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Efficacy of organic foliar amendments for disease control in tree fruits and grapes

FINAL PROJECT REPORT

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APPLE (*Malus domestica* `Rome')
Scab; *Venturia inaequalis*
Powdery Mildew; *Podosphaera leucotricha*

EFFICACY OF FUNGICIDES AND M-PEDE FOR CONTROL OF APPLE SCAB AND POWDERY MILDEW, 1995: Fungicide treatments were arranged in a randomized complete block design in a planting of 16 yr `Rome' apples on M-7 rootstock on a 20 x 20 ft spacing. Each treatment was applied to 5 single tree replicates. Treatments were applied using a hydraulic handgun sprayer at 300 psi at a rate of 300 gal water/A, and with a gasoline powered backpack mist blower (Solo, Port423) at a rate of 50 gal water/A. Approximately 14 gal of a spray suspension for the handgun sprayer and 2.25 gal spray solution for the mist blower were applied per 5 trees. Treatments were applied on 10 Apr (prepink), 21 Apr (pink). 7 May (petal fall), 22 May (1st cover), 7 Jun (2nd cover), 21 Jun (3rd cover) and 4 Jul (4th cover). Applications of Guthion 50WP (2 lb/A) on 8 Jun and Imidan 50WP (4 lb/A) on 30 Jun were made for control of codling moth. Apple scab infection periods were monitored using a Metos environmental monitoring system. Using a modified primary infection model (wet periods start with rain and end with 8 hr drying time) a total of 10 infection periods were detected: 3 high infection periods (6 and 12 Apr, and 14 Jun); 4 moderate infection periods (10, 19 and 27 Apr, and 1 May); and 3 light infection periods (29 Apr, 4 and 10 May). A conidial model detected 9 infection periods from May through Jun. Percentage of 100 terminals with powdery mildew was determined on 3 Jul. Leaf scab incidence was evaluated on 1l Aug by examining all leaves (190-205 leaves) from 15 vegetative shoots randomly selected from each tree. A random selection of 70-100 fruit per tree were examined on 7 Sep and evaluated for both apple scab and fruit russeting.

M-Pede rates differed for the two types of application equipment to maintain the manufacture's recommended concentration of the spray solution at 2 %. Incidence of apple scab on leaves and fruit was significantly lower for all treatments when compared to the nontreated control. Leaf and fruit scab control in the Fluazinam treatment was not significantly different than the Rubigan treatment. Incidence of powdery mildew was significantly lower for all treatments when compared to the nontreated control. The significantly lowest incidence of powdery mildew was obtained with Rubigan and M-Pede applied with the handgun. Control of powdery mildew and apple scab was significantly greater for M-Pede applied with the handgun when compared to M-Pede applied with the mist blower. Both M-Pede treatments and Neemgard significantly increased the amount of russeting when compared to the nontreated control, with M-Pede applied with the handgun showing the significantly highest incidence of russeting. Problems with insoluble particles, especially clogging the filter screen, were experienced with Neemgard. Air temperature during these applications was in the mid to low 40's F and minimum air temperature on each preceding day was in the high 30's F. The temperature of well water used for mixing was not determined.

Treatment and Rate/A	Application Equipment	% Apple Scab* Leaves	% Apple Scab* Fruit	% Powdery Mildew*	% Fruit Russeting*
Nontreated		26.6 a	76.5 a	99.0 a	5.6 c
Rubigan 1EC 12 fl oz	Handgun	0.5 d	3.6 d	1.4 d	2.6 c
M-Pede 6 gal	Handgun	10.9 c	21.8 c	1.4 d	50.0 a
M-Pede 1 gal	Mist Blower	19.5 b	51.9 b	23.6 c	25.6 b
Neemgard 3 gal	Handgun	16.4 b	59.2 b	20.8 c	23.3 b
Fluazinam 500F 2.4 pt + Bayleton 50DF 4 oz (PP-PF) then Fluazinam 500F 1.8 pt + Bayleton 50DF 4 oz (cover sprays) **	Mist Blower	4.0 d	10.4 d	37.0 b	1.8 c

* Means followed by same letter do not differ significantly based on Fisher's protected LSD (P=0.05).

** Fungicide treatments applied on a standard spray schedule for a total of 7 applications, where PP= prepink, P= pink, PF=petal fall, plus four cover sprays.

Apple (*Malus domestica* 'Red Delicious')
Scab: *Venturia inaequalis*

ORGANIC FOLIAR SPRAYS FOR CONTROL OF APPLE SCAB, 1995: Foliar spray treatments were arranged in a randomized complete block design in a planting of 44 yr `Red Delicious' apples on M-4 rootstock on a 20 x 20 ft spacing. Each treatment was applied to 5 single tree replicates. Treatments were applied using a hydraulic handgun sprayer at 300 psi at a rate of 400 gal water/A. Approximately 18 gal of spray solution was applied per 5 trees. Treatments were applied on 29 Mar (prepink), 5 Apr (pink), 15 Apr (early full bloom), 25 Apr (petal fall), 7 May (1st cover), 16 May (2nd cover), 9 Jun (3rd cover) and 21 Jun (4th cover). The lime sulfur treatment was not applied on 25 Apr and 16 May. Applications of Guthion 50WP (2 lb/A) on 8 Jun and Imidan 50WP (4 lb/A) on 30 Jun were made for control of coddling moth. Apple scab infection periods were monitored using a Metos environmental monitoring system. Using a modified primary infection model (wet periods start with rain and end with 8 hr drying time) a total of 12 infection periods were detected from Mar through May: 3 high infection periods (6 and 12 Apr, and 14 Jun); 6 moderate infection periods (31 Mar, 4, 10, 19 and 27 Apr, and 1 May); and 3 light infection periods (29 Apr, 4 and 10 May). A conidial model detected 9 infection periods from May to Jun. Leaf scab incidence was evaluated on 2 Aug by examining all leaves (210-230 leaves) from 15 vegetative shoots randomly selected from each tree. A random selection of 50-150 fruit per tree were examined on 22 Aug for incidence of both apple scab and fruit russeting.

