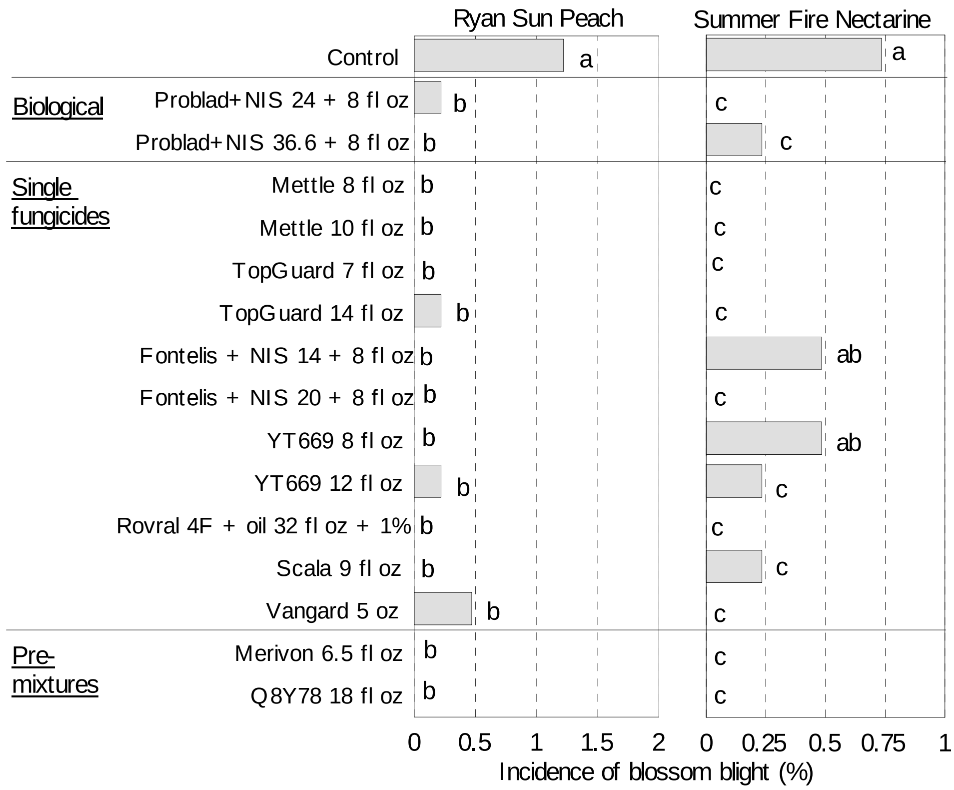
Treatments were applied using an air-blast sprayer at a rate of 100 gal/A. Evaluation was done on 5-16-12.

Fig. 3. Evaluation of the pre- and post-infection activity of new fungicides against brown rot blossom blight of Fay Elberta peach in the laboratory



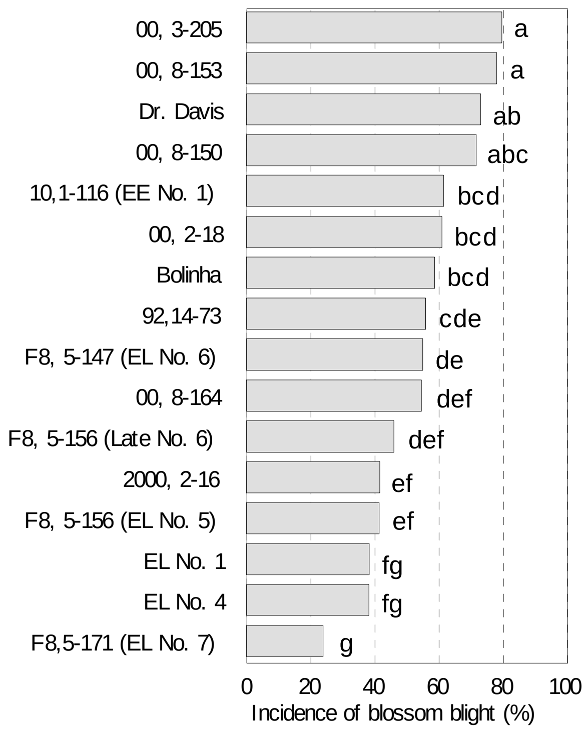
Blossoms at popcorn stage were collected in the field and allowed to open in the laboratory. Blossoms were then either treated using an air-nozzle sprayer 24 h before (pre-infection activity) or after (post-infection activity) inoculation with conidia of *M. fructicola* 20,000 conidia/ml). Blossoms were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

