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Title:	*Management of Brown Rot and Powdery Mildew Diseases of Peach in California*
Status:	Forth-Year of Four
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SUMMARY OF RESEARCH ACCOMPLISHMENTS DURING 2010

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

1) For peach leaf curl, ziram and Syllit were highly effective when timed properly and according to accumulated winter precipitation and represent alternatives to copper fungicides. With high rainfall last winter, two applications as dormant and delayed dormant treatments were highly effective. Ziram at 4-6 lb or Syllit at 32-48 fl oz were the most effective treatments, whereas copper treatments were significantly less effective.
2) For powdery mildew management, Quintec (quinoxyfen) was recently registered based on our efforts and is one of the most effective treatments. Vivando (metrafenone, BAS 560) was effective and accepted into the IR-4 program. These materials are highly specific against powdery mildew and are being developed for rotation programs to minimize use of the very effective DMI and QoI fungicides that are also used extensively in blossom and fruit brown rot programs. Differences of materials within fungicides classes or modes of action (e.g., DMI or QoI fungicides) were also noted. The biological control Actinovate was moderately effective, whereas Regalia was ineffective.
3) For brown rot blossom blight management, trials were done on peach cultivars at KAC and at UC Davis. Disease incidence was moderate to high in the untreated control trees for all the cultivars but was significantly reduced by all treatments. The most important developments are: a) new chemistries continue to be developed for stone fruit crops; b) Registrants are developing pre-mixtures with both active ingredients inhibitory to the brown rot pathogens; c) Some of the new products are the most effective materials ever tested in our program and include Quash (metconazole), Luna Privilege (fluopyram), and the pre-mixtures Luna Sensation (fluopyram + trifloxystrobin), BAS703 (fluxapyroxad+pyraclostrobin), Inspire Super (difenoconazole+cyprodonil), Inspire XT (difenoconazole + propiconazole), Quilt Xcel (azoxystrobin + propiconazole), Quadris Top (azoxystrobin + difenoconazole), as well as the registered pre-mixture Adament (tebuconazole + trifloxystrobin). Blossoms of Fay Elberta peach were used in laboratory tests and demonstrated excellent pre- and post-infection activity of most of these materials.
4) Preharvest fungicide applications were evaluated for the management of postharvest brown rot decay in three orchards at different timings. Harvests were done 1, 7, or 14 days after the last treatment. In general, the 2-application programs were more effective than the one-application program, especially on the later maturing fruit, where a higher incidence of disease occurs. Promising new fungicides that reduced decay to low levels include Luna Privilege and Quash. As in the blossom studies, the new pre-mixtures Luna Sensation, Inspire XT, and BAS703 performed very well. Low rates of Adament, Inspire Super, Quilt Xcel, were less effective. As in previous years, the anilinopyrimidine Scala was not as effective as most of the other fungicides in these summer applications. An organic fermentation product was also evaluated that showed considerable promise in reducing disease by 50-75%.

5) Evaluation of brown rot blossom blight susceptibility among peach genotypes in the UC Davis breeding program continued. Twenty-five to seventy-five percent reductions in blossom blight were demonstrated among the genotypes as compared to Dr. Davis. All were susceptible; however, the less susceptible ones were similar to the commercial cultivar Ross. No correlation was found between extra early or extra late selections and brown rot blossom blight susceptibility. Still, extra late No. 1 was one of the least susceptible.
6) New field inoculation methods were evaluated to determine fruit susceptibility to brown rot. This was done to help the breeding program rapidly assess new genotypes for resistance without harvesting the fruit. The procedure did not involve wounding and required a minimal amount of labor.

INTRODUCTION

In an integrated approach for the management of fungal diseases of peach, fungicide use is currently the most effective control strategy. 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 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. 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. Over the years, we evaluated many 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 our fungicide studies 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. Broad-spectrum fungicides such as Rovral and Topsin-M, and more narrow-spectrum fungicides such as the DMIs Tilt (Orbit), Elite, and Indar; the anilinopyrimidines (APs) Vangard (cyprodinil) and Scala (pyrimethanil); the hydroxyanilide Elevate (fenhexamid); as well as the pre-mixes Adament (tebuconazole + trifloxystrobin), Pristine (pyraclostrobin + boscalid), and the recently registered Quilt Xcel (azoxystrobin + propiconazole) are available in California that are very effective for control of brown rot. The newer fungicides were registered based on research in our laboratory and currently, we are developing new products with new modes of action and new pre-mixtures to ensure that highly effective materials will always be available to the stone fruit industry and that mixture and rotation programs can be designed to help prevent the selection of resistant populations to any given class of fungicide.

