2003
Cooperative Research Projects
in
Plant Pathology

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APPLE SCAB

APPLE SCAB TRIAL MATERIALS AND COOPERATORS

Thanks to the following companies for donating materials and providing funding to support this trial:

AgraQuest, Inc.
B.A.S.F. Corp.
Bayer Crop Science
Dow AgroSciences LLC
Microflo Co.
Nufarm Americas Inc.
Uniroyal Chemical Inc.

Final Report Cooperative Research Project, Doug Gubler, U.C. Davis Dept. of Plant Pathology

Trial name.....	Apple scab trial, 2003		
Location.....	Camino, CA El Dorado County		
Investigators	Doug Gubler, 530.752.0304; Ken Dell, 752.4982; Lynn Wunderlich, 621.5505		
Cooperators	Bud & Sharon Olsem 'HoneyBear Ranch'		
Crop.....	Apple 'Red delicious'	Age	25 years
Disease.....	Apple scab '*Venturia inequalis*'		

Trial layout and method

Objective	Efficacy of fungicides for control of fruit and/or leaf scab		
Experimental design	Treatments consist of fungicide applications to single tree plots, in a randomized complete block design, with 5 replications.		
Application method	Backpack Sprayer (Stihl SR400)		
Tree spacing	8 ft	Row spacing	16 ft
Treatment unit	2 trees	Treatment unit area.....	256 ft^2
Area/Treatment, sq ft...	1024 ft^2	Area/Treatment, acre	0.0235078
Vol. Water/acre, gal.....	135 - 157	Vol. water/trt, liter	11.5 – 14.0
Apps. Start	½" green	Apps. End	Cover sprays as needed
Treatment interval.....	7 day at A=1/2" green, B=pink, C=bloom/petal fall, D=covers	Evaluation stage.....	End of applications, harvest
Evaluation method.....	Leaves and fruit rated for severity of scab lesion		

Treatments protocol

#	Color	Materials	Interval / timing	FP/A		Tol
1	W	Untreated check				Y
2	P	Procure 50WS + Dithane 75DF	ABCD	12.0 3.0	oz lb	Y
3	YBD	Flint 50WG/ Procure 50WS+ Dithane 75DF	AC BD	2.5 12.0 3.0	oz oz lb	Y
4	Y	BAS516 04 F	ABCD	4.0	oz	N
5	R	Flint 50WG	ABCD	2.5	oz	Y
6	OBD	Champion WP Kumulus DF	A BCD	12 15	lb lb	Y
7	O	Dithane 75DF / Captan 50WP	ABC D	6.0 6.0	lb lb	Y
8	B	Champion WP / Serenade	A BCD	12 8	lb lb	Y

Notes:

1. Tol indicates whether all products in the treatment have an EPA tolerance for apples, and the crop can be harvested.

Materials list

Sponsor	Product	Active Ing.	Conc ai	Tol	Manufctr
Uniroyal	Procure 50WS	Triflumizol	50%	Y	Uniroyal
	Pristine 38WG	BAS516	38%	N	BASF
	Flint 50WG	Trifloxystrobin	50%	Y	Bayer Crop
	Dithane 75DF	Manganese^{++}	15%	Y	Dow Agro
		Zinc^{++}	1.87%		
		Ethylene bisdithiocarbamate	58.1%		
lab	Champion WP	copper hydroxide	77%	Y	Nufarm
		(copper elemental)	(50%)		Americas
	Kumulus DF	Sulfur	80%	Y	BASF
lab	Dithane 75DF	Manganese^{++}	15%	Y	Dow Agro
		Zinc^{++}	1.87%		
		Ethylene bisdithiocarbamate	58.1%		
	Captan 50WP	Captan	50%	Y	Arvesta
lab	Serenade	*Bacilis subtilis* (min. 5x10^{9}cfu/g)	10%	Y	AgraQuest

Application schedule

Date	25 Mar		8 Apr		23 Apr		7 May	
App.#	1		2		3		4	
Stage	½" green		pink		Pink-bloom		Bloom-petal fall	
Vol/trt	11.5 L		13 L		14 L		14 L	
Trt#								
1	--		--		--		--	
2	Procure	8.01g	Procure	8.01g	Procure	8.01g	Procure	8.01g
	Dithane	32g	Dithane	32g	Dithane	32g	Dithane	32g
3	Flint	1.67g	Procure	8.01g	Flint	1.67g	Procure	8.01g
			Dithane	32g			Dithane	32g
4	BAS516	2.67g	BAS516	2.67g	BAS516	2.67g	BAS516	2.67g
5	Flint	1.67g	Flint	1.67g	Flint	1.67g	Flint	1.67g
6	Champion	128g	Kumulus	160g	Kumulus	160g	Kumulus	160g
7	Dithane	64g	Dithane	64g	Dithane	64g	Captan	64g
8	Champion	128g	Serenade	85.3g	Serenade	85.3g	Serenade	85.3g

Calendar of events

Date	Activity
19 Feb	Scout site w/Lynn; collect leaves from ground for examination, kept in fridge.
5 Mar	Examine leaves: most populated with other perethecial ascomycete, 1 leaf with Venturia psuedothecia, approx. half asci mature, half immature; many psuedothecia on well-lesioned leaf.
6 Mar	Budswell. Flag plots w/Lynn. Set up spore trap.
14 Mar	Some green tip
25 Mar	KD (LW) App. #1; 6:45 – 8 am; calm, 60F, cloudy. Stage ½" green average (tight bud to 1" green); Posted 4 corner trees with 'experimental pesticide' signs. Met grower -may treat for moth. Rain forecast.
8 Apr	KD, LW, App. #2; 7:30-8:45am; calm, 60F, clear. Stage: Green bud to first flower, average= pink. No sign of scab symptoms.
23 Apr	KD App. #3; 6:40 – 8:10am; calm, cloudy, 60F. 14L/trt, 38 sec. per tree. Pink to bloom, very slow development and rain forecast, 15 day interval since last app. Scab lesions found on leaves and flower base and stem on untreated trees. Lesions examined w/LW, Fusicladium type conidia found.
7 May	KD app #4; 7-8:30am; calm, 60F, cloudy, dry.. Scab lesions found on leaves Untrt, Sulfur, Serenade.
10 Jun	KD, LW, Jenna; rate leaf scab
3 Jul	KD, Jenna; rate fruit scab

Summary -Evaluation of fungicides for control of apple scab, 2003.

Apple (*Malus domestica* 'red delicious')
Apple scab; *Venturia inequalis*

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Method

The trial was conducted in a 25 year old 'Red Delicious' apple orchard in Camino, El Dorado County, CA. The trees were spaced 8 ft apart and 16 ft between rows. The experimental design was a randomized complete block with 4 replications of two-tree treatment units. Treatments consisted of 4 fungicide applications with a backpack motorized air-assisted sprayer (Stihl SR2100), in a spray volume of 137-157 gallons water per acre, and an untreated check. Fungicides were applied on 25 Mar at 1/2 in green, 8 Apr at pink bud, 23 Apr at early-bloom, and 7 May at late-bloom/petal-fall. Plots were evaluated for leaf scab on 10 Jun and fruit scab on 3 Jul using 100 leaves and 50 fruit per experimental tree, selected at random between four to seven foot height. Percent surface coverage with scab lesions (severity) was estimated. Weather data was recorded by a CIMIS station located approximately 2 miles away. Monthly rainfall totals were: Mar with 9 rain days totaling 4.6 in; Apr, 16 rain days and 10.1 in; May with 5 rain days and 2.4 in; 1 to 15 Jun, zero. Severity and incidence data were analyzed by ANOVA; if treatment effects were significant at $p \leq 0.05$, treatment means were separated with the Waller-Duncan K-ratio t-Test at $p = 0.05$.

Results

Mills table infection periods were estimated from duration of continuous rain or relative humidity ≥95% as indicators of leaf wetness. Eleven conidial infection periods were identified by this method: 7 light, 3 moderate, and 1 heavy, occurring from 15 Mar to 12 Jun (Figure 1). Due to the frequent rainfall and high humidity throughout the treatment period, all treatment applications were considered necessary. Scab symptoms were first observed on 23 Apr, at the 3rd application. All fungicide treatments, except Champion followed by Serenade, gave significantly reduced apple scab incidence and severity compared to check trees (Table 1). Champion WP, Kumulus DF, and Serenade are listed by O.M.R.I. (Organic Materials Review Institute) as organic materials. Treatment with Champion WP followed by Kumulus DF resulted in similar levels of fruit scab as the non-organic materials.

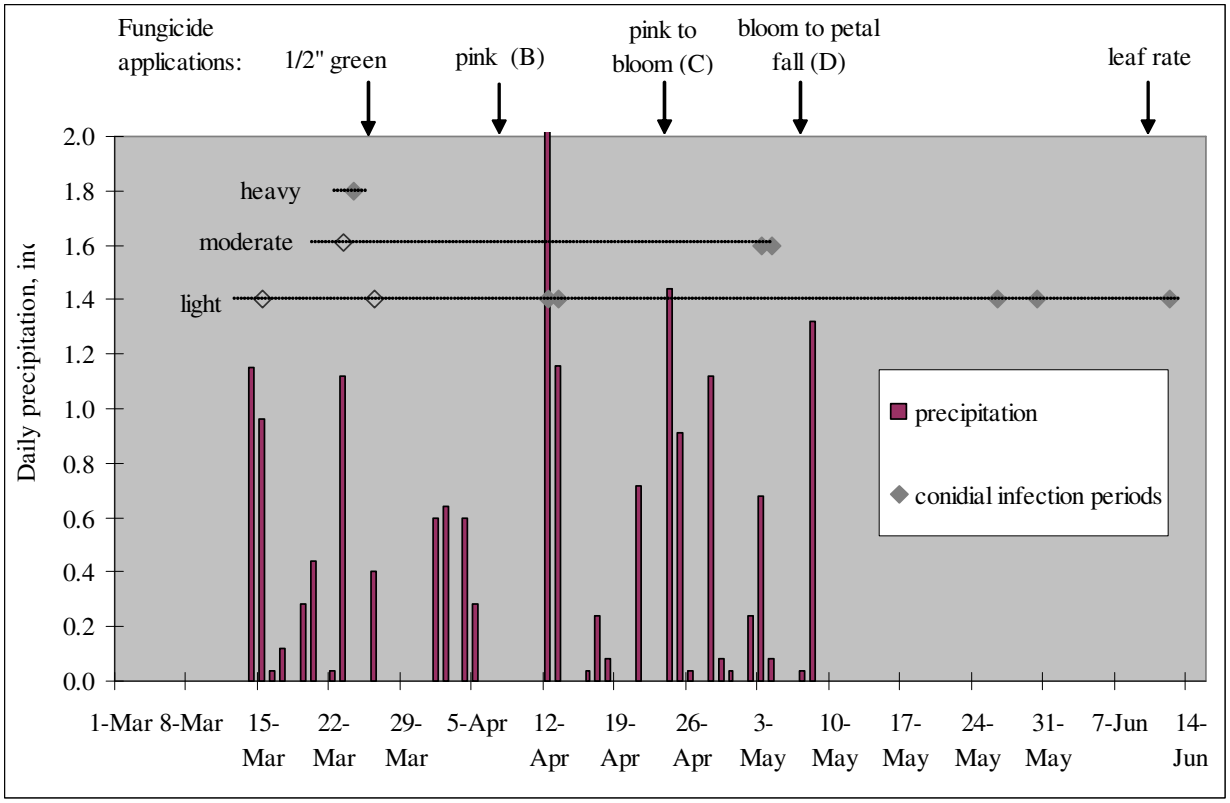

Figure 1. Fungicide application, precipitation, and calculated Mills Table infection periods. Infection periods with hollow markers are from duration of rain events, from solid markers are from duration of relative humidity ≥ 95%.