Fig. 4. Efficacy of fungicide treatments for management of brown rot blossom blight of two peach cultivars at the Kearney Agricultural Center



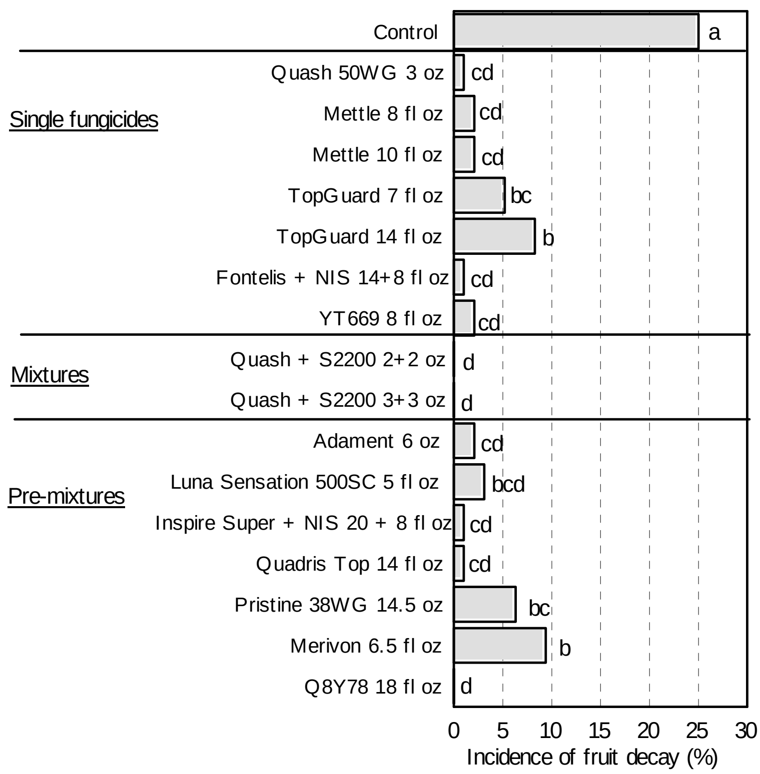
One application of each treatment was made in the field on 2-24-12 to Ryan Sun peach (20% bloom) and Summerfire peach (55% bloom) using an air-blast sprayer at 100 gal/A. NIS = non-ionic surfactant. Q8Y78 240SC is a pre-mix of picoxystrobin and penthiopyrad. Blossoms were evaluated for blossom blight on 4-17-12. There were four single-tree replications for each treatment.

Fig. 5. Host susceptibility of standard and advanced peach genotypes with almond and wild-almond lineage to brown rot blossom blight