In 2010 we continued to conduct comparative blossom and preharvest efficacy studies with registered and new fungicide treatments. Single-active ingredient fungicides evaluated included materials in the following classes: DMIs (Tilt – propiconazole, Elite - tebuconazole, Quash - metconazole), anilinopyrimidines (Vangard - cyprodinil, Scala - pyrimethanil), and experimental fungicides such as the succinate dehydrogenase inhibitors or SDHIs (Luna Privilege-fluopyram) and the chitin inhibitor Ph-D (polyoxin-D; conventional and organic formulations). In addition, we evaluated the registered pre-mixtures Pristine (QoI pyraclostrobin + SDHI boscalid), Adament (DMI tebuconazole + QoI trifloxystrobin), and the recently registered Quilt Xcel (azoxystrobin + propiconazole), Quadris Top (DMI difenoconazole + QoI azoxystrobin), Inspire Super (DMI difenoconazole + anilinopyrimidine cyprodinil), as well as numerous new pre-mixtures planned for registration including Inspire XT (DMI difenoconazole + DMI propiconazole), Luna Sensation (SDHI fluopyram + QoI trifloxystrobin), and BAS703 (SDHI fluxapyroxad + QoI pyraclostrobin). We also evaluated the biocontrol

Actinovate in blossom blight and powdery mildew studies, as well as the natural product Regalia in powdery mildew studies. Alternative materials of new classes are needed to prevent the overuse of any one class of fungicide because resistance in brown rot populations against the DMI fungicides has developed in other stone fruit growing areas of the United States and resistance in pathogens of other crops has been reported for Elevate and the anilinopyrimidines. In 2007 and 2009 we found isolates of *Monilinia* spp. resistant to the AP fungicides in locations in Northern California where these fungicides did not provide satisfactory disease control. In our samplings in 2010 in the same area, however, no AP-resistant isolates of the pathogens were recovered. We also initiated studies to elucidate the poor efficacy of the AP fungicides (Vangard, Scala) as summertime treatments and we conducted residue studies on Vangard-treated plants that were incubated for selected times at different temperatures and relative humidities.

In 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 four classes of fungicides (e.g., QoIs, APs, DMI fungicides (including Quash, Inspire), and other new classes like the SDHI fungicides (fluopyram), as well as, selected pre-mixtures of fungicides (Pristine, Adamant, Distinguish, Luna Sensation, Luna Experience, Inspire XT, Quilt Xcel, Quadris Top) 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

- 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 and lower rates of ziram, dodine, and new copper formulations as 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, metrafenone, metconazole, fluopyram, and pre-mixtures), 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. Trials were established in two orchards at the Kearney Agricultural Center (KAC) in Parlier, CA, on three peach cultivars (i.e., Elegant Lady, Ryan Sun, and July Flame) to evaluate fungicides for control of brown rot blossom blight. Fungicides that were applied to trees using an air-blast sprayer calibrated for 100 gal/A are indicated in the Figures of the Results. Randomized sub-plots of four single-tree replications for each treatment were used. In another study on Ryan Sun peach, an application timing trial was done using four selected fungicides. Applications of each fungicide were done at 5% bloom, at 30% bloom, or at both timings. Randomized sub-plots of four single-tree replications for each treatment were used. Incidence of brown rot blossom blight was recorded in April 2010. For this, 200 blossoms were evaluated for blight for each of the four single-tree replications per treatment. Incidence of brown rot blossom blight caused by *M. fructicola* was recorded in April 2010. For this, 200 blossoms were evaluated for blight for each single-tree replication and 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.