Weather conditions were extremely conducive for disease development during the bloom period. Low numbers of fruit were available for fruit counts due to burning of blossoms by the lime sulfur treatment applied during bloom and the poor control of scab for all other treatments. Incidence of apple scab on leaves was significantly lower for trees treated with Lime-Sulfur Solution and Ocean Fresh Fish when compared to the nontreated control. However, the level of leaf scab control obtained with Ocean Fresh Fish was not commercially acceptable. Incidence of apple scab on fruit was significantly lower for only LimeSulfur Solution when compared to the nontreated control. Lime-Sulfur Solution and Ocean Fresh Fish significantly increased the amount of russeting when compared to the nontreated control. Lime sulfur applications also resulted in small leaves and reduced overall shoot growth. As the label on the product indicates, use of lime sulfur on Delicious apples may result in injury.

	% Apple Scab*		
Treatment and Rate/A	Leaves	Fruit	% Fruit Russeting*
Nontreated	47.4 a	94.9 a	5.0 b
Lime-Sulfur Solution 8 gal**	2.3 c	2.3 b	24.6 a
Soluble Seaweed Powder 4 oz	47.6 a	92.3 a	4.9 b
Maxicrop 4 oz	48.2 a	94.7 a	6.0 b
Ocean Fresh Fish 1.5 gal	36.9 b	91.2 a	22.6 a

* Means followed by same letter do not differ significantly based on Fisher's protected LSD (P=0.05).

** Lime-Sulfur Solution was applied 6 times during the growing season compared to 8 applications for all other treatments.

CHERRY, SWEET (*Prunus avium* 'Black Republican')
Brown Rot Blossom Blight; *Monilinia laxa*
Cherry Leaf Spot: *Blumeriella jaapii*

EFFICACY OF FUNGICIDES FOR CONTROL OF BROWN ROT BLOSSOM BLIGHT AND LEAF SPOT OF CHERRY, 1995: Fungicide treatments were arranged in a randomized complete block design in a planting of 34 yr `Black Republican' sweet cherries on Mazzard F-12-1 rootstock on a 20 x 20 ft spacing. Trees were approximately 20 ft high. Each treatment was applied to 5 single tree replicates. Fungicides were applied using a hydraulic handgun sprayer at 300 psi at a rate of 400 gal water/A. Approximately 18 gal of a spray suspension was applied per 5 trees. Fungicide applications were made on 25 Mar (popcorn), 30 Mar (full bloom), 10 Apr (petal fall) and 2 May (shuck split). Cherry leaf spot infection periods were monitored using a Metos environmental monitoring system. From pink through normal harvest, a total of 11 leaf spot infection periods were detected: 3 high infection periods (17 Mar, 6 Apr and 14 Jun); 2 moderate infection periods (12 Apr and 1 May); and 6 low infection periods (31 Mar, 4, 10, 19, 27 and 29 Apr). Brown rot blossom blight was evaluated on 13 Apr by randomly observing 375-400 blossoms from the lower portion of each tree. Incidence of leaf spot was determined on 26 May by examining all leaves (185-200 leaves) from 20 vegetative shoots selected at random from the lower portion of each tree. Leaf drop due to leaf spot was evaluated on 22 Aug by determining the amount of defoliation on 15 vegetative shoots (180-195 leaf scars) selected at random from the lower portion of each tree. Due to cold and wet weather during bloom, insufficient fruit were produced for evaluation of fruit rot.

Incidence of brown rot blossom blight was significantly lower for all treatments when compared to the nontreated control. Control of blossom blight with Procure and M-Pede was not significantly different than control provided by Rally. Incidence of leaf spot and defoliation was significantly lower for all treatments when compared to the nontreated control. Incidence of leaf spot and defoliation on trees treated with Procure was not significantly different than trees treated with Rally.

Treatment and Rate/A	% Brown Rot Blossom Blight*	% Leaf Spot 26 May*	% Defoliation 22 Aug*
Nontreated	9.6 a	78.8 a	32.6 a
Rally 40WP 4.5 oz + Latron B1956 12 fl oz	0.4 b	0.6 c	3.1 c
Procure 50WS 1 lb	0.6 b	0.4 c	3.3 c
M-Pede 8 gal	1.4 b	7.4 b	18.0 b

* Means followed by same letter do not differ significantly based on Fisher's protected LSD (P=0.05).