Table 1. Percent severity and incidence of fruit and leaf scab.

Material, rate/A	Appl timing	Fruit				Leaf			
		Severity (%)		Incidence (%)		Severity (%)		Incidence (%)	
Procure 50WS, 12 oz + Dithane 75DF, 3 lb	ABCD	0.3	c	6	c	0.1	c	7	de
Flint 50WG 2.5oz AC / Procure 12oz + Dithane 3 lb	BD	0.4	c	7	c	0.2	c	7	de
Champion WP 12 lb A / Kumulus DF 15 lb	BCD	0.5	c	9	c	0.5	c	13	d
Flint 50WG 2.5oz	ABCD	0.6	c	12	c	0.0	c	3	e
Dithane 75DF 6 lb ABC / Captan 50WP 6 lb	D	1.9	c	25	b	1.7	c	26	c
Champion WP 12 lb A / Serenade 8 lb	BCD	9.3	b	77	a	9.0	b	59	b
Untreated		17.7	a	85	a	17.5	a	67	a

[1] Severity is the estimated percent of fruit or leaf surface area covered with apple scab lesions
[2] Incidence is the percent of fruit or leaves rated with any scab lesions.
[3] Values in a column followed by the same letter are not significantly different according to the Waller-Duncan K-ratio t Test at $p = 0.05$

CUCURBIT POWDERY MILDEW

CUCURBIT TRIAL MATERIALS AND COOPERATORS

Thanks to the following companies for donating materials and providing funding to support this trial:

B.A.S.F. Corp.
Cerexagri, Inc.
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Valent Agricultural Products

Cooperative Research Project, Doug Gubler, U.C. Davis Dept. of Plant Pathology
Final report

Trial name.....	Cucurbit Powdery Mildew Trial, 2003
Location.....	Armstrong field area, U. C. Davis Plant Pathology Experimental Farm
Investigators	Doug Gubler, 530.752.0304; Ken Dell, Eugene Erickson 752.4982
Cooperators	Tom Komineck, Richard Webb
Crop.....	Squash 'Early White Bush Scallop', Cantalope 'Top Net Senior', Pumpkin 'Atlantic Giant'
Disease.....	Powdery mildew: *Sphaerotheca fuliginea*

Trial layout and method

Objective	Efficacy of fungicides for control of foliar powdery mildew		
Experimental design	Treatments consist of fungicide applications to single bed plots, in a randomized complete block design, with 4 replications.		
Application method	Backpack sprayer, dual nozzle wand (Echo SHR2100)		
plot length.....	14'squash, 12' cantalope	Bed spacing	60" sq 80" can 120" pum
Treatment unit	14'x5' sq, 12'x7' can	Treatment unit area.....	70 ft^2 sq, 84 ft^2 can
Area/Treatment, sq ft...	280sq + 336can = 616 total	Area/Treatment, acre	0.014141
Vol. Water/acre, gal.....	100	Vol. water/trt, liter	5.350
Apps. Start	Sept '03	Apps. End	
Treatment interval.....	7-14 days as needed	Evaluation stage.....	end of applications
Evaluation method.....	Leaf surface, upper and lower, rated for # colonies and/or surface covered with mildew.		

Treatments protocol

#	Col	Materials	FP/ac		Tol
1	W	Untreated			Y
2	B	Rally 40W	4.0	oz	Y
3	O	Procure 50WS	8.0	oz	Y
4	Y	Procure 50WS	4.0	oz	Y
5	R	Quintec 250SC	4.0	foz	N
6	P	Quintec 250SC	8.0	foz	N
7	BY	Rally 40W alt / Quintec 250SC	4.0 4.0	oz foz	N
8	BR	Quillaja 35 + Latron B-1956	1.0 .05	% %	Y
9	YR	Quillaja 35 + Procure 50WS	1.0 4.0	% oz	Y
10	BP	Pristine 38WG	12.6	oz	N
11	YP	VC-01 .41EC	3.5	foz	N
12	PR	Microthiol Disperss	25	lb	Y

Notes:

1. Tol indicates whether all products in the treatment have an EPA tolerance for cucurbits and if the crop can be harvested.
2. All treatment intervals are adjusted according to the U.C. grape powdery mildew risk assessment index as follows: Intervals between the range given are prorated to the index between 30 and 60. An index of 30 or below would translate to the maximum interval given, and an index of 60 or above translates to the minimum interval given.
3. Cantalope leaf area small compared to ground area, so volume applied is less than calculated per acre.

Materials list

Sponsor	Product	Active Ing.	Conc	Tol	Manufctr
Lab	Rally 40W	Myclobutanil	40%	Y	DowAgro
	Pristine 38WG	BAS516	38%	N	BASF
	VC-01		.41lb/gal	N	Valent
	Microthiol disperss	sulfur	80%		Cerexagri
Uniroyal	Procure 50WS	Triflumizole	50%	Y	Uniroyal
Dow	Quintec 250SC	Quinoxyfen	250g/L	N	DowAgro
	Rally 40W	Myclobutanil	40%	Y	DowAgro
DK Int.	Quillaja (QL35)		35%	Y	DK Int.
	Procure 50WS	Triflumizole	50%	Y	Uniroyal

Application schedule

Date	19 Sept		24 Sept		6 Oct		6 Oct	
App.#	1		1		2		2	
Crop	Squash		Squash		Squash		Cantalope	
Stage	Pre-flower		First flower		Fruit mature		early flower	
Vol/trt	2.5L		2.5L		2.5L		2.0L	
Trt# 1	--		--		--		--	
2	Rally	.75g	--		Rally	.75g	Rally	.60g
3	Procure	1.50g	--		Procure	1.50g	Procure	1.20g
4	Procure	.75g	--		Procure	.75g	Procure	.60g
5	Quintec	.78ml	--		Quintec	.78ml	Quintec	.63ml
6	Quintec	1.56ml	--		Quintec	1.56ml	Quintec	1.25ml
7	Rally	.75g	--		Quintec	.78ml	Rally	.60g
8	Quillija	25ml	--		Quillija	25ml	Quillija	25ml
	Latron	1.3ml			Latron	1.3ml	Latron	1.3ml
9	Quillaja	25ml	--		Quillaja	25ml	Quillaja	20ml
	Procure	.75g			Procure	.75g	Procure	.60g
10	Pristine	2.37g	--		Pristine	2.37g	Pristine	1.9g
11		--	VC-01	.68 ml	VC-01	.68 ml	VC-01	.54 ml
12	Disperss	75g	--		Disperss	75g	Disperss	60g

Calendar of events

Date	Activity
12 Aug	Seed planted at Armstrong; pumpkin, squash, cantaloupe; 200' row length.
17 Sept	Mildew found on squash, none found on melon or pumpkin. No flowers, foliage mature. Many white flies, aphid, leafhopper, few diabrotica; 'Knack' to be applied when arrives 9/22 (8oz/A). Pumpkin insufficient stand, deleted from treatments; cantalope rows short at east end, squash rows full length. Squash flagged at 16' intervals – 15' treated + 1' walking buffer.
18 Sept	Reflag to add 2 trts; plots 13' treated, 14' flagged.
19 Sept	KD, EE, app #1 to squash only; 8-9:20am; 70F, sunny, calm. Echo calibration: 29 sec/L output; for 2.5L per squash trt app. for 18 sec/rep (100gpa). Mixed 4L per treatment, applied 2.5L. Leaf sample (40) for disease progress north and south border rows – average = .5 col and .09% sev lower leaf surface.
22 Sept	TK app. of Diazinon for insect control
24 Sept	KD app #1 to YP. Squash aphids still plentiful; 'Knack' given to TK for additional insect control. No mildew seen on Cantalope.
6 Oct	KD, EE trt #2 squash, #1 cantalope; 8-11:30am, 80F, clear, calm.. First mature fruit squash, flowering in cantaloupe. Leaf samples taken from border rows. Squash app. 18 sec per rep, cantaloupe 14-16 sec /rep due to smaller leaf area index.
20 Oct	KD, EE; Sample squash plots for rate. Ninth leaf chosen from 12 plant shoots per plot. Rate during week, to 24 Oct.
27 Oct	KD sample border rows; rate indicates increased mildew
29 Oct	KD sample second time for rating; 10^{th} leaf position leaf selected from 12 plant shoots per plotRating from 3-5 Nov.

Summary - Fungicide control of powdery mildew of squash, 2003.

Squash
(*Cucurbita pepo* 'Early White Bush Scallop')
Powdery mildew; *Sphaerotheca fuliginea*

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Method.

The trial was conducted at the Plant Pathology Experimental Field, at U. C. Davis, Yolo Co., CA. The soil type was Yolo sandy loam. Squash seeds were planted on 12 August into six 4 ft wide beds spaced 5 ft apart and 200 ft long, and furrow irrigated as needed thereafter. A 16-20-0 pre-plant fertilizer at 200 lb/ac. was incorporated into the seed bed prior to planting. The planting was treated by for insect pests, primarily cucumber beetle, aphid, and whitefly, with Diazinon and Knack sprays in early Sep. Treatment plots were a single row 14 ft long, arranged in the central 4 rows, leaving a row on each side as a border. The experimental design was a randomized complete block design with 4 replications per treatment; replicate blocks were arranged across rows. Treatments were applied using a motorized backpack sprayer with a dual nozzle wand (Echo SHR2100) delivering 2.2 qts per minute, at 100 gallons per acre. Treatments were applied twice, on 19 Sep and 6 Oct. Plots were sampled twice following the last application, on 20 and 29 Oct., by selecting the 9^{th} and 10^{th} position leaf, respectively, from 12 plant shoots per plot. Leaves were rated for number and severity of mildew on upper and lower leaf surface by visual examination for mildew colonies and confirmation with hand lens (14x) or dissecting microscope (30x). The data was analyzed by ANOVA; if treatment effects were significant at $p \leq 0.05$, treatment means were separated with Fisher's protected LSD test at $p=0.05$.

Results.