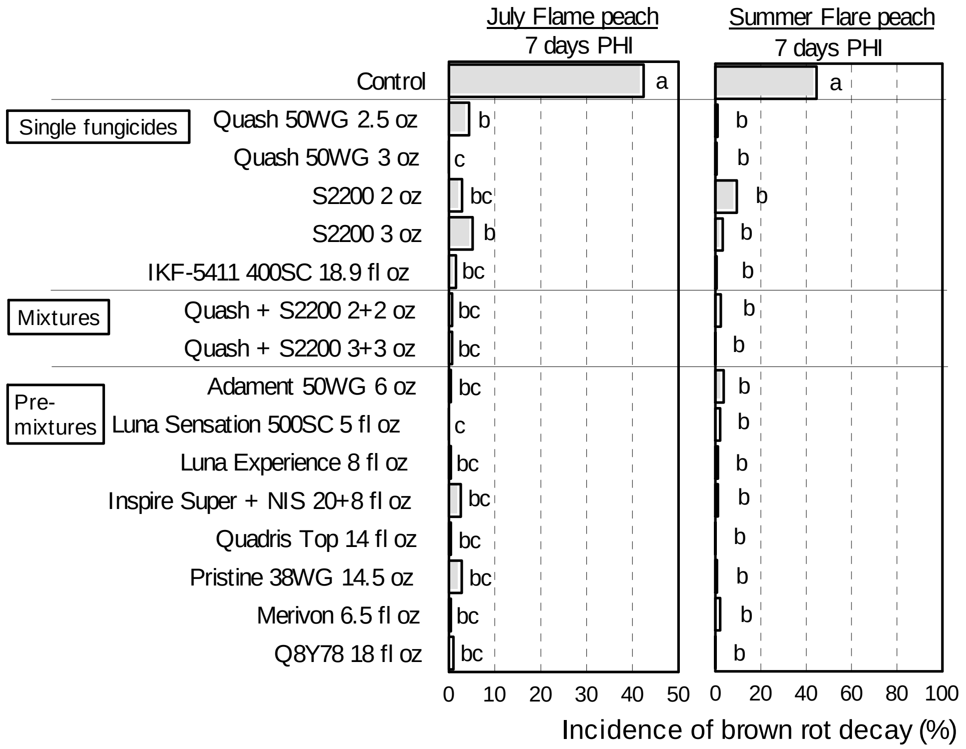
Blossoms at pink bud stage were collected, allowed to open in the laboratory, and inoculated with conidia of *Monilinia fructicola* (10^4 conidia/ml). Blossoms were evaluated for stamen infection after 5-6 days of incubation at 20C.

Fig. 6. Efficacy of 7-day PHI fungicide applications for management of postharvest brown rot of Fay Elberta peach at UC Davis 2012



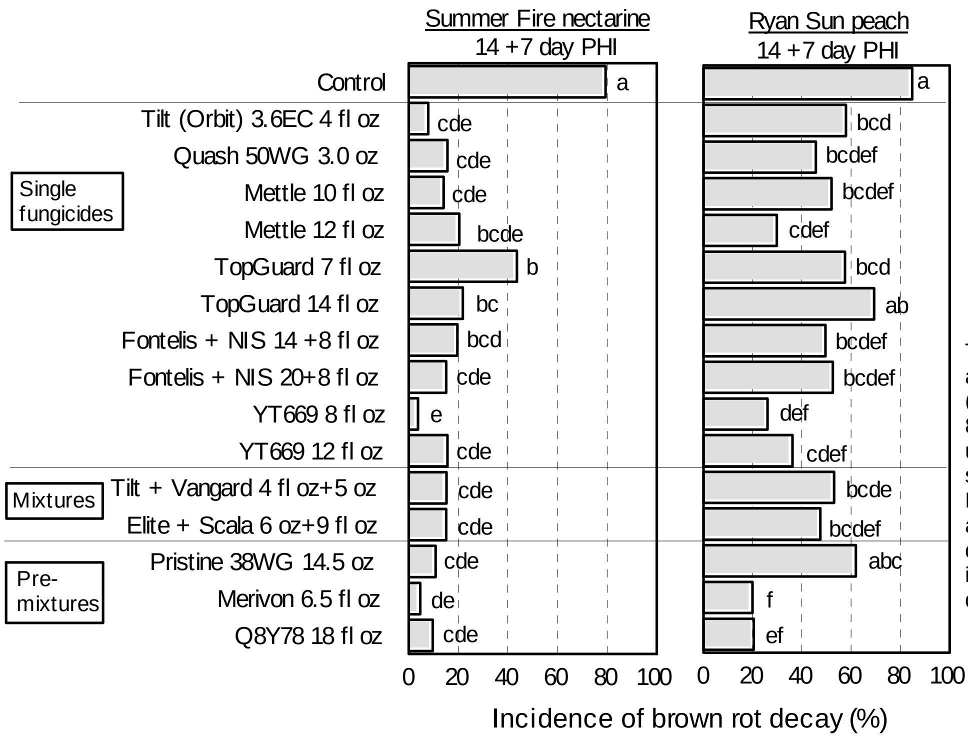
Treatments were applied in the field on 7-18-12 using an air-blast sprayer (100 gal/A). Twenty-four fruit were harvested from each of four single-tree replications. Fruit were stored for 24 h at 5 C and then incubated for 14 days at 20 C.