CHERRY, SWEET (*Prunus avium* `Royal Anne')
Brown Rot Blossom Blight: Monilinia laxa
Brown Rot Fruit Rot: *Monilinia fructicola*

SEAWEED EXTRACTS FOR CONTROL OF BROWN ROT BLOSSOM BLIGHT AND LATENT FRUIT INFECTIONS OF CHERRY, 1995: Treatments were arranged in a randomized complete block design in a planting of 31 yr `Royal Anne' sweet cherries on Mazzard F-12-1 rootstock on a 20 x 40 ft spacing. Each treatment was applied to 5 single tree replicates. Treatments were applied using a hydraulic handgun sprayer at 300 psi at a rate of 200 gal water/A. Approximately 18 gal of a spray suspension was applied per 5 trees. Treatment applications were made on 27 Mar (popcorn), 31 Mar (full bloom) and 15 Apr (petal fall). Brown rot blossom blight was evaluated on 10 and 27 Apr by observing 400 blossoms randomly selected from the lower portion of each tree. Incidence of latent infections of brown rot fungi in green symptomless immature fruits was determined through a dilute paraquat dip method. Green cherries were harvested from each tree (40-50 fruit) on 24 May. Cherries were first sterilized for 1 min by dipping in 70% ethanol and 3 min in 10% chlorine bleach, then rinsed in sterile distilled water for 1 min before dipping in a 1:16 dilution of 23.2% paraquat dichloride for 2 min. Treated fruit was then placed into sterile tissue culture plates and placed into crisper boxes lined with moist paper towels to insure high humidity. Following 11 days incubation cherries were evaluated for incidence of brown rot fungi and other fungal growth. Green cherries were also weighed and measured for width and length before being treated. Due to cold and wet weather during bloom, insufficient fruit were produced for fruit rot evaluations at maturity in the field.

Incidence of brown rot blossom blight for both evaluation dates was significantly lower for all treatments when compared to the nontreated control. The significantly lowest incidence of blossom blight for the second evaluation date was observed with Kocide DF. Control of brown rot blossom blight using any seaweed extract was not significantly different than control achieved with sulfur. Phytotoxicity was observed with the Kocide DF treatment in the form of necrotic leaf spots shortly after bloom applications. No significant effects were detected for green fruit weight, or for green fruit length and width between treatments. No significant control of brown rot latent infections within green fruit was observed. Incidence of latent infections of green fruit caused by all fungi expressing growth was significantly lower only for Kocide DF when compared to the nontreated control.

	% Brown Rot Blossom Blight*			% Latent Infection*	
Treatment and Rate/100 gal	10 Apr	27 Apr	Green Fruit Weight (g)	Brown Rot Fungi	Total Fungi
Nontreated	1.7 a	5.2 a	2.1	13.3	53.8 ab
Spray Sulfur 6 lb	0.7 b	2.6 b	2.2	7.4	54.7 a
Kocide DF 4 lb	0.2 b	1.0 c	2.0	1.7	17.5 c
Algamin CPP-85 0.75 lb	0.1 b	2.4 b	2.0	10.6	43.5 ab
Soluble Seaweed Powder 2 oz .	0.7 b	2.7 b	2.1	10.9	39.2 b
Maxicrop 2 oz	0.8 b	2.3 b	2.2	7.1	40.8 ab

* Means followed by same letter do not differ significantly based on Fisher's protected LSD (P=0.05).

GRAPE (*Vitis vinifera* 'Cabernet Sauvignon', 'Chardonnay')
Powdery Mildew: *Uncinula necator*

EFFICACY OF FUNGICIDES FOR CONTROL OF GRAPE POWDERY MILDEW, 1995: Fungicide treatments were arranged in a randomized complete block design in a block of 10 yr 'Cabernet Sauvignon' and 'Chardonnay' with a 7x 10 ft spacing. Vines were trained to a bilateral cordon with spur pruning. Rows of each cultivar were randomized within the block at planting. Each treatment was replicated on 3 sets of 5 vines of each cultivar. Treatments were applied using a hooded boom sprayer at 300 psi at a rate of 100-200 gal water/A. Approximately 5 gal of a spray suspension was applied on 22 May and 1 Jun (100 gal water/A), 7 gal of a spray suspension was applied on 8 and 22 Jun, and 3 Jul (140 gal water/A), 9 gal of a spray suspension was applied on 13 Jul (180 gal water/A) and 10 gal of a spray suspension was applied (200 gal water/A) for the rest of the applications per 30 vines. Treatments were applied on 22 May (6 inch shoots), 1 Jun (12 inch shoots), 8 Jun, 22 Jun (beginning of bloom), 3 Jul (end of bloom), 13 Jul (berries forming), 27 Jul, 4 Aug and 15 Aug. No Botrytis control measures, including leaf removal, were applied to test vines. For the treatment using Thiolux DF alternating with Procure 50WS, Procure 50WS was applied on 8 Jun, 22 Jun, 13 Jul and 4 Aug. For the treatment using Thiolux DF alternating with M-Pede, M-Pede was applied on 1 Jun, 13 Jul and 4 Aug. Incidence of powdery mildew on leaves was evaluated on 15 Jun, 26 Jun, 5 Jul, 14 Jul and 28 Jul by randomly examining 30 or 50 leaves from the middle 3 vines of each replicate. Severity of powdery mildew on leaves was evaluated on 5 Jul, 14 Jul, 28 Jul, 10 Aug and 23 Aug by randomly examining 30 leaves from the middle 3 vines of each replicate. Severity of powdery mildew on clusters was evaluated on 17 Jul, 31 Jul, 10 Aug and 23 Aug by randomly examining 30 clusters from the middle 3 vines of each replicate. Comparisons among treatments for incidence and severity of powdery mildew on leaves and severity of powdery mildew on clusters was evaluated by calculating the area under disease progress curves (AUDPC). AUDPC was calculated by multiplying the mean incidence or severity from two observation dates by the number of days between observations. Values calculated between each pair of observations are added together to obtain a total AUDPC. Incidence of powdery mildew on clusters was evaluated on 31 Jul by examining 30 clusters from the center 3 vines of each set of 5 vines.