Disease increased sharply during late October at a time when plants were beginning to senesce, a period of unusually warm daytime temperatures (Figure 1). Readings on 20 Oct showed eight treatments with zero incidence. On 29 Oct, all treatments were positive for mildew. The second samples were made 23 days following the final fungicide application, and thereby reflected the residual effects of the fungicide applications. Analysis by ANOVA showed that disease incidence and colony numbers on both leaf surfaces were significantly affected by treatments. All treatments except Quillaja alone, resulted in significantly less powdery mildew than the untreated check (Table 1). Procure at 4 oz/A was less effective than at 8 oz/A with significantly higher incidence on lower leaf surfaces. Quintec was equally effective applied at 4 or 8 foz/A. The addition of Quillaja to Procure at 4 oz/A did not reduce disease compared to Procure alone.

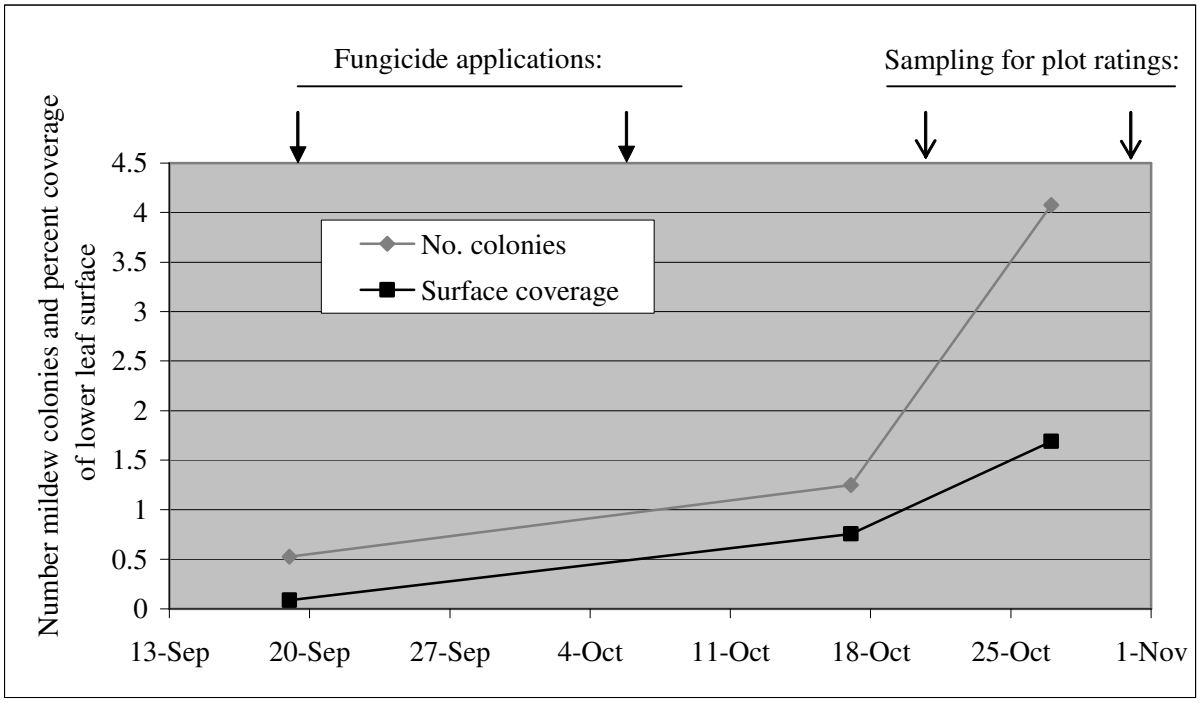

Figure 1. Disease progress in squash plots of randomly chosen leaves from border rows.

Table 1. Results of foliar rating of leaf at the 10th leaf position, sampled on 29 October, 23 days following second fungicide application.

Trt #	Treatment materials[1]	Incidence[2] upper surface		Incidence[2] lower surface		No. colonies[3] upper surface		No. colonies[3] lower surface	
5	Quintec 250SC, 4 foz	11.61	c[4]	8.04	c[4]	0.26	c[4]	0.17	c[4]
7	Rally 40W, 4 oz fol/by Quintec 250SC, 4 foz	15.45	bc	11.72	c	0.32	c	0.19	c
3	Procure 50WS, 8 oz	13.37	c	15.59	c	0.21	c	0.21	c
6	Quintec 250SC, 8 foz	11.90	c	10.42	c	0.45	c	0.23	c
10	Pristine 38WG, 12.6 oz	15.32	bc	17.24	c	0.28	c	0.27	c
11	VC-01, 3.5 foz	22.39	bc	10.99	c	0.85	bc	0.38	bc
12	Microthiol Disperss, 25 lb	10.12	c	18.45	c	0.23	c	0.39	bc
2	Rally 40W, 4 oz	15.73	bc	24.98	bc	0.49	c	0.51	bc
4	Procure 50WS, 4 oz	26.26	bc	41.85	b	1.15	bc	0.88	bc
9	Quillaja 35, 1% + Procure 50WS, 4 oz	31.85	b	37.80	b	1.76	b	1.12	b
8	Quillaja 35, 1% + Latron B-1956, 0.05%	68.10	a	68.59	a	4.31	a	4.25	a
1	Untreated	61.01	a	70.24	a	5.75	a	6.99	a
	Minimum significant difference	17.22		17.32					

[1] Two fungicide applications were made, on 19 Sept and 6 Oct.

[2] Incidence is the percent of leaves with any mildew.

[3] Upper and lower number of colonies was arcsin transformed prior to statistical analysis due to heterogeneity of variance; values shown are back transformed.

[4] Values in a column with the same letter are not significantly different according to the Waller-Duncan K-ratio t test at P=0.05.

GRAPEVINE POWDERY MILDEW

GRAPE POWDERY MILDEW TRIALS MATERIALS AND COOPERATORS

Thanks to the following companies for donating materials and providing funding to support this trial:

Arvesta Corp.
B.A.S.F. Corp.
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Gowan Corp.
Griffin LLC
JMS Flower Farms, Inc.
Loveland Industries
Nufarm Americas, Inc.
NutrEcology, Inc.
Petro-Canada Lubricants
Rotem BKG LLC
Syngenta Crop Protection Inc.
Uniroyal Chemical Inc.
Wilbur-Ellis Co.

Cooperative Research Project, Doug Gubler, U.C. Davis Dept. of Plant Pathology

Trial name.....	Grape powdery mildew fungicide Trial 1, 2003
Location.....	Courtland, Sacramento Co. (Herzog Ranch)
Investigators	Doug Gubler, 530.752.0304; Ken Dell, Eugene Erickson 752.4982
Cooperators	John Baranek, Tom Herzog
Crop.....	Grape 'Chardonnay'
Disease.....	Powdery mildew, *Uncinula necator*

Trial 1 layout and method

Objective	Efficacy of fungicides for control of powdery mildew		
Experimental design	Treatments are field applications to 4 vine plots, in a randomized complete block design, with 4 replications.		
Application method	high pressure hand gun sprayer		
Vine spacing	7'	Row spacing	12'
Treatment unit	4 vines	Treatment unit area.....	336 ft^2
Area/Treatment, sq ft...	1344	Area/Treatment, acre	0.0308539
Vol. Water/acre, gal.....	138	Vol. water/trt, gal.....	4.25
Apps timing	A=shoot growth, B = pre-bloom; C=bloom, D=berry set, E=preclose, F,G=veraison		
		Evaluation stage.....	1 week after final app.

Treatments protocol, Trial 1

#	Color	Sponsor	Materials	App code	Interval	Tol
1	W	Lab	Untreated			Y
2	B	lab-std	Sulfur 80DF Abound 2.08F	AB C-G	7-10d 14d	Y
3	G	Nufarm	Champ 2F + Micro Sulf Champ 2F	ABC D-G	7-10d 10-14d	Y
4	P	Nufarm	Champ 2F + Micro Sulf Rally 40W	ABC D-G	7-10d 14d	Y
5	BKC	lab	Sulfur 80DF Rally 40W	A1 A2-G	7-10d 14d	Y
6	GBKC	Bayer	Sulfur 80DF Flint 50WG Elite 45WP	A1-4 B alt/ C	7-10d 14d 14d	Y
7	GBKD	Bayer	Sulfur 80DF KWG 4168 300CS Flint 50WG Elite 45WP	A1-4 BD CF E	7-10d 14d 14d 14d	N
8	OBKD	Cerexagri	Microthiol Cuprofix Disperss 20 + Microthiol Disperss Cuprofix Disperss 20	A1 A2-C D-G	7-10d 7-10d 7-10d	Y
9	O / BK	Cerexagri	Microthiol TD-2463 + Microthiol Disperss TD-2463	A1 A2-C D-G	7-10d 7-10d 7-10d	Y

10	BD	Cerexagri	Microthiol TD-2463 + Microthiol Disperss + Silwet L-77 TD-2463 + Silwet L-77	A1 A2-C D-G	7-10d 7-10d 7-10d	Y
11	O	Arvesta	Sulfur 80DF Flint 50WG Elevate 50WG + Flint 50WG Sulfur 80DF	A1-4 B CD E-G	7-10d 14d 14d 7-10d	Y
12	PU	Arvesta	Sulfur 80DF Rally 40W Elevate 50WG + Rally 40W Sulfur 80DF	A1-4 B CD E-G	7-10d 14d 14d 7-10d	Y
13	BKD	BASF	Sulfur 80DF Pristine + Latron B-1956	A-B C-G	7-10d 21d	?
14	W / BK	BASF	Sulfur 80DF Pristine + Latron B-1956	A-B C-G	7-10d 21-28d RI	?
15	GD	JMS	Stylet Oil Stylet Oil	A-B C-G	10-14d RI	Y
16	W / G	JMS	Stylet Oil Stylet Oil + Abound 2.08F	A-B C-G	10-14d RI	Y
17	OC	Uniroyal	Sulfur 80DF Procure 50WS	A-B C-G	7-10d 14d	Y
18	OD	lab	Sulfur 80DF Chilean Sulfur	A-B C-G	7-10d 7-10d	Y
19	W / O	Griffin	Kocide 2000 + Sulfur 80DF Rally 40W Rally 40W	A-C D E-G	7-10d 14d 14d	Y
20	YC	Griffin	Kocide 2000 + Sulfur 80DF Rally 40W Rally 40W	A-C D E-G	7-10d 14d 14d	Y
21	W / Y	Griffin	Kocide 101 + Sulfur 80DF Rally 40W Rally 40W	A-C D E-G	7-10d 14d 14d	Y
22	YBKC	Griffin	GX-569 + Sulfur 80DF Rally 40W Rally 40W	A-C D E-G	7-10d 14d 14d	Y
23	YBKD	lab	Flint 50WG Elite 45WP	A1 A2-G	10d 14d	Y
24	Y / BK	lab	KWG 4168 300CS Flint 50WG KWG 4168 300CS	A1 A2 A3-G	14d 14d 14d	N
25	PC	Rotem	Nutrol + Latron B-1956 Rally 40W	A1 alt/ A2,B	14d 14d	Y

26	BBKD	Rotem	Nutrol + Latron B-1956 Sulfur 80DF	A1-F alt/ A2-G	7-10d RI 7-10d	Y
27	L	Rotem	Nutrol + Latron B-1956 + Sulfur 80DF	A-G	7-10d RI	Y
28	Y	Rotem	Sulfur 80DF Nutrol + Latron B-1956 Rally 40W	A1 A2 alt/ A3	10d 7-14d RI 14d	Y
29	W/B	Lab	Sulfur 80DF Flint 50WG	A1 A2-G	7-10d 14d	Y
30	R	Lab	Water only + Latron B-1956	A-G		Y
31	BC		Untreated			Y

Notes:

1. Tol indicates whether all products in the treatment have an EPA tolerance for grapes, and the crop can be harvested.
2. A slash '/' in a sequence of materials means 'followed by'.