For the evaluation of preharvest treatments, two orchards at KAC were used. Applications were made in the field using an air-blast sprayer (100 gal/A) at 7+1 days PHI to Elegant Lady, at 6 days or 14+8 days to Ryan Sun, and at 8 days or 17+7 days PHI to July Flame. In the orchard with July Flame peach, simulated rain was applied for 6 h each one and two days after the first application. Fungicides evaluated are indicated in Figs. 6 and 7. 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 and then for 5 to 7 days at 20C. In another trial on Fay Elberta peach at UC Davis, fungicides were applied 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.

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 2010. Due to the almost simultaneous bloom of most accessions in 2010, 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* ($2x10^4$ 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.

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 Regalia and Actinovate, three single-fungicides, nine pre-mixtures, and two rotation programs were evaluated (*see* Fig. 7). Applications were done on March 4 (full bloom), March 18 (2 weeks after petal fall), and April 19 2010 (6 weeks after petal fall). Disease was evaluated on June 15. For this, fruit of each of the four single-tree replications were rated for disease.

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, Ziram, copper materials (i.e., Kocide 3000, GWN4620), or Syllit were applied at selected rates in combination with 4% Omni oil. In addition, a Kocide3000-Ziram rotation program was done. Applications using an air-blast sprayer at 100 gal/A were done during dormancy on 12-12-09 and 1-11-10, except for one Ziram treatment that was applied only on 12-29-09. Trees were evaluated for disease on March 6, 2010. For this, the number of leaf curl infections was counted on 100 shoots for each of the four single-tree replications.

Studies on the effect of environmental conditions on breakdown of cyprodinil (Vangard). Greenhouse grown plants were sprayed to run-off with Vangard at 10 oz/100 gal. Plants were then bagged with white plastic bags or were not bagged (two plants each) to simulate different relative humidity conditions. Plants were kept in a lath house and ten leaves were sampled immediately after application and air-drying, and after 2, 3, 7, or 8 days. The experiment was done twice, once in April and once in August. Leaves were analyzed for cyprodinil residues by an analytical lab. Fungicide residues in Fig. 9 are calculated as a percentage based on initial values (immediately after application; = 100%).

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 9.1.

RESULTS AND DISCUSSION

Efficacy of fungicides for management of blossom blight. The performance of fungicides was evaluated after applications timed between 25 and 50% bloom. A single application was done for each fungicide to better differentiate between treatment effects, although a two-spray program would have benefitted the overall efficacy. Due to highly conducive environmental conditions in the spring and early summer of 2010 (high amounts of rainfall), the natural incidence of blossom blight and fruit rot in our experimental orchards was high. The incidence of blossom blight in the untreated control was 6.6% for Elegant Lady peach, 9.4% for Ryan Sun peach, and 4.1% for July Flame peach (Figs. 1,2). Under this high disease pressure, only Tilt on Ryan Sun peach (Fig. 1) and Quash on July Flame peach (Fig. 2) reduced the incidence of blight to zero levels. Overall, Quash was the most effective fungicide, reducing the disease to very low levels in the three cultivars evaluated. Other very effective materials included Luna Privilege (fluopyram), and the pre-mixtures Luna Sensation (fluopyram + trifloxystrobin), BAS703 (fluxapyroxad + pyraclostrobin), Inspire Super (difenoconazole + cyprodonil; recently registered), Inspire XT (difenoconazole + propiconazole), Quadris Top (azoxystrobin + difenoconazole; recently registered), as well as the registered pre-mixtures Adament (tebuconazole + trifloxystrobin; recently registered) and Quilt Xcel (azoxystrobin + propiconazole; recently registered). Two rates were evaluated for Quash, Adament, and Inspire Super, and the higher rate was often found to be more effective. Blossoms of Fay Elberta peach were used in laboratory tests and the fungicides evaluated demonstrated excellent pre- and post-infection activity (Fig. 3). The biocontrol Actinovate only showed some activity as a pre-infection treatment in this test. This material should be tested at higher rates.