There were no interactions between cultivar and fungicide treatments. Mean incidence of powdery mildew on nontreated leaves was above 80% by 26 Jun, and mean severity on clusters was above 95% by 17 Jul. There were no significant differences for any of the evaluations for powdery mildew between the cultivars. Treatments involving the use of Thiolux DF had the significantly lowest incidence and severity of powdery mildew on leaves. Thiolux DF alternating with Procure 50WS had the significantly lowest incidence and severity of powdery mildew on clusters. Neemgard did not provide commercially acceptable control of powdery mildew. Some phytotoxicity was observed where Neemgard and Thiolux DF applications overlapped in the form of burned necrotic leaves.

	Powdery Mildew Infected Leaves[1]			Powdery Mildew Infected Clusters[1]	
Treatment and Rate/100 gal	Incidence 26 Jun	Incidence AUDPC	Severity AUDPC	Incidence 31 Jul	Severity AUDPC
Nontreated	83.3 a	24.4 a	--[2]	--[2]	--[2]
Thiolux DF 3 lb alternating with Procure 50WS 3 oz[3]	0.0 c	0.5 c	0.5 b	46.7 c	1.4 c
Thiolux DF 3 lb alternating with M-Pede 2 gal[4]	1.3 c	1.3 c	0.6 b	70.0 b	4.4 b
Neemgard 1 gal	11.7 b	8.8 b	5.6 a	100.0 a	28.6 a

1 Means followed by same letter do not differ significantly based on Fisher's protected LSD (P=0.05).

2 Nontreated vines were not evaluated due to eradicative measures taken beginning on 18 Jul to control excessive powdery mildew development early in the growing season.

3 Thiolux DF applications were made on 22 May, 1 Jun, 3 Jul, 27 Jul, and 15 Aug, Procure 50WS applications were made on 8 and 22 Jun, 13 Jul and 4 Aug.

4 Thiolux DF applications were made on 22 May, 8 and 22 Jun, 3 and 27 Jul, and 15 Aug, M-Pede applications were made on 1 Jun, 13 Jul and 4 Aug.

GRAPE (*Vitis* hybrid 'Venus')
Powdery Mildew:*Uncinula necator*

ORGANIC FUNGICIDES FOR CONTROL OF GRAPE POWDERY MILDEW, 1995: Fungicide treatments were arranged in a randomized complete block design in a block of 5 *yr* `Venus' with a 7 x 9 ft spacing. Vines were trained to a bilateral cordon with spur pruning. Each treatment was applied to 5 separate vines. Treatments were applied using a backpack sprayer at a rate of 200 gal water/A. Approximately 1.5-2 gal of a spray suspension was applied per 5 vines depending on growth stage. Treatments were applied on 4 Jun (18 inch shoots), 16 Jun (prebloom), 3 Aug and 25 Aug. For the treatment using Thiolux DF alternating with M-Pede, M-Pede was applied on 16 Jun and 25 Aug. The McKenzie Rock Flour treatment was prepared by mixing the rock flour (at a rate of 20 lb/A) with 3 gal water for I min, then allowing the suspension to settle for 30 sec, and then pouring off the top 2 gal of the suspension for the spray application for a final concentration of approximately 7 lb/Ar Incidence and severity of powdery mildew on leaves was determined on 10 Sep by examining 30-35 leaves from each vine. Incidence and severity of powdery mildew on clusters was determined on 6 Oct by examining 10-15 clusters from each vine. Cane infections caused by powdery mildew were evaluated on 10 Sep by rating a 2 node section (20-30 cm) from 7 canes selected at random from each vine with a rating scale of 0-5 where 0- healthy, 1= 1-5% infected, 2= 5-25% infected, 3= 25-50% infected, 4= 50-75% infected and 5= 75-100% infected.

Incidence and severity of powdery mildew on leaves was significantly lower for all treatments when compared to the nontreated control. Treatments involving Thiolux DF had significantly lower incidence of powdery mildew on leaves. The leaves of the table grape cultivar `Venus' had a moderate level of resistance for powdery mildew and even the nontreated control had commercially acceptable levels of infection. Leaves of vines treated with Neemgard, Sunspray Ultrafme Oil and McKenzie Rock Flour showed signs of phytotoxicity on 10 Sep in the form of premature yellowing. Incidence of powdery mildew on clusters was significantly lower for all treatments, except McKenzie Rock Flour, when compared to the nontreated control. Treatments involving Thiolux DF had the significantly lowest incidence of powdery mildew on clusters. Severity of powdery mildew on clusters was significantly lower for all treatments when compared to the nontreated control. Only the treatments involving Thiolux DF or M-Pede gave commercially acceptable control of powdery mildew on clusters. Powdery mildew infection on canes was significantly lower for all treatments when compared to the nontreated control. Only 4 spray applications were made during the growing season, and materials may have performed better had additional applications been made, especially during the period following bloom.

	Powdery Mildew on Leaves[1]		Powdery Mildew on Clusters[1]		Powdery Mildew
Treatment and Rate/A	Incidence	Severity	Incidence	Severity	Cane Infections[1,2]
Nontreated	72.6 a	10.5 a	100.0 a	39.8 a	3.8 a
Thiolux DF 6 lb	14.2 d	1.1 d	27.1 d	0.7 c	0.1 d
Thiolux DF 6 lb alternating with M-Pede 4 gal[3]	26.0 c	2.2 cd	27.3 d	0.9 c	0.2 d
Neemgard 2 gal	47.9 b	4.8 b	87.0 b	11.1 bc	1.1 c
Sunspray Ultrafine Oil 2 gal	46.0 b	4.2 bc	64.5 c	5.2 c	0.7 c
McKenzie Rock Flour 7 lb[4]	43.9 b	3.3 bcd	98.7 a	18.6 b	3.2 b

1 Means followed by same letter do not differ significantly based on Fisher's protected LSD (P=0.05).

2 Canes infected with powdery mildew were evaluated with a rating scale where 0= healthy, 1= 1-5% infected, 2= 5-25% infected, 3= 25-50% infected, 4= 50-75% infected and 5= 75-100% infected.