Materials list

Sponsor	Product	Active Ingr.	Conc.	Tol.	Mfr
Arvesta	Flint 50WG	Trifloxystrobin	50%	Y	Bayer
	Elevate 50WG	Fenhexamid	50%	Y	Arvesta
	Rally 40W	Myclobutanil	40%	Y	Dow Agro
	Sulfur 80DF	Sulfur	80%	Y	Wilbur-Ellis
BASF	Pristine	BAS516	38%	N	BASF
	Latron B-1956	Non-ionic surfactant		Y	Dow Agro
	Sulfur 80DF	Sulfur	80%	Y	Wilbur-Ellis
Bayer	KWG 4168 300CS	Spiroxamine	300 g/L	N	Bayer
	Elite 45 WP	Tebuconazole	45%	Y	Bayer
	Flint 50 WG	Trifloxystrobin	50%	Y	Bayer
Cerexagri	Cuprofix Disperss 20	Copper	20%	Y	Cerexagri
	TD-2463	Copper	40%	Y	Cerexagri
	Microthiol	Sulfur	80%	Y	Cerexagri
	Microthiol Disperss	Sulfur	80%	Y	Cerexagri
	Silwet L-77	Silicone surfactant		Y	Loveland
Griffin	Kocide 2000 ProTech	Copper hydroxide	50%	N	Griffin
	Kocide 101 ProTech	Copper hydroxide	77%	N	Griffin
	GX-569			N	Griffin
	Rally 40W	Myclobutanil	40%	Y	Dow Agro
	Sulfur 80DF	Sulfur	80%	Y	Wilbur-Ellis
JMS	Stylet Oil	Mineral oil	99%	Y	JMS
	Abound 2.08F	Azoxystrobin	300 g/L	Y	Syngenta
Nufarm	Champ 2F	Copper hydroxide	4.6lb/ga	Y	Nufarm
	Micro Sulf	Sulfur	80%	Y	Agtrol
Rotem BKG	Nutrol	MKP		Y	NutrEcology
Syngenta	Vangard 75WG	Cyprodinil	75%	Y	Syngenta
	Sulfur 80DF	Sulfur	80%	Y	Wilbur-Ellis
Uniroyal	Procure 50WS	Triflumizole	50%	Y	Uniroyal
	Sulfur 80DF	Sulfur	80%	Y	Wilbur-Ellis

Application schedule

Date App.# Stage Vol/trt Color	Trt#	4 Apr 03 A1 prebloom 4.25 gal	FP/trt	7 Apr 03 A1 prebloom 4.25 gal	FP/trt	14 Apr 03 A2 Prebloom 4.25 gal	FP/trt	16 Apr 03 A2 Prebloom 4.25 gal	FP/trt
W	1	----		----		----			
B	2	Sulfur 80DF	56 g			Sulfur 80DF	56 g		
G	3	Champ 2F Micro Sulf	29.2 mL 70 g			Champ 2F Micro Sulf	29.2 mL 70 g		
P	4	Champ 2F Micro Sulf	29.2 mL 70 g			Champ 2F Micro Sulf	29.2 mL 70 g		
BKC	5	Sulfur 80DF	56 g			Rally 40W	3.5 g		
GBKC	6	Sulfur 80DF	56 g			Sulfur 80DF	56 g		
GBKD	7	Sulfur 80DF	56 g			Sulfur 80DF	56 g		
OBKD	8			Microthiol	56 g	Cuprofix 20 Microthiol	42 g 56 g		
O / BK	9			Microthiol	56 g	TD-2463 Microthiol	42 g 28 g		
BD	10			Microthiol	56 g	TD-2463 Microthiol Silwet L-77	42 g 28 g 5 mL		
O	11			Sulfur 80DF	56 g	Sulfur 80DF	56 g		
PU	12	Sulfur 80DF	56 g			Sulfur 80DF	56 g		
BKD	13	Sulfur 80DF	56 g			Sulfur 80DF	56 g		
W /BK	14	Sulfur 80DF	56 g			Sulfur 80DF	56 g		
GD	15	Stylet Oil	161 mL			Stylet Oil	161 mL		
W / G	16	Stylet Oil	161 mL			Stylet Oil	161 mL		
OC	17	Sulfur 80DF	56 g			Sulfur 80DF	56 g		
OD	18	Sulfur 80DF	56 g			Sulfur 80DF	56 g		
W / O	19	Kocide 2000 Sulfur 80DF	21 g 70 g			Kocide 2000 Sulfur 80DF	21 g 70 g		
YC	20	Kocide 2000 Sulfur 80DF	42 g 70 g			Kocide 2000 Sulfur 80DF	42 g 70 g		
W / Y	21	Kocide 101 Sulfur 80DF	28 g 70 g			Kocide 101 Sulfur 80DF	28 g 70 g		
YBKC	22	GX-569 Sulfur 80DF	11.6 g 70 g			GX-569 Sulfur 80DF	11.6 g 70 g		
YBKD	23	Flint 50WG	1.3 g			Elite 45WP	3.5 g		
Y /BK	24	KWG 4168	16.4 mL			Flint 50WG	1.3 g		
PC	25	Nutrol	140 g			Rally 40W	3.5 g		
BBKD	26	Nutrol	140 g			Sulfur 80DF	56 g		
L	27	Nutrol Sulfur 80DF	98 g 21 g					Nutrol Sulfur 80DF	98 g 21
Y	28			Sulfur 80DF	56 g			Nutrol Silwet L-77	140 g 5 mL
W / B	29	Sulfur 80DF	56 g			Flint 50WG	1.75 g		
R	30			Water Latron B-1956	5 Ml	Water Latron B-1956	5 mL		
BC	31	-----		-----		-----		-----	

Date App.# Stage Vol/trt Color	Trt#	25 Apr 03 A3 Pre-bloom 4.25 gal	FP/trt	29 Apr 03 A3 Pre-bloom 4.25 gal	FP/trt	5 May 03 A4 BBCH 57 4.25 gal	FP/trt	13 May 03 B BBCH 57 4.25 gal	FP/trt
W	1	-----		-----		-----			
B	2	Sulfur 80DF	56 g			Sulfur 80DF	56 g		
G	3	Champ 2F Micro Sulf	29.2 mL 70 g			Champ 2F Micro Sulf	29.2 mL 70 g		
P	4	Champ 2F Micro Sulf	29.2 mL 70 g			Champ 2F Micro Sulf	29.2 mL 70 g		
BKC	5			Rally 40W	3.5 g			Rally 40W	3.5 g
GBKC	6	Sulfur 80DF	56 g			Sulfur 80DF	56 g		
GBKD	7	Sulfur 80DF	56 g			Sulfur 80DF	56 g		
OBKD	8	Cuprofix 20 Microthiol	56 g 42 g			Cuprofix 20 Microthiol	56 g 42 g		
O / BK	9	TD -2463 Microthiol	28 g 42 g			TD -2463 Microthiol	28 g 42 g		
BD	10	TD-2463 Microthiol Silwet L-77	28 g 42 g 5 mL			TD-2463 Microthiol Silwet L-77	28 g 42 g 5 mL		
O	11	Sulfur 80DF	56 g			Sulfur 80DF	56 g		
PU	12	Sulfur 80DF	56 g			Sulfur 80DF	56 g		
BKD	13	Sulfur 80DF	56 g			Sulfur 80DF	56 g		
W /BK	14	Sulfur 80DF	56 g			Sulfur 80DF	56 g		
GD	15			Stylet Oil	161 mL			Stylet Oil	161 mL
W / G	16			Stylet Oil	161 mL			Stylet Oil	161 mL
OC	17	Sulfur 80DF	56 g			Sulfur 80DF	56 g		
OD	18	Sulfur 80DF	56 g			Sulfur 80DF	56 g		
W / O	19	Kocide 2000 Sulfur 80DF	21 g 70 g			Kocide 2000 Sulfur 80DF	21 g 70 g		
YC	20	Kocide 2000 Sulfur 80DF	42 g 70 g			Kocide 2000 Sulfur 80DF	42 g 70 g		
W / Y	21	Kocide 101 Sulfur 80DF	28 g 70 g			Kocide 101 Sulfur 80DF	28 g 70 g		
YBKC	22	GX-569 Sulfur 80DF	11.6 g 70 g			GX-569 Sulfur 80DF	11.6 g 70 g		
YBKD	23			Elite 45WP	3.5 g			Elite 45WP	3.5 g
Y /BK	24			KWG 4168	16.4 mL			KWG 4168	16.4 mL
PC	25			Nutrol	140 g			Rally 40W	3.5 g
BBKD	26	Nutrol	140 g			Sulfur 80DF	70 g		
L	27	Nutrol Sulfur 80DF	98 g 21 g			Nutrol Sulfur 80DF	98 g 21 g		
Y	28			Rally 40W	3.5 g			Nutrol Latron B1956	140 g 5 mL
W / B	29			Flint 50WG	1.3 g			Flint 50WG	1.3 g
R	30	Water Latron B-1956	5 mL			Water Latron B-1956	5 mL		
BC	31	-----		-----		-----		-----	