An application timing study was done on cv. Ryan Sun using Quash, Vangard, Tilt, and the pre-mixture Adament. Timings included treatments at 5% bloom, at 30% bloom, or at both timings. For Quash, the 5%-bloom application program was the least effective (Fig. 4). For Adament, both single-treatment programs were less effective than the two-treatment program. Vangard and Tilt were similarly highly effective on Ryan Sun peach at all timings. These fungicides have some locally systemic activity. Thus, they may have a higher post-infection activity and additionally, they may penetrate into blossom tissues at the early opening stage in sufficient amounts to protect the flower during its entire susceptible stage. This is the first time that we compared fungicide timings within an orchard under highly conducive disease conditions and we will continue these studies in the 2011 season.

Efficacy of preharvest fungicides for management of fruit decays. In the trial at UC Davis on Fay Elberta using 14-day PHI treatments, Adament and BAS 703 were the most effective treatments, reducing the incidence of decay from 75% to 0-5% (Fig. 5). Thus, these treatments were very persistent for the 14-day interval between application and harvest. The organic formulation of Ph-D was the least effective material, whereas all other treatments performed intermediately.

At KAC, the efficacy of selected preharvest fungicides for control of fruit brown rot decay was evaluated in two orchards. Harvests were done 1 to 8 days after the last treatment. The natural incidence of brown rot ranged between 54% and 95% for fruit of the untreated control when incubated at 20C for 5 to 8 days and thus, no fruit inoculations had to be done. In a comparison of one- and two-application programs on two cultivars (6 and 14+8 days PHI on Ryan Sun, 8 and 17+7 days PHI on July Flame) most treatments were similarly effective for the two timings (Figs. 6,7). New fungicides that reduced decay to low levels include Luna Privilege, Quash, and the pre-mixtures Luna Sensation, Inspire XT, and BAS703, similar to the blossom studies. Low rates of Adament, Inspire Super, and Quilt Xcel, were less effective and only higher labeled rates should be used. As in previous years, the anilinopyrimidine Scala was not as effective as most of the other fungicides in these summer applications. The chitinase inhibitor compound Ph-D was inconsistent in its efficacy ranging from highly effective in a two-spray program on Elegant Lady Peach to ineffective as single-treatments on Ryan Sun peach (Fig. 6). The labeled rate of Ph-D is low (6.2 oz of the 11.2 DF formulation) but the persistence is high. Thus, multiple applications close to harvest should prove to be consistent and effective. Potentially this fungicide could be available as an organic fungicide. Studies will be continued in 2011 with multiple applications of an organic formulation. Although simulated rain was applied after the first fungicide application in the orchard with July Flame peach, most treatments still performed well. Lower rates of Adament and Inspire Super were less effective under these conditions more favorable for disease.

Conclusions on blossom blight and preharvest decay management of cling peach. Our data indicate that numerous registered and new fungicides can be used as very effective treatments for managing blossom blight and preharvest diseases, and for reducing postharvest brown rot decay. Currently registered fungicides belong to six different classes, the DMIs (Quash, Tilt, Elite, Enable, Rally), the anilinopyrimidines (Vangard, Scala), the dicarboximides (Rovral/Oil), the hydroxyanilides (Elevate), as well as the SDHIs (boscalid in the pre-mixture Pristine) and QoIs in pre-mixtures (pyraclostrobin/boscalid, trifloxystrobin/tebuconazole, azoxystrobin/propiconazole, azoxystrobin/difenoconazole, and difenoconazole/cyprodonil - in the pre-mixtures Pristine, Adament, and the recently registered Quilt Xcel, Quadris Top, and Inspire Super, respectively). The AP fungicides should be limited to spring time usage (*see* below). Future pre-mixture registrations include a double DMI product (difenoconazole mixed with propiconazole - Inspire XT), and two SDHI-QoI products (fluopyram mixed with trifloxystrobin - Luna Sensation or fluxapyroxad mixed with pyraclostrobin – BAS703). The new SDHI compounds are more effective than boscalid (a component of Pristine) and thus, this FRAC group 7 with activity against brown rot, gray mold, and powdery mildews is a valuable rotation partner for the DMI fungicides. In contrast to the DMIs, however, the SDHIs have little or no systemic activity. The registration of several new pre-mixtures will provide tools for the implementation of resistance management strategies in brown rot control. For preharvest decay control, single applications are best applied within 8 days of harvest, whereas treatments in a two-spray program should be done at a 7- to 10-day interval within two weeks of harvest.