3 Thiolux DF applications were made on 4 Jun and 3 Aug, M-Pede applications were made on 16 Jun and 25 Aug.

4 Rate for McKenzie Rock Flour was subject to fluctuations due to variability in the mixing procedure.

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PEACH (*Prunus persica* 'Improved Elberta')
Brown Rot Blossom Blight: *Monilinia laxa*
Brown Rot Fruit Rot: *Monilinia fructicola*
Peach Leaf Curl: *Taphrina deformans*

COMPARISON OF FUNGICIDES FOR CONTROL OF BROWN ROT AND LEAF CURL OF PEACH, 1995: Treatments were arranged in a randomized complete block design in a block of 12 yr `Improved Elberta' peaches planted on a 20 x 20 ft spacing. Each treatment was applied to 4 single tree replicates. Treatments were applied using a hydraulic handgun sprayer at 300 psi and at a rate of 200 gal water/A. Approximately 8 gal of a spray suspension was applied per 4 trees. Dormant treatments were applied to all trees on 24 Oct 1994 (Kocide DF at 121b/A), 5 Dec 1994 (Kocide DF at 15 lb/A) and 4 Jan 1995 (Kocide DF at 16 lb/A) for control of shothole (*Wilsonomyces carpophilus*) and peach leaf curl (*Taphrina deformans*). Bloom stage applications were made on 3 Mar (popcorn), 17 Mar (full bloom) and 27 Mar (petal fall). The Orbit treatment, established to evaluate a reduced bloom spray schedule, was applied only twice during bloom on 10 Mar and 25 Mar, following suspected infection periods for blossom blight (temperatures >_ 55° F and wet blossoms for at least 8 hr or wet blossoms for more than 24 hr). Brown rot blossom blight was evaluated on 14 Apr by determining the number of twig cankers found on each tree. Incidence of peach leaf curl was determined on 8 May by observing 200 leaves randomly selected from each tree.

Due to unseasonably cool weather during bloom, fruit set was very low and in order to evaluate fungicides for fruit rot control additional trees were required to provided sufficient fruit for evaluation. An additional replicate was established from 15 yr `Improved Elberta' peaches (within the same block) that received no bloom sprays. Fruit was combined from 6 nontreated , trees for the control, 7 trees treated with Elite, 9 trees treated with Thiram and 6 trees treated with Orbit. Preharvest applications were made on 24 Aug and 31 Aug. Incidence of brown rot fruit rot was determined on 3 Sep, the day of harvest for postharvest fruit rot evaluation, by examining previously fallen fruit and fruit remaining on the tree (60-160 fruit). Fallen fruit had been monitored regularly to ensure that infected fruit was diseased prior to falling to the ground. Postharvest fruit rot was evaluated by harvesting all fruit (40-60) from each tree on 3 Sep and placing them into plastic packing trays and covering them with moist cheese cloth and plastic sheeting. Incidence of fruits with brown rot fruit rot was recorded after 8 days incubation.

Unseasonably warm weather during February resulted in an unusually early bloom period. Cool temperatures during the extended bloom period (4 nights below freezing) were unfavorable for brown rot blossom blight development. The number of twig cankers per tree, due to brown rot blossom blight, was significantly lower for all treatments when compared to the nontreated control (Table 1). Control of blossom blight with two applications of Orbit was not significantly different than control achieved with three fungicide applications in all other treatments. Despite the application of dormant sprays, significant peach leaf curl infections were observed. Incidence of leaves infected with peach leaf curl was significantly lower for all treatments when compared to the nontreated control (Table 1). The significantly lowest incidence of peach leaf curl was observed with Thiram or Ziram. Although peach leaf curl severity data were not collected, canopies of trees treated with Thiram or Ziram had noticeably less disease and were greener when compared with other trees. No significant control of brown rot fruit rot at harvest was observed as a result of preharvest treatment applications (Table 2). Incidence of postharvest fruit rot was significantly lower for all preharvest treatments when compared to the nontreated control (Table 2).

Table 1: Evaluations for Treatments applied at Bloom

Treatment and Rate/A	Number of Twig Cankers/Tree*	Peach Leaf Curl % Infected Leaves*
Nontreated during Bloom	5.8 a	61.6 a
Ronilan 50DF 2lb (Popcorn) then Captan 50WP 8 lb + Benlate 50WP 2 lb (Full Bloom) then Bravo 720 4 pt (Petal Fall)		
Replicate 1	0.0 b	30.6 c
Replicate 2	0.0 b	20.6 cd
Thiram 65WP 4 lb	0.8 b	9.1 d
Thiram 65WP 5 lb	0.8 b	9.6 d
Ziram 76 WDG 8 lb	0.8 b	12.0 d
Botran 75WP 2.67 lb	1.0 b	31.8 c
M-Pede 4 gal	1.0 b	32.6 c
Orbit 3.6EC 3 fl oz**	0.3 b	45.1 b

* Means followed by same letter do not differ significantly based on Fisher's protected LSD (P=0.05).

** Applied only twice during the bloom period.

Table 2: Evaluations for Treatments applied prior to Harvest.

Treatment and Rate/A	% Brown Rot Fruit Rot	% Postharvest Fruit Rot*
Nontreated	5.9	65.4 a
Ronilan 50DF 2lb (Popcorn) then Captan 50WP 8 lb + Benlate 50WP 2 lb (Full Bloom) then Bravo 720 4 pt (Petal Fall) then Elite 45DF 4 oz (Preharvest)	4.2	25.3 b
Thiram 65WP 4 or 5 lb (Bloom) then Thiram 65WP 5 lb (Preharvest)	4.1	38.0 b
Orbit 3.6EC 3 fl oz**	5.3	27.4 b

* Means followed by same letter do not differ significantly based on Fisher's protected LSD (P=0.05).