Date App.# Stage Vol/trt Color	Trt#	16 May 03 B BBCH 57-61 4.25 gal	FP/trt	20 May 03 B BBCH 61 4.25 gal	FP/trt	23 May 03 C BBCH 66 4.25 gal	FP/trt	27 May 03 C BBCH 69-71 4.25 gal	FP/trt
W	1	-----							
B	2	Sulfur 80DF	56 g			Abound 2.08F	14.1 mL		
G	3	Champ 2F Micro Sulf	29.2 mL 70 g			Champ 2F Micro Sulf	29.2 mL 70 g		
P	4	Champ 2F Micro Sulf	29.2 mL 70 g			Champ 2F Micro Sulf	29.2 mL 70 g		
BKC	5							Rally 40W	3.5 g
GBKC	6	Flint 50WG	1.3 g						
GBKD	7	KWG 4168	16.4 mL						
OBKD	8	Cuprofix 20 Microthiol	56 g 42 g			Cuprofix 20 Microthiol	56 g 42 g		
O / BK	9	TD -2463 Microthiol	28 g 42 g			TD -2463 Microthiol	28 g 42 g		
BD	10	TD-2463 Microthiol Silwet L-77	28 g 42 g 5 mL			TD-2463 Microthiol Silwet L-77	28 g 42 g 5 mL		
O	11	Flint 50WG	1.8 g						
PU	12	Rally 40W	3.5 g						
BKD	13	Sulfur 80DF	56 g			Pristine Latron B-1956	9.2 g 3.7 mL		
W /BK	14	Sulfur 80DF	56 g			Pristine Latron B-1956	9.2 g 3.7 mL		
GD	15					Stylet Oil	242 mL		
W / G	16					Stylet Oil Abound 2.08F	161 mL 11 mL		
OC	17	Sulfur 80DF	56 g			Procure 50WS	5.25 g		
OD	18	Sulfur 80DF	56 g			Chile Sulfur	56 g		
W / O	19	Kocide 2000 Sulfur 80DF	21 g 70 g			Kocide 2000 Sulfur 80DF	21 g 70 g		
YC	20	Kocide 2000 Sulfur 80DF	42 g 70 g			Kocide 2000 Sulfur 80DF	42 g 70 g		
W / Y	21	Kocide 101 Sulfur 80DF	28 g 70 g			Kocide 101 Sulfur 80DF	28 g 70 g		
YBKC	22	GX-569 Sulfur 80DF	11.6 g 70 g			GX-569 Sulfur 80DF	11.6 g 70 g		
YBKD	23							Elite 45WP	3.5 g
Y /BK	24							KWG 4168	16.4 mL
PC	25							Nutrol Latron B-1956	140 g 5.0 mL
BBKD	26	Nutrol Latron B-1956	140 g 5 mL			Sulfur 80DF	70 g		
L	27	Nutrol Sulfur 80DF Latron B-1956	98 g 21 g 5 mL			Nutrol Sulfur 80DF Latron B-1956	98 g 21 g 5 mL		
Y	28			Rally 40W	3.5 g				
W / B	29							Flint 50WG	1.3 g
R	30	Water Latron B-1956	5 mL			Water Latron B-1956	5 mL		

BC	31	-----				-----			

Date App.# Stage Vol/trt Color	Trt#	30 May 03 C BBCH 69 4.25 gal	FP/trt	3 Jun 03 D BBCH 71 4.25 gal	FP/trt	5 Jun 03 D BBCH 71 4.25 gal	FP/trt	10 Jun 03 D BBCH 71-73 4.25 gal	FP/trt
W	1	-----		-----		-----		-----	
B	2					Abound 2.08F	14.1 mL		
G	3	Champ 2F Micro Sulf	29.2 mL 70 g			Champ 2F	29.2 mL		
P	4	Champ 2F Micro Sulf	29.2 mL 70 g			Rally 40W	3.5 g		
BKC	5							Rally 40W	3.5 g
GBKC	6	Elite 45WP	3.5 g						
GBKD	7	Flint 50WG	1.3 g						
OBKD	8	Cuprofix 20 Microthiol	56 g 42 g			Cuprofix 20	56 g		
O / BK	9	TD -2463 Microthiol	28 g 42 g			TD -2463	28 g		
BD	10	TD-2463 Microthiol Silwet L-77	28 g 42 g 5 mL			TD-2463 Silwet L-77	28 g 5 mL		
O	11	Elevate 50WG Flint 50WG	14 g 1.3 g						
PU	12	Elevate 50WG Rally 40W	14 g 2.6 g						
BKD	13								
W /BK	14								
GD	15			Stylet Oil	323 mL				
W / G	16			Stylet Oil Abound 2.08F	161 mL 11 mL				
OC	17					Procure 50WS	5.5 mL		
OD	18	Chile Sulfur	56 g			Chile Sulfur	56 g		
W / O	19	Kocide 2000 Sulfur 80DF	21 g 70 g			Rally 40W	3.5 g		
YC	20	Kocide 2000 Sulfur 80DF	42 g 70 g			Rally 40W	3.5 g		
W / Y	21	Kocide 101 Sulfur 80DF	28 g 70 g			Rally 40W	3.5 g		
YBKC	22	GX-569 Sulfur 80DF	11.6 g 70 g			Rally 40W	3.5 g		
YBKD	23							Elite 45WP	3.5 g
Y /BK	24							KWG 4168	16.4 mL
PC	25							Rally 40W	3.5 g
BBKD	26	Nutrol Latron B-1956	140 g 5 mL			Sulfur 80DF	70 g		
L	27	Nutrol Sulfur 80DF Latron B-1956	98 g 21 g 5 mL			Nutrol Sulfur 80DF Latron B-1956	98 g 21 g 5 mL		
Y	28			Nutrol Latron B-1956	140 g 5 mL			Rally 40W	3.5 g
W / B	29							Flint 50WG	1.3 g

R	30	Water Latron B-1956	 5 mL			Water Latron B-1956	 5 mL		
BC	31								

Date App.# Stage Vol/trt Color	Trt#	12 Jun D BBCH 71-73 4.25 gal	FP/trt	13 Jun BBCH 73 4.25 gal	FP/trt	16 Jun 4.25 gal	FP/trt	19 Jun E BBCH 77 4.25 gal	FP/trt
W	1	-----		-----		-----		-----	
B	2							Abound 2.08F	14.1 mL
G	3					Champ 2F	29.2 mL		
P	4							Rally 40W	3.5 g
BKC	5								
GBKC	6			Flint 50WG	1.3 g				
GBKD	7			KWG 4168	16.4 mL				
OBKD	8	Cuprofix 20	56 g					Cuprofix 20	56 g
O / BK	9	TD -2463	28 g					TD -2463	28 g
BD	10	TD-2463 Silwet L-77	28 g 5 mL					TD-2463 Silwet L-77	28 g 5 mL
O	11			Elevate 50WG Flint 50WG	14 g 1.3 g				
PU	12			Elevate 50WG Rally 40W	14 g 2.6 g				
BKD	13			Pristine Latron B-1956	9.2 g 3.7 mL				
W /BK	14			Pristine Latron B-1956	9.2 g 3.7 mL				
GD	15			Stylet Oil	323 mL				
W / G	16			Stylet Oil Abound 2.08F	161 mL 11 mL				
OC	17							Procure 50WS	5.5 mL
OD	18	Chile Sulfur	56 g					Chile Sulfur	56 g
W / O	19							Rally	5.4 g
YC	20							Rally	5.4 g
W / Y	21							Rally	5.4 g
YBKC	22							Rally	5.4 g
YBKD	23								
Y /BK	24								
PC	25								
BBKD	26	Nutrol Latron B-1956	140 g 5 mL					Sulfur 80DF	70 g
L	27	Nutrol Sulfur 80DF Latron B-1956	98 g 21 g 5 mL					Nutrol Sulfur 80DF Latron B-1956	98 g 21 g 5 mL
Y	28								
W / B	29								
R	30	Water Latron B-1956	 5 mL					Water Latron B-1956	 5 mL
BC	31								

Date App.# Stage Vol/trt Color	Trt#	23 Jun F BBCH 78 4.25 gal	FP/trt	24 Jun F BBCH 77-79 4.25 gal	FP/trt	26 Jun F BBCH 79 4.25 gal	FP/trt	27 Jun F BBCH 79 4.25 gal	FP/trt
W	1	-----		-----		-----		-----	
B	2								
G	3					Champ 2F	29.2 mL		
P	4								
BKC	5			Rally 40W	3.5 g				
GBKC	6							Elite 45WP	3.5 g
GBKD	7							Elite 45WP	3.5 g
OBKD	8					Cuprofix 20	56 g		
O / BK	9					TD -2463	28 g		
BD	10					TD-2463 Silwet L-77	28 g 5 mL		
O	11							Sulfur 80DF	56 g
PU	12							Sulfur 80DF	56 g
BKD	13								
W /BK	14								
GD	15	Stylet Oil	323 mL						
W / G	16	Stylet Oil Abound 2.08F	161 mL 11 mL						
OC	17								
OD	18					Chile Sulfur	56 g		
W / O	19								
YC	20								
W / Y	21								
YBKC	22								
YBKD	23			Elite 45WP	3.5 g				
Y /BK	24			KWG 4168	16.4 mL				
PC	25			Nutrol Latron B-1956	140 g 5.0 mL				
BBKD	26					Nutrol Latron B-1956	140 g 5 mL		
L	27					Nutrol Sulfur 80DF Latron B-1956	98 g 21 g 5 mL		
Y	28			Nutrol Latron B-1956	140 g 5.0 mL				
W / B	29			Flint 50WG	1.3 g				
R	30							Water Latron B-1956	5 mL
BC	31								

Date App.# Stage Vol/trt Color	Trt#	1 Jul F BBCH 79 4.25 gal	FP/trt	3 Jul F BBCH 79 4.25 gal	FP/trt	8 Jul F BBCH 79 4.25 gal	FP/trt	10 Jul F BBCH 79 4.25 gal	FP/trt
W	1	-----		-----		-----		-----	
B	2			Abound 2.08F	14.1 mL				
G	3							Champ 2F	29.2 mL
P	4			Rally 40W	3.5 g				
BKC	5					Rally 40W	3.5 g		
GBKC	6								
GBKD	7								
OBKD	8			Cuprofix 20	56 g				
O / BK	9			TD -2463	28 g				
BD	10			TD-2463 Silwet L-77	28 g 5 mL				
O	11			Sulfur 80DF	56 g				
PU	12			Sulfur 80DF	56 g				
BKD	13			Pristine Latron B-1956	9.2 g 3.7 mL				
W /BK	14								
GD	15			Stylet Oil	323 mL				
W / G	16			Stylet Oil Abound 2.08F	161 mL 11 mL				
OC	17			Procure 50WS	5.5 mL				
OD	18			Chile Sulfur	56 g				
W / O	19			Rally	5.4 g				
YC	20			Rally	5.4 g				
W / Y	21			Rally	5.4 g				
YBKC	22			Rally	5.4 g				
YBKD	23					Elite 45WP	3.5 g		
Y /BK	24					KWG 4168	16.4 mL		
PC	25					Rally 40W	3.5 g		
BBKD	26			Sulfur 80DF	70 g				
L	27			Nutrol Sulfur 80DF Latron B-1956	98 g 21 g 5 mL				
Y	28	Rally 40W	3.5 g						
W / B	29					Flint 50WG	1.3 g		
R	30			Water Latron B-1956	5 mL				
BC	31								