Fig. 7. Efficacy of preharvest fungicide treatments for management of brown rot (natural incidence of decay) of peach at the Kearney Agricultural Center



Treatments were applied on 6-26-12 (July Flame) or 8-11-12 (Ryan Sun) using an air-blast sprayer (100 gal/A). NIS = non-ionic surfactant. Q8Y78 240SC is a pre-mix of picoxystrobin and penthiopyrad. Fruit were harvested and stored at 1C for 7 days and were then incubated at 20C for 7 days.

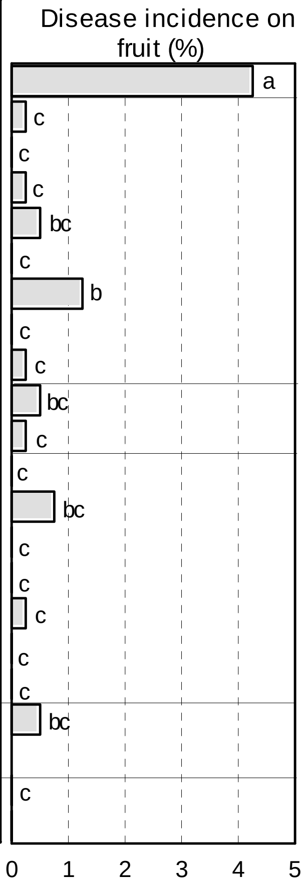
Fig.8. Efficacy of preharvest fungicide treatments for management of brown rot (natural incidence of decay) of peach at the Kearney Agricultural Center



Treatments were applied on 7-19 (Summer Fire) or 8-2-12 (Ryan Sun) using an air-blast sprayer (100 gal/A). Fruit were harvested and stored at 1C for 7 days and were then incubated at 20C for 7 days.

Fig. 9. Efficacy of fungicide treatments for management of powdery mildew of cv. Carson peach in Butte Co.

Program	Treatment	3-1 FB	3-20 PF	4-09 PF
---	Control	---	---	---
Single treatments	Problad + NIS 24.4 + 8 fl oz	@	@	@
	Problad + NIS 36.6 + 8 fl oz	@	@	@
	Quash 3 oz	@	@	@
	Topguard 7 fl oz	@	@	@
	Topguard 14 fl oz	@	@	@
	Fontelis 14 fl oz	@	@	@
	YT669 + NIS 12 + 8 fl oz	@	@	@
	Vivando 30 fl oz	@	@	@
Mixtures	Quash + S2200 2 + 2 oz	@	@	@
	Quash + S2200 3 + 3 oz	@	@	@
Pre-mixtures	Adament 6 oz	@	@	@
	Luna Sensation 5 fl oz	@	@	@
	Inspire Super + NIS 20 + 8 fl oz	@	@	@
	Quadris Top 14 fl oz	@	@	@
	Pristine 14.5 oz	@	@	@
	Merivon 6.5 fl oz	@	@	@
	Q8Y78 + NIS 24 + 8 fl oz	@	@	@
Rotations	Merivon 6.5 fl oz	@	---	@
	Vivando 30 fl oz	---	@	---
	Iprodione 32 fl oz	@	---	---
	Quintec 7 fl oz	@	@	@



Treatments were applied using an air-blast sprayer at a rate of 100 gal/A. NIS=non-ionic surfactant. Q8Y78 240SC is a pre-mix of picoxystrobin and penthiopyrad. Evaluation was done on 6-6-12. For this, fruit on each of the 4 single-tree replications were evaluated for the presence of powdery mildew.