** Applied only twice during bloom.

PEAR (*Pyrus communis* 'Bartlett')
Scab: *Venturia pirina*
Pacific Coast Pear Rust: *Gymnosporangium libocedri*

EFFICACY OF FUNGICIDES AND ORGANIC FOLIAR SPRAYS FOR CONTROL OF PEAR RUST AND SCAB, 1995: Treatments were arranged in a randomized complete block design in a planting of 41 yr 'Bartlett' pears on a 20 x 20 ft spacing. Each treatment was applied to 4 single tree replicates. Treatments were applied using a hydraulic handgun sprayer at 300 psi at a rate of 200 gal water/A. Approximately 8 gal of a spray suspension were applied per 4 trees. Treatments were applied on 12 Mar (prepink), 17 Mar (pink), 25 Mar (early full bloom), 3 Apr (petal fall), 17 Apr (1st cover), 3 May (2nd cover) and 18 May (3rd cover). Frozen Ocean Fresh Fish (formulated without phosphoric acid stabilizer) was not applied for the first two applications. The phosphoric acid treatment represents the concentration of this stabilizer used in formulating Ocean Fresh Fish. Applications of Guthion 5OWP (2 lb/A) on 8 Jun and Imidan 5OWP (41b/A) on 30 Jun were made for control of coddling moth. Apple scab infection periods were monitored using a Metos environmental monitoring system. Using a modified primary infection model (wet periods start with rain and end with 8 hr drying time) a total of 15 infection periods were detected from Mar through May: 6 high infection periods (12 and 17 Mar, 6 and 12 Apr, 14 May and 14 Jun); 6 moderate infection periods (31 Mar, 4, 10, 19 and 27 Apr, and 1 May); and 3 light infection periods (29 Apr, 4 and 10 *May).* All apple scab infection periods were also pear scab infection periods (Spotts and Cervantes, 1991). Pacific coast pear rust incidence was determined on 9 May by examining 200 fruit randomly selected from each tree. Incidence of pear scab was evaluated on 23 Jun by randomly harvesting 150 fruit from each tree. An additional 100 fruit from each tree were harvested on 15 Aug to evaluate for both pear scab and fruit russeting. Fruit was considered russeted if more than 50% of the fruit was marked.

Scab lesions on fruit were first detected on 25 Apr. Incidence of pacific coast pear rust was significantly lower for all treatments, except frozen Ocean Fresh Fish and Dithane M-45, when compared to the nontreated control. The significantly lowest incidence of pacific coast pear rust was obtained with Thiram plus Procure, with no observed infections on the fruit. The early harvest evaluation for pear scab was done to obtain an accurate measure of the efficacy of the treatments, due to the late season infection period (14 Jun) that followed the last cover spray. Incidence of pear scab on fruit for both fruit evaluation dates was significantly lower for all fungicide treatments, except for Alliette, when compared to the nontreated control. No control of pear scab on fruit was observed using the foliar liquid fish sprays. Thiram 65WP at 5 lb/A had a very noticeable white residue on leaves and fruit after application, but was not evident near normal pear harvest. Incidence of fruit russeting was significantly lower for all fungicide treatments, except Alliette, when compared to the nontreated control. A significant increase in the incidence of russeting was observed with both Ocean Fresh Fish treatments when compared to the nontreated control. Caution should be used when applying this material to pears.

		% Pear Scab*		
Treatment and Rate/A	Pacific Coast Pear Rust (%)*	23 Jun	15 Aug	% Fruit Russeting*
Nontreated	11.4 a	10.5 a	21.5 a	29.0 b
Syllit 65WP 3 lb	4.0 c	0.2 c	0.5 b	13.8 c
Dithane M-45 80WP 3 lb	7.9 ab	1.0 bc	0.8 b	0.8 d
Thiram 65WP 5 lb	6.4 bc	0.0 c	1.3 b	5.3 cd
Thiram 65WP 3 lb + Procure 50WS 10 oz	0.0 d	0.2 c	0.8 b	6.0 cd
Alliette 80WP 2.5 lb	5.5 bc	7.0 ab	18.3 a	23.8 b
Ocean Fresh Fish 1.5 gal	6.6 bc	7.0 ab	22.8 a	50.0 a
Phosphoric Acid (82.5%) 7 fl oz	5.3 bc	8.7 a	23.0 a	27.0 b
Frozen Ocean Fresh Fish 1.5 gal**	8.6 ab	7.8 a	24.0 a	44.8 a

* Means followed by same letter do not significantly differ based on Fisher's protected LSD (P=0.05).

** Frozen Ocean Fresh Fish (formulated without phosphoric acid stabilizer) was not applied for the first two applications.