Date App.# Stage Vol/trt Color	Trt#	11 Jul F BBCH 79 4.25 gal	FP/trt	14 Jul F BBCH 79 4.25 gal	FP/trt	15 Jul F BBCH 79 4.25 gal	FP/trt	17 Jul F BBCH 79 4.25 gal	FP/trt
W	1	-----		-----		-----		-----	
B	2							Abound 2.08F	14.1 mL
G	3								
P	4							Rally 40W	3.5 g
BKC	5								
GBKC	6	Flint 50WG	1.3 g						
GBKD	7	Flint 50WG	1.3 g						
OBKD	8			Cuprofix 20	56 g				
O / BK	9			TD -2463	28 g				
BD	10			TD-2463 Silwet L-77	28 g 5 mL				
O	11			Sulfur 80DF	56 g				
PU	12			Sulfur 80DF	56 g				
BKD	13								
W /BK	14	Pristine Latron B-1956	9.2 g 3.7 mL						
GD	15							Stylet Oil	323 mL
W / G	16							Stylet Oil Abound 2.08F	161 mL 11 mL
OC	17							Procure 50WS	5.5 mL
OD	18			Chile Sulfur	56 g				
W / O	19							Rally	5.4 g
YC	20							Rally	5.4 g
W / Y	21							Rally	5.4 g
YBKC	22							Rally	5.4 g
YBKD	23								
Y /BK	24								
PC	25								
BBKD	26			Nutrol Latron B-1956	140 g 5 mL				
L	27			Nutrol Sulfur 80DF Latron B-1956	98 g 21 g 5 mL				
Y	28					Nutrol Latron B-1956	140 g 5.0 mL		
W / B	29								
R	30			Water Latron B-1956	5 mL				
BC	31								

Date App.# Stage Vol/trt Color	Trt#	22 Jul F BBCH 81 4.25 gal	FP/trt	24 Jul F BBCH 81 4.25 gal	FP/trt	25 Jul F BBCH 83 4.25 gal	FP/trt
W	1	-----		-----		-----	
B	2						
G	3			Champ 2F	29.2 mL		
P	4						
BKC	5	Rally 40W	3.5 g				
GBKC	6					Elite 45WP	3.5 g
GBKD	7						
OBKD	8			Cuprofix 20	56 g		
O / BK	9			TD -2463	28 g		
BD	10			TD-2463 Silwet L-77	28 g 5 mL		
O	11			Sulfur 80DF	56 g		
PU	12			Sulfur 80DF	56 g		
BKD	13			Pristine Latron B-1956	9.2 g 3.7 mL		
W /BK	14						
GD	15						
W / G	16						
OC	17						
OD	18			Chile Sulfur	56 g		
W / O	19						
YC	20						
W / Y	21						
YBKC	22						
YBKD	23	Elite 45WP	3.5 g				
Y /BK	24	KWG 4168	16.4 mL				
PC	25	Nutrol Latron B-1956	140 g 5.0 mL				
BBKD	26			Sulfur 80DF	70 g		
L	27			Nutrol Sulfur 80DF Latron B-1956	98 g 21 g 5 mL		
Y	28						
W / B	29	Flint 50WG	1.3 g				
R	30			Water Latron B-1956	5 mL		
BC	31						

Calendar of events

Date	Activity
27 Mar	Deflag old plots; BBCH-13 stage.
3 Apr 03	KD, EE; Flag rows; BBCH-15 stage
4 Apr	"A1";KD, EE; most treatments. 10:30AM-3:30PM, partly cloudy, 60F, westerly wind 5-20 mph, 4.25 gal/trt at 200 psi with #5 ceramic nozzle. Shoots 6"-8"
7 Apr	KD, EE; Finished "A1" spray (trtmts 8-10, 28-31), 4:00PM-5:30PM, clear, 65F, calm, shoots 6"-10"
14 Apr	'A2'; KD, EE; 10:00AM-3:00PM, 62-65F, 5-10 mph west breeze, PC-overcast, BBCH 1-5, 8"-14" shoots
16 Apr	Finish 'A2'; EE; 8:00AM-8:30AM, 58F, calm, overcast, BBCH 1-5, 8"-14" shoots
23 Apr	Grower-applied sulfur dust to new guard rows 26, 27; flagged Trial 2
24 Apr	Rain; postpone spraying
25 Apr	'A3' (most trtmts); KD, EE; 7:30AM-11-30AM, 55-60F, 0-15mph south wind, overcast, 10"-14" shoots; Sulfur 80DF on guard rows 14, 15
28 Apr	Rain; postponed spraying
29 Apr	'A3' finish; KD, EE; 10:15-11:00AM; 60F, 0-10 mph SSE breeze; partly overcast, shoots 10"-14", sprinkles began at 11:40AM
5 May	'A4'; KD, EE; 9:45-1:45PM; 55-64F, calm to 8 mph west breeze; overcast to clear; BBCH 57; incl. rows 14-15, finish row 27
13 May	'B'; KD, EE; 8:30-10:00AM; 64-70F; clear, calm; BBCH 57
16 May	'B'; KD, EE; 7:00-10:00AM; 62-74F; clear, calm to slight N breeze; BBCH 57-61
20 May	'B'; EE; 7:00-7:30AM; 62F; clear; calm ;BBCH 61
23 May	'C'; KD, EE; 7:15-10:45AM; 64-84F; clear, calm; BBCH 61-69 (avg 66)
27 May	'C'; KD, EE; 10:00-11:15AM; 80-86F; clear, 3-8mph N breeze; BBCH 69-71
30 May	'C'; KD, EE; 7:00-10:00AM; 60-72F; overcast, 5mph W breeze to calm; BBCH 69
3 Jun	'D'; KD, EE; 12:15-1:00PM; 80-84F; clear, 8 mph W breeze; BBCH 71
5 Jun	'D'; KD, EE; 6:30AM-12:30PM; 60-76F; clear 5-10 mph W wind; BBCH 71
10 Jun	'D'; EE; 11:30AM-1:45PM; 72-75F; clear, 5-10 mph W wind; BBCH 71-73
12 Jun	'D'; EE, BE;1:15-2:15PM; 75F; clear, 5-10 mph SW breeze; BBCH 71-73
13 Jun	KD, EE; 9:15-11:15AM; 68-74F; clear, 5-10 mph SW breeze; BBCH 73-77 (mostly 73)
16 Jun	KD;
19 Jun	'E'; KD, EE; 7:45-11:15AM; 60-66F; clear, 10-15 mph W wind; BBCH 75-79 (mostly 77)
23 Jun	'F'; KD, EE; 10:30-11:30AM; 70F; clear, 5-10 mph NW breeze; BBCH 77-79; sprayed all skipped vines w/ 2% Stylet Oil + Flint (1.5 oz/A)
24 Jun	'F'; KD, EE; 8:30-9:45AM; 70-72F; clear, 5-10 mph N wind; BBCH 77-79
26 Jun	'F'; EE, PO; 8:30-11:00AM; 75-80F; clear, calm; BBCH 79
27 Jun	'F'; KD, EE; 8:15-10:00AM; 72-76F; clear, calm; BBCH 79
1 Jul	'F'; EE; 6:45-7:00AM; 58F; clear, 5 mph S breeze; BBCH 79
3 Jul	'F'; EE, PO; 7:15AM-12:15PM; 65-80F; clear, calm to 10mph breeze; BBCH 79
8 Jul	'F'; EE, PO; 6:45-7:30AM; 64-66F; clear, 5-10 mph W wind; BBCH 79
10 Jul	'F'; EE, PO; 7:30-7:45AM; 62F; clear, calm; BBCH 79
11 Jul	'F'; EE, KD; 7:45-8:15AM; 64F; clear, calm; BBCH 79
14 Jul	'F'; EE, PO; 7:30-9:30AM; 65-74F; clear, calm; BBCH 79
15 Jul	'F'; EE; 8:30-8:45AM; 68F; clear, 5-10 mph W breeze; BBCH 79
17 Jul	'F'; EE, PO; 10:00AM-1:45PM; 72-90F; clear, calm-5mph W breeze; BBCH 79
22 Jul	'F'; EE; 7:15-8:15AM; 68F; partial high clouds, calm-slight W breeze; BBCH 81-83
24 Jul	'F'; EE, PO; 7:45-10:15AM; 68-74F; overcast-high clouds; calm-5 mph W breeze; BBCH 81-83
25 Jul	'F'; EE, PO; 7:15-7:30AM; 65F; clear 5 mph W breeze; BBCH 83
29 Jul	Lab rate all plots; 7.5 brix
28-29 Aug	EE; crop drop: Y/BK, GBKD (KWG 4168, Spiroxamine)
9 Sep	EE; map bad vines for next season; remove flagging tape

Results and discussion

The trial was conducted in a 26 year old commercial Chardonnay vineyard, planted on 7' x 12' spacing and trained to a 2-wire T-trellis. Plots were 4 adjacent vines, arranged in a randomized complete block with 4 replications. Treatments were applied in 150 gallons water per acre by high pressure hand gun (Rears Nifty Fifty) at 200 p.s.i. Deposition was mainly on the cluster zone. Treatments started at 6 inch shoot growth on 4 Apr, and continued to veraison on 25 Jul. Applications were made on 10 to 28 day intervals as listed in the table. Plots were evaluated for disease on 29 Jul, at 7.5 brix fruit soluble sugars. Disease evaluation was made by estimating powdery mildew severity on 40 fruit clusters per replication. Results were analyzed by ANOVA at $p \leq 0.05$ and treatments separated with Fisher's LSD t test at $p \leq 0.05$ (SAS Institute).

Powdery mildew on basal leaves (most severely infected) from untreated plots rose consistently from 4% surface coverage on 25 Apr to 83% on 3 Jun. Fruit clusters from untreated plots had 98% of berries infected by 19 Jun. The powdery mildew risk index (0-100 scale) increased consistently beginning 14 May and was near 100 from 19 May to 26 Jun. Disease pressure was considered very high for the season. Pristine (BAS516), a strobilurin containing compound, applied on 21 to 28 day intervals (the higher interval was used at the end of the season during a period of low risk index) resulted in less than ½% infected berries, significantly lower fruit disease than treatments with other strobilurin (Flint, Abound) or DMI (Rally, Procure) fungicides on 14 day intervals. California registration of Pristine is expected by BASF Corp. sometime in 2004.