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 17 other genotypes that were compared to cvs. Ross and Dr. Davis. Dr. Davis had the highest incidence of stamen infections, whereas cv. Ross and Bolinha had a significantly lower incidence (Fig. 8). Four breeding lines were found to be less susceptible than cv. Ross and Bolinha with numerically (not statistically) lower incidences of disease. Our results on these genotype evaluations have been variable over the years, presumably due to environmental conditions in the orchard, pre-disposition of the host, and cultural practices that may have a more profound effect on blossom susceptibility than the genetic background of the host. 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 peach leaf curl and powdery mildew. In the powdery mildew trial, we evaluated single-fungicides, new pre-mixtures, as well as two biologicals. The incidence of disease was low (2% in the untreated control) in our research plot, but differences among treatments were found. Treatments that reduced the disease to zero levels included Luna Privilege, Adament, Quadris Top, BAS703, and Pristine (Fig. 9). The recently registered Quintec (quinoxyfen) that was used in rotation with Iprodione again was also among the most effective treatments. Another new material that we evaluated previously, Vivando (metrafenone, BAS 560), was accepted into the IR-4 program. These latter two fungicides are highly specific against powdery mildew and are being developed for rotation programs to minimize use of the very effective DMI and QoI fungicides that are also used extensively in blossom and fruit brown rot programs. In this year's trial, the biological control Actinovate was moderately effective. Regalia was ineffective (Fig. 8). Severe outbreaks of powdery mildew are very sporadic and localized, and we hope to be able to obtain data for all material evaluated under higher disease pressure conditions.

Evaluation of fungicides for management of peach leaf curl and powdery mildew. In a trial on cv. Fay Elberta peach on the management of peach leaf curl, the efficacy of selected fungicides applied alone or in a rotation during dormancy and late dormancy was compared (only Ziram was also evaluated in a one-spray program). Ziram and Syllit were highly effective in this trial. Under very high disease pressure with nearly 100% disease incidence in the control, disease was reduced to 10% or less by these treatments (Fig. 10). Ziram was also highly effective when used at the lower off-label rates of 4 or 6 lb/A. These lower rates of Ziram may be revised in a supplemental label as discussed with the registrant. A single application of Ziram at 8 lb/A at mid-dormancy was less effective than two applications at reduced rates. The copper materials Kocide 3000 and GWN4620 were significantly less effective or not effective (i.e., GWN4620) than Syllit or Ziram. Based on this and previous years' trials, peach leaf curl can be most effectively managed by single (less conducive conditions) or two (highly conducive conditions) dormant applications with copper fungicides, Ziram, or the recently registered Syllit. Syllit represents a new class of fungicides for stone fruit production in California. Copper-Ziram rotations are also very effective, rotation programs that include Syllit need to be evaluated.

Studies on the effect of environmental conditions on breakdown of cyprodinil (Vangard). One experiment each was conducted in April and in August of 2010. In April, daily temperatures ranged from 5°C to 32.8°C and from 5°C to 35°C, and relative humidity ranged from 24.7% to 98.6% and from 65% to 100% for non-bagged and bagged plants, respectively. In August, daily temperatures ranged from 12.3°C to 45°C and relative humidity from 15% to 95% for the non-bagged plants and from 73% to 100% for the bagged plants. Degradation of Vangard was more rapid during the August experiment with higher daily maximum temperatures than in the April experiment (Fig. 11). After 7 to 8 days, 62% and 30% of the initial amount of fungicide could still be detected on non-bagged plants in the April and August experiments, respectively. For bagged plants, these values were 43% and 28% for April and August, respectively. Thus, the amount of degradation was the same for bagged and non-bagged plants in the August experiment, but was faster for the bagged plants in the April experiment. These data indicate that degradation of Vangard appears to be more dependent on temperature than on relative humidity. This can explain the higher efficacy of this fungicide against blossom diseases as compared to fruit decays. These studies will be repeated in 2011.