ROSE (*Rosa* sp. hybrid 'Sterling Silver')
Powdery Mildew: *Sphaerotheca pannosa*
Rust: *Phragmidium mucronatum*
Rose Aphid: *Macrosiphum rosae*

COMPARISON OF FUNGICIDES, INSECTICIDES, AND CULTURAL PRACTICE FOR CONTROL OF ROSE DISEASES AND APHIDS, 1995: Two year old bare-root rose bushes, hybrid 'Sterling Silver', were planted on 30 Mar, 1995, at the Oregon State University Botany and Plant Pathology Field Research Laboratory. Plants were set at two foot intervals in rows with twenty foot spacing. Commercial plant food fertilizer (10-15-10) was applied and incorporated on 5 May, using approximately 0.25 cup (43-45 g) per plant. On 28 Jun., drip irrigation was installed to reduce possible interference with the development of powdery mildew, and plants were watered as needed. During the course of the experiment, spent blossoms were routinely pruned to 0.25" above the first five-leaflet leaf. Dates for blossom pruning were 20-22 and 29 Jun, 11 and 23 Jul. Treatments were randomized and assigned to individual plants, with each treatment replicated four times. Spray treatments were applied beginning on 8 May and continued at 7 to 10 day intervals. The water control treatment consisted of water applied with a pump-style back-pack sprayer at the same rate (to run-off) as other water based treatments. The high pressure water treatment was a forceful stream of water from a spray nozzle attached to a garden hose directed at all foliage surfaces and et the bases of blooms (always done in late afternoon). The water pressure on the incoming irrigation system header was 90 psi, the garden hose was 200 feet long. Treatments with M-Pede were initially applied with 3% M-Pede for the first 4 application dates. The concentration was then reduced to 1.5% for the rest of the applications. Application dates for all treatments were 5, 15, 22, and 31 May, 8, 16, and 23 Jun, 1, 11, and 22 Jul. The number of stems with leaves supporting powdery mildew was evaluated on 6, 15, 22, and 30 Jun, 10 and 30 Jul, and 8 Aug. Percent of leaves with lesions was estimated visually on 8 Aug. On 30 Jul, percent of leaves with rust lesions was estimated. On 8 Aug, ratings were made of foliar phytotoxicity symptoms on a scale from 1 to 5, where 1= no difference from adjacent buffer plants, and esthetically acceptable, 2= leaves intact and healthy, but compressed in size, or shiny, plant may be somewhat shorter than adjacent plants, 3= leaves tattered, deformed, some burnt and/or with spray residue and or plant shows moderate size reduction, 4= plant shows burning throughout on leaves but not defoliated, or plant severely reduced in size, 5= plant appearance unacceptable due to defoliation, severe burning, browning of leaves. Readings were made of aphid incidence by counting numbers of stems with leaves or flowers supporting aphids on 15 Jun and 10 Jul. On 30 Jul, total numbers of aphids per plant were counted. On all reading dates, any aphid predators or instances of parasitized individuals were also counted and recorded.

Powdery mildew was first noted in the experiment on 5 Jun and was established on some plants in all replications by 7 Jun. Rust was first detected on lower leaves of several plants on 30 Jun. Aphids were first noted in the field on 8 May, and had established throughout the experiment by the first reading date of 15 May. Though populations fluctuated, individuals and colonies were present for the duration of the experiment. Two products were found to be difficult to use. Neemgard formed tiny solid balls in the concentrate container. These were not a problem if warm or hot water was used to dissolve the Neemgard before pouring into the sprayer. The Orthenex Rose and Flower Spray directs users to apply the product to top and undersides of leaves, which turns out to be difficult as it is an aerosol spray and nothing comes out when the can is inverted in the attempt to apply to leaf undersides, and still keep the requisite 18 inch distance from the foliage.

Rose bushes receiving all treatments except canopy pruning had significantly lower percentages of leaves infected with powdery mildew than the unsprayed control (Table 1). All materials tested produced plants with significantly lower percentages of powderyy mildew than plants sprayed with water alone. The combination of canopy pruning with sodium bicarbonate and Sunspray Oil produced plants with significantly higher percentage of powdery mildew than plants treated with sodium bicarbonate and Sunspray Oil in the absence of canopy pruning. This appeared to be a factor of blossom pruning date, as all plants treated with just the sodium bicarbonateloil application had been pruned just prior to the evaluation date, which removed any new, more heavily infected leaves. The plants with the canopy pinning in conjunction with the spray had more intact young growth, which was more infected. This was also the case for plants treated with Orthenex, where application date and blossom pruning dates combined to leave plants with more new growth, which became infected quickly and was not controlled by the previous spray application. The AUDPC computations show that the performance of these two treatments over time was not significantly different from the sodium bicarbonate and oil treatment The AUDPCs of all treatments

except canopy pruning were significantly lower than the unsprayed control. All materials tested produced plants with significantly lower AUDPCs than plants treated with water alone. Rust infection levels were low, and there was no significant difference in rust control when all treatments were compared to untreated plants. All plants treated with sodium bicarbonate had significantly higher phytotoxicity ratings than plants treated with other materials. Leaves were burnt and curled and lower stems were defoliated. The Orthenex treated plants had burnt spots on leaves. Garden Fungicide left a white, filmy residue on foliage. Weekly applications of Wilt Pruf resulted in slightly more compact bush growth.

The aphid incidence readings from 15 Jun show more variation than do those of 10 Jul (Table 2). All materials tested and the high pressure water treatment produced plants with aphid incidences statistically similar to plants treated with Orthenex on 10 Jul. Numbers of predators and parasitizations closely reflect aphid incidences of 10 Jul, and primarily indicate that where there are more aphids, there are more predators and parasites.