Trial 1 treatment results- Systemic fungicides

#	Color	Materials, rate/A	Applications	Severity (%)		Incidence (%)	
14	W/BK	Sulfur 80DF, 4 lb, 7-10d Pristine 38WG, 10.5 oz + Latron, 4.1 foz, 21-28d	ABCDE FGH	0.3	f	12.5	f
13	BKD	Sulfur 80DF, 4 lb, 7-10d Pristine 38WG, 10.5 oz + Latron, 4.1 foz, 21d	ABCDE FGHI	0.4	f	16.3	f
29	W/B	Sulfur 80DF, 4 lb, 7-10d Flint 50WG, 1.5 oz, 14d	A BCDEFGHI	1.8	e	51.9	e
24	Y/BK	KWG 4168 300SC, 18.0 foz, 14d Flint 50WG, 1.5 oz, 14d	ACDEFGHI B	4.4	d	69.4	cde
11	O	Sulfur 80DF, 4 lb, 7-10d Flint 50WG, 2 oz, 14d Elevate 50WG, 1lb + Flint 50WG, 1.5 oz, 14d	ABCDHIJK E FG	4.8	d	67.5	de
23	YBKD	Flint 50WG, 1.5 oz, 10d Elite 45DF, 4 oz, 14d	A BCDEFGHI	5.2	cd	77.5	bcd
6	GBKC	Sulfur 80DF, 4 lb, 7-10d Flint 50WG, 1.5 oz, 14d Elite 45DF, 4 oz, 14d	ABCD EGI FHJ	5.8	cd	86.3	abcd
17	OC	Sulfur 80DF, 4 lb, 7-10d Procure 50WS, 6.0 oz, 14d	ABCDE FGHIJ	6.5	cd	77.5	bcd
7	GBKD	Sulfur 80DF, 4 lb, 7-10d KWG 4168 300SC, 18.0 foz, 14d Flint 50WG, 1.5 oz, 14d Elite 45DF, 4 oz, 14d	ABCD EG FI H	8.5	bcd	89.4	abc
2	B	Sulfur 80DF, 4 lb, 7-10d Abound 2.08F, 15.4 foz, 14d	ABCDE FGHIJ	11.2	bc	88.8	abc
5	BKC	Sulfur 80DF, 4 lb, 7-10d Rally 40W, 4 oz, 14d	A BCDEFGHI	15.5	b	93.8	ab
12	PU	Sulfur 80DF, 4 lb7-10d Rally 40W, 4 oz, 14d Elevate 50WG, 1 lb + Rally 40W, 3.0 oz, 14d	ABCDHIJK E FG	18.8	b	91.3	ab
1	W	Untreated		98.9	a	100.0	a

Note: Applications are listed in alphabetical sequence, and each letter corresponds to one application. Severity values were arcsin transformed prior to statistical analysis due to heterogeneity of variance; values shown are back-transformed. Values in a column followed by the same letter are not significantly different according to Fisher's LSD t test, P=0.05.

Trial 1 treatment results- Contact fungicides

#	Color	Treatment materials, rate/A	Application	Severity (%)		Incidence (%)	
16	W/G	Stylet Oil, 1%, 10-14d Stylet Oil, 1% + Abound 2.08F, 12foz,10-14d	ABCD EFGHIJ	0.6	f	21.4	e
27	L	Nutrol, 7lb + Sulfur 80DF, 1.5lb, 7-10d Nutrol, 7lb + Latron, 4foz + Sulfur 80DF, 1.5lb, 7-10d	ABCD E-N	2.9	e	57.5	d
10	BD	Microthiol Special, 2lb, 7-10d TD-2463, 2lb + Microthiol Disperss, 3lb + Silwet, 4foz, 7-10d TD-2463, 2lb + Silwet L-77, 4foz, 7-10d	A BCDEFG HIJKLMN	4.0	de	65.6	cd
3	G	Champ 2F, 2pt + Micro Sulf, 5lb, 7-10d Champ 2F, 2pt, 10-14d	ABCDEFG HIJKL	6.5	cde	74.4	bcd
15	GD	Stylet Oil, 1%, 10-14d Stylet Oil, 2%, 10-14d	ABCD EFGHIJ	6.6	cde	75.0	bcd
26	BBKD	Nutrol, 10lb, 7-10d Nutrol, 10lb + Latron B-1956, 4foz, 7-10d Sulfur 80DF, 5lb, 7-10d	AC EGIKM BDFHJLN	9.0	bcd	81.9	abc
21	W/Y	Kocide 101. 2lb + Sulfur 80DF, 5lb, 7-10d Rally 40W, 4oz, 14d Rally 40W, 6oz, 14d	ABCDEFG H IJK	10.4	bcd	88.8	ab
20	YC	Kocide 2000, 3lb + Sulfur 80DF, 5lb, 7-10d Rally 40W, 4lb, 14d Rally 40W, 6oz, 14d	ABCDEFG H IJK	10.8	bc	84.4	abc
2	B	Sulfur 80DF, 4 lb, 7-10d Abound 2.08F, 15.4 foz, 14d	ABCDE FGHIJ	11.2	bc	88.8	ab
9	O/BK	Microthiol Special, 2lb, 7-10d TD-2463, 2lb + Microthiol Disperss, 3lb, 7-10d TD-2463, 2lb, 7-10d	A BCDEFG HIJKLMN	11.8	bc	95.6	a
25	PC	Nutrol, 10lb, 14d Nutrol, 10lb + Latron, 4foz, 14d Rally 40W, 4oz, 14d	AC EGI BDFH	11.8	bc	86.9	ab
19	W/O	Kocide 2000, 1.5lb + Sulfur 80DF, 5lb, 7-10d Rally 40W, 4oz, 14d Rally 40W, 6oz, 14d	ABCDEFG H IJK	12.0	bc	85.0	abc
28	Y	Sulfur 80DF, 4lb, 10d Nutrol, 10lb + Latron, 4foz, 7-14d Rally 40W, 4oz, 14d	A BDFHJ CEGI	12.1	bc	86.3	ab
4	P	Champ 2F, 2pt + Micro Sulf, 5lb, 7-10d Rally 40W, 4oz, 14d	ABCDEFG HIJK	12.3	bc	93.1	ab
18	OD	Sulfur 80DF, 4lb, 7-10d Chilean Sulfur, 4lb, 7-10d	ABCDE FGHIJKLMN	13.6	bc	91.3	ab
8	OBKD	Microthiol Special, 4lb, 7-10d Cuprofix Disperss 20, 4lb + Microthiol Disperss, 3lb, 7-10d Cuprofix Disperss 20, 4lb, 7-10d	A BCDEFG HIJKLMN	15.0	bc	92.5	ab
30	R	Latron B-1956, 4foz, 14d	A-N	16.5	bc	91.3	ab
22	YBKC	GX-569, .83lb + Sulfur 80DF, 5lb, 7-10d Rally 40W, 4oz, 14d Rally 40W, 6oz, 14d	ABCDEFG H IJK	18.5	b	95.0	a
1	W	Untreated		98.9	a	100.0	a

Note: Applications are listed in alphabetical sequence, and each letter corresponds to one application. Severity values were arcsin transformed prior to statistical analysis due to heterogeneity of variance; values shown are back-transformed. Values in a column followed by the same letter are not significantly different according to Fisher's LSD t test, P=0.05.

Cooperative Research Project, Doug Gubler, U.C. Davis Dept. of Plant Pathology

Trial name.....	Grape powdery mildew fungicide Trial 2, 2003
Location.....	Courtland, Sacramento Co. (Herzog Ranch)
Investigators	Doug Gubler, 530.752.0304; Ken Dell, Eugene Erickson 752.4982
Cooperators	John Baranek, Tom Herzog
Crop.....	Grape 'Chardonnay'
Disease.....	Powdery mildew, *Uncinula necator*

Trial 2 layout and method

Objective	Efficacy of fungicides for control of powdery mildew		
Experimental design	Treatments are field applications to 4 vine plots, in a randomized complete block design, with 4 replications.		
Application method	high pressure hand gun sprayer		
Vine spacing	7'	Row spacing	12'
Treatment unit	4 vines	Treatment unit area.....	336 ft^2
Area/Treatment, sq ft...	1344	Area/Treatment, acre	0.0308539
Vol. Water/acre, gal.....	138	Vol. water/trt, gal.....	4.25
Apps timing	A=shoot growth, B = pre-bloom; C=bloom, D=berry set, E=preclose, F,G=veraison		
		Evaluation stage.....	1 week after final app.

Treatments protocol, Trial 2

#	Color	Sponsor	Materials	App code	Interval	FP/A		Tol
1	W	Lab	Untreated					Y
2	GD	Lab	Sulfur DF Abound 2.08F	A B-G	7-10d 14d	4.0 15.4	lb foz	Y
3	W / G	Emero USA	Sulfur DF Flint 50WG EM-1	A1-3 B C	7-10d 14d 7d	4.0 1.5 0.8	lb oz %	Y
4	B	Dow	Sulfur DF Quintec 250SC	A1-3 B-G	7-10d 14d	4.0 4.0	lb foz	N
5	Y / BK	Dow	Sulfur DF Quintec 250SC	A1-3 B-G	7-10d 21d	4.0 6.0	lb foz	N
6	P	Dow	Sulfur DF Rally 40W alt w/ Quintec 250SC	A1-3 BDF CEG	7-10d 14d 14d	4.0 4.0 4.0	lb oz foz	N
7	PU	Dow	Sulfur DF Rally 40W alt w/ Quintec 250SC	A1-3 BDF CEG	7-10d 21d 21d	4.0 5.0 6.0	lb oz foz	N
8	L	Dow	Sulfur DF Rally 40W Quintec 250SC Rally 40W Quintec 250SC	A1-3 B CD E FG	7-10d 14d 14d 14d 14d	4.0 4.0 4.0 4.0 4.0	lb oz foz oz foz	N
9	R	Dow	Sulfur DF Rally 40W Quintec 250SC Rally 40W Quintec 250SC	A1-3 B CD E FG	7-10d 21d 21d 21d 21d	4.0 4.0 6.0 5.0 6.0	lb oz foz oz foz	N
10	OD	Dow	Sulfur DF Quintec 250SC	A1-3 B-G	7-10d 14-21d	4.0 4.0	lb foz	N

11	O / BK	Dow	Sulfur DF Quintec 250SC	A1-3 B-G	7-10d 21-35d	4.0 5.0	lb foz	N
12	BKD	Gowan	Sulfur DF Sovran 50WG Rubigan 1EC+ Latron B-1956	A1-3 B C D EF	7-10d 14d RI 14d RI 14d RI 14d RI	4.0 3.2 3 4 6 5.5	lb oz foz foz foz foz	Y
13	W / BK	Gowan	Sulfur DF Sovran 50WG GWN-4350 + Latron B-1956	A1-3 B C D EFG	7-10d 14d RI 14d RI 14d RI 14d RI	4.0 3.2 4 5 7 5.5	lb oz foz foz foz foz	Y
14	BD	Gowan	Sulfur DF Sovran 50WG Rubigan 1EC + Latron B-1956	A1-3 B C-G	7-10d 14d RI 14d RI	4.0 3.2 3 5.5	lb oz foz foz	Y
15	BBKD	Gowan	Sulfur DF Sovran 50WG Rubigan 1EC + Latron B-1956	A1-3 BD C EFG	7-10d 14d RI 14d RI 14d RI	4.0 3.2 4 6 5.5	lb oz foz foz foz	Y
16	OC	Lab	Sulfur DF Sovran 50WG	A1-3 BC	7-10d 14d	4.0 3.2	lb oz	Y
17	YBKC	Lab	Sulfur DF Sovran 50WG	A1-3 B-D	7-10d 14d	4.0 3.2	lb oz	Y
18	OBKD	Lab	Sulfur DF Sovran 50WG	A1-3 B-E	7-10d 14d	4.0 3.2	lb oz	Y
19	W / B	Lab	Sulfur DF Sovran 50WG	A1-3 B-F	7-10d 14d	4.0 3.2	lb oz	Y
20	W / O	Lab	Sulfur DF Sovran 50WG	A1-3 B-G	7-10d 14d	4.0 3.2	lb oz	Y
21	YBKD	Canada	Sulfur DF Sovran Oil	A1,2 A3,BEF CDGH	7-10d 14d 7-10d	4.0 3.2 1.5	lb oz %	Y
22	BC, BC2a, BC4a	EMRO USA	Untreated EM-1	AB C-G	 7d	 0.8	 %	Y

Notes:

1. Tol indicates whether all products in the treatment have an EPA tolerance for grapes, and the crop can be harvested.
2. A slash '/' in a sequence of materials means 'followed by'.