Table 1. Disease and phytotoxicity ratings for rose

	Powdery Mildew*			
Treatment and Rate/100 gal	% Infected	AUDPC	% Leaf Rust*	Phytotoxicity**
Nontreated	60.0 a	35.4 a	1.3 abc	1.0 e
Water Control	45.8 b	25.4 b	2.6 a	1.0 e
High pressure water	20.8 c	15.4 c	2.0 ab	2.3 d
Sodium Bicarbonate 4.2 lb + Sunspray Ultrafine Oil 1 gal	6.3 d	3.9 e	0.0 c	4.3 ab
Sodium Bicarbonate 4.2 lb + Neemgard 0.63 gal	24.5 c	7.5 de	0.0 c	4.0 b
Sodium Bicarbonate 4.2 lb + Sunspray Ultrafine Oil 1 gal + M-Pede (3 gal, then) 1.5 gal	6.3 d	7.3 e	0.5 bc	4.8 a
M-Pede (3 gal, then) 1.5 gal	6.3 d	7.7 de	1.4 abc	2.0 d
Garden Fungicide	5.5 d	5.0 e	0.0 c	2.5 cd
Wilt-Pruf 3 gal	6.3 d	4.8 e	0.0 c	2.5 cd
Orthenex	30.0 c	13.0 cd	0.0 c	3.0 c
Canopy Pruning	48.8 ab	32.9 a	1.8 abc	1.0 e
Canopy Pruning with Sunspray Ultrafine Oil 1 gal + Sodium Bicarbonate 4.2 lb	23.0 c	8.3 de	0.5 bc	4.5 ab

* Means followed by same letter do not differ significantly based on Fisher's protected LSD (P=0.05).

**1-5 scale where 1= acceptable and 5= unacceptable plant appearance.

Table 2. Aphid, predator and parasitization counts for rose

	Aphid incidence*		Total no.*
Treatment and Rate/100 gal	15 Jun	30 Jul	Predators and Parasitizations
Nontreated	41.3 bc	10 a-d	13.5 a
Water Control	53.3 ab	15 abc	18.8 a
High pressure water	37.0 bc	8 bcd	2.0 b
Sodium Bicarbonate 4.2 lb + Sunspray Ultrafine Oil 1 gal	29.7 bcd	15 bcd	3.5 b
Sodium Bicarbonate 4.2 lb + Neemgard 0.63 gal	23.7 cd	16 ab	3.0 b
Sodium Bicarbonate 4.2 lb + Sunspray Ultrafine Oil 1 gal + M-Pede 1.5 gal	30.7 bcd	4 cd	3.0 b
M-Pede 1.5 gal	24.7 bcd	1 d	4.8 b
Garden Fungicide	40.3 bc	3 d	6.0 b
Wilt-Pruf 3 gal	28.3 bcd	5 cd	3.8 b
Orthenex	3.0 d	0 d	0.8 b
Canopy Pruning	70.7 a	20 a	17.5 a
Canopy Pruning with Sunspray Ultrafine Oil 1 gal + Sodium Bicarbonate 4.2 lb	45.0 abc	19 ab	4.0 b

* Means followed by same letter do not differ significantly based on Fisher's protected LSD (P=0.05).

ROSE (*Rosa* sp, hybrid 'Sterling Silver')
Powdery Mildew: *Sphaerotheca pannosa*

EVALUATION OF OILS AND SODIUM BICARBONATE FOR PHYTOTOXICITY AND CONTROL OF ROSE POWDERY MILDEW, 1995: Treatments were arranged in a randomized complete block design in a planting of 1 yr `Sterling Silver' roses on a 2 x 20 ft spacing. Each treatment was applied to 4 single bush replicates. Spray treatments were applied beginning on 8 Jun and continued at 7 to 10 day intervals, including 16 and 23 Jun, 1, 11, and 22 Jul. Wilt Pruf was only applied on 8 Jun. The water control treatment consisted of water applied with a pump-style back-pack sprayer at the same rate (to runoff) as subsequent water based treatments. During the course of the experiment, spent blossoms were routinely pruned to 0.25" above the first five-leaflet leaf. Dates for blossom pruning were 20-22 and 29 Jun, 11 and 23 Jul. Percent of total number of leaves with powdery mildew lesions were estimated visually on 8 Aug. Also on 8 Aug, readings were made of foliar phytotoxicity symptoms, on a scale from 1 to 5, where 1= no difference from adjacent buffer plants, and esthetically acceptable, 2= leaves intact and healthy, but compressed in size, or shiny, plant may be somewhat shorter than adjacent plants, 3= leaves tattered, deformed, some burnt and/or with spray residue and/or plant shows moderate size reduction, 4= plant shows burning throughout on leaves but not defoliated, or plant severely reduced in size, 5= plant appearance unacceptable due to defoliation, severe burning, browning of leaves.

Powdery mildew was first noted in the experiment on 5 Jun. and was established on some plants in all replications by 7 Jun. All treatments produced plants with significantly lower percentages of leaves infected with powdery mildew than the unsprayed control. All materials tested produced plants with significantly lower percentages of powdery mildew than water alone. One application of Wilt-Pruf resulted in levels of infection comparable to those obtained by weekly applications of MPede. Treatments containing sodium bicarbonate significantly reduced the aesthetic value of the test plants to unacceptable levels, due to burning of the leaves.

Treatment and Rate/100 gal	% Leaves Infected with Powdery Mildew*	Phytotoxicity Rating**
Nontreated	60.0 a	1.0 c
Water Control	45.8 b	1.0 c
Sodium Bicarbonate 4.2 lb	15.0 d	4.5 a
Sunspray Ultrafine Oil 1 gal	15.0 d	2.0 b
Sodium Bicarbonate 4.2 lb + Sunspray Ultrafine Oil 1 gal	10.0 d	5.0 a
Neemgard 0.625 gal	12.4 d	2.0 b
M-Pede 1.5 gal	18.8 cd	1.3 c
Wilt-Pruf 3 gal	27.5 c	1.3 c

* Means followed by same letter do not differ significantly based on Fisher's protected LSD (P=0.05).

**1-5 scale where 1= acceptable and 5= unacceptable plant appearance.