Materials list

Sponsor	Product	Active Ingr.	Conc.	Tol.	Mfr
Lab	Sulfur 80DF	Sulfur	80%	Y	Wilbur-Ellis
	Abound 2.08F	Azoxystrobin	300 g/L	Y	Syngenta
	Flint 50WG	Trifloxystrobin	50%	Y	Bayer
	Elite 45DF	Tebuconazole	45%	Y	Bayer
Dow Agro	Sulfur 80DF	Sulfur	80%	Y	Wilbur-Ellis
	Quintec 250SC	Quinoxyfen	25 g/L	N	Dow Agro
	Abound 2.08F	Azoxystrobin	300 g/L	Y	Syngenta
Gowan	Sulfur 80DF	Sulfur	80%	Y	Wilbur-Ellis
	Rubigan 1EC	Fenarimol	l lb/gal	Y	Gowan
	GWN-4350			N	Gowan
Canada	Sulfur DF	Sulfur	80%	Y	Wilbur-Ellis
	Oil	Petroleum oil		N	Petro Canada
	Sovran 50WG	Kresoxim methyl	50%	Y	BASF
EMRO USA	EM-1	Biologicals			EMRO USA

Application schedule

Date App.# Stage Vol/trt Color	Trt#	4 Apr 03 A1 Pre-bloom 4.25 gal	FP/trt	15 Apr 03 A2 Pre-bloom 4.25 gal	FP/trt	29 Apr 03 A3 Pre-bloom 4.25 gal	FP/trt	8 May 03 A4 BBCH 57 4.25 gal	FP/trt
W	1	-----		-----		-----		----	
GD	2	Sulfur dust Sulfur DF	 56 g	Sulfur dust Sulfur DF	 56 g	Sulfur DF	56 g	Sulfur DF	56 g
W / G	3	Sulfur dust Sulfur DF	 56 g	Sulfur dust Sulfur DF	 56 g	Sulfur DF	56 g	Sulfur DF	56 g
B	4	Sulfur dust Sulfur DF	 56 g	Sulfur dust Sulfur DF	 56 g	Sulfur DF	56 g	Sulfur DF	56 g
Y /BK	5	Sulfur dust Sulfur DF	 56 g	Sulfur dust Sulfur DF	 56 g	Sulfur DF	56 g	Sulfur DF	56 g
P	6	Sulfur dust Sulfur DF	 56 g	Sulfur dust Sulfur DF	 56 g	Sulfur DF	56 g	Sulfur DF	56 g
PU	7	Sulfur dust Sulfur DF	 56 g	Sulfur dust Sulfur DF	 56 g	Sulfur DF	56 g	Sulfur DF	56 g
L	8	Sulfur dust Sulfur DF	 56 g	Sulfur dust Sulfur DF	 56 g	Sulfur DF	56 g	Sulfur DF	56 g
R	9	Sulfur dust Sulfur DF	 56 g	Sulfur dust Sulfur DF	 56 g	Sulfur DF	56 g	Sulfur DF	56 g
OD	10	Sulfur dust Sulfur DF	 56 g	Sulfur dust Sulfur DF	 56 g	Sulfur DF	56 g	Sulfur DF	56 g
O /BK	11	Sulfur dust Sulfur DF	 56 g	Sulfur dust Sulfur DF	 56 g	Sulfur DF	56 g	Sulfur DF	56 g
BKD	12	Sulfur dust Sulfur DF	 56 g	Sulfur dust Sulfur DF	 56 g	Sulfur DF	56 g	Sulfur DF	56 g
W /BK	13	Sulfur dust Sulfur DF	 56 g	Sulfur dust Sulfur DF	 56 g	Sulfur DF	56 g	Sulfur DF	56 g
BD	14	Sulfur dust Sulfur DF	 56 g	Sulfur dust Sulfur DF	 56 g	Sulfur DF	56 g	Sulfur DF	56 g

BBKD	15	Sulfur dust Sulfur DF	 56 g	Sulfur dust Sulfur DF	 56 g	Sulfur DF	56 g	Sulfur DF	56 g
OC	16	Sulfur dust Sulfur DF	 56 g	Sulfur dust Sulfur DF	 56 g	Sulfur DF	56 g	Sulfur DF	56 g
YBKC	17	Sulfur dust Sulfur DF	 56 g	Sulfur dust Sulfur DF	 56 g	Sulfur DF	56 g	Sulfur DF	56 g
OBKD	18	Sulfur dust Sulfur DF	 56 g	Sulfur dust Sulfur DF	 56 g	Sulfur DF	56 g	Sulfur DF	56 g
W / B	19	Sulfur dust Sulfur DF	 56 g	Sulfur dust Sulfur DF	 56 g	Sulfur DF	56 g	Sulfur DF	56 g
W / O	20	Sulfur dust Sulfur DF	 56 g	Sulfur dust Sulfur DF	 56 g	Sulfur DF	56 g	Sulfur DF	56 g
YBKD	21	Sulfur dust Sulfur DF	 56 g	Sulfur dust Sulfur DF	 56 g	Sovran 50WG	2.8 g		
BC	22	Sulfur dust Sulfur DF	 56 g	Sulfur dust Sulfur DF	 56 g	-----		-----	

Date App.# Stage Vol/trt Color	Trt#	13 May 03 B BBCH 57 4.25 gal	FP/trt	16 May 03 B BBCH 57-61 4.25 gal	FP/trt	23 May 03 C BBCH 67 4.25 gal	FP/trt	30 May 03 C BBCH 69 4.25 gal	FP/trt
W	1	----		-----		----		-----	
GD	2			Abound 2.08F	15 mL			Abound 2.08F	15 mL
W / G	3			Flint 50WG	1.3 g			EM-1	128 mL
B	4			Quintec 250SC	3.7 mL			Quintec 250SC	3.7 mL
Y /BK	5			Quintec 250SC	5.5 mL				
P	6			Rally 40W	3.5 g			Quintec 250SC	3.7 mL
PU	7			Rally 40W	4.3 g				
L	8			Rally 40W	3.5			Quintec 250SC	3.7 mL
R	9			Rally 40W	3.5				
OD	10			Quintec 250SC	3.7 mL			Quintec 250SC	3.7 mL
O /BK	11			Quintec 250SC	4.6 mL				
BKD	12			Sovran 50WG	2.8 g			Rubigan 1EC + Latron B-1956	3.0 g 5.0 mL
W /BK	13			Sovran 50WG	2.8 g			GWN-4350 + Latron B-1956	3.9 mL 5.0 mL
BD	14			Sovran 50WG	2.8 g			Rubigan 1EC + Latron B-1956	3.0 g 5.0 mL
BBKD	15			Sovran 50WG	2.8 g			Rubigan 1EC + Latron B-1956	3.9 g 5.0 mL
OC	16			Sovran 50WG	2.8 g			Sovran 50WG	2.8 g
YBKC	17			Sovran 50WG	2.8 g			Sovran 50WG	2.8 g
OBKD	18			Sovran 50WG	2.8 g			Sovran 50WG	2.8 g
W / B	19			Sovran 50WG	2.8 g			Sovran 50WG	2.8 g
W / O	20			Sovran 50WG	2.8 g			Sovran 50WG	2.8 g
YBKD	21	Sovran 50WG	2.8 g			Canada Oil	242 mL		
BC	22	-----		-----				EM-1	128 mL

Date App.# Stage Vol/trt Color	Trt#	3 Jun 03 D BBCH 71 4.25	FP/trt	5 Jun 03 D BBCH 71 4.25 gal	FP/trt	10 Jun 03 D BBCH 71-73 4.25 gal	FP/trt	12 Jun 03 D BBCH 71-73 4.25 gal	FP/trt
W	1	----		----		----		----	
GD	2								
W / G	3			EM-1	128 mL			EM-1	128 mL
B	4								
Y /BK	5			Quintec 250SC	5.5 mL				
P	6								
PU	7			Quintec 250SC	5.5 mL				
L	8								
R	9			Quintec 250SC	5.5 mL				
OD	10								
O /BK	11			Quintec 250SC	4.6 mL				
BKD	12								
W /BK	13								
BD	14								
BBKD	15								
OC	16								
YBKC	17								
OBKD	18								
W / B	19								
W / O	20								
YBKD	21	Canada Oil	242 mL			Sovran 50WG	2.8 g		
BC	22			EM-1	128 mL			EM-1	128 mL

Date App.# Stage Vol/trt Color	Trt#	13 Jun BBCH 73-75 4.25 gal	FP/trt	19 Jun BBCH 77 4.25 gal	FP/trt	24 Jun BBCH 77-79 4.25 gal	FP/trt	26 Jun BBCH 79 4.25 gal	FP/trt
W	1	----		----		----		----	
GD	2	Abound 2.08F	15 mL						
W / G	3			EM-1	128 mL			EM-1	128 mL
B	4	Quintec 250SC	3.7 mL						
Y /BK	5							Quintec 250SC	5.5 mL
P	6	Rally 40W	3.5 g						
PU	7							Rally 40W	4.3 g
L	8	Quintec 250SC	3.7 mL						
R	9							Quintec 250SC	5.5 mL
OD	10	Quintec 250SC	3.7 mL						
O /BK	11							Quintec 250SC	4.6 mL
BKD	12	Rubigan 1EC Latron B-1956	3.9 mL 5.0 mL						
W /BK	13	GWN-4350 Latron B-1956	4.9 mL 5.0 mL						
BD	14	Rubigan 1EC + Latron B-1956	3.0 mL 5.0 mL						
BBKD	15	Sovran 50WG	2.8 g						
OC	16								
YBKC	17	Sovran 50WG	2.8 g						
OBKD	18	Sovran 50WG	2.8 g						
W / B	19	Sovran 50WG	2.8 g						
W / O	20	Sovran 50WG	2.8 g						
YBKD	21					Sovran 50WG	2.8 g		
BC	22			EM-1	128 mL			EM-1	128 mL

Date App.# Stage Vol/trt Color	Trt#	27 Jun F BBCH 79 4.25 gal	FP/trt	3 Jul F BBCH 79 4.25 gal	FP/trt	8 Jul F BBCH 79 4.25 gal	FP/trt	10 Jul F BBCH 79 4.25 gal	FP/trt
W	1	----		----		----		----	
GD	2	Abound 2.08F	15 mL						
W / G	3			EM-1	128 mL			EM-1	128 mL
B	4	Quintec 250SC	3.7 mL						
Y /BK	5								
P	6	Quintec 250SC	3.7 mL						
PU	7								
L	8	Rally 40W	3.5 g						
R	9								
OD	10	Quintec 250SC	3.7 mL						
O /BK	11								
BKD	12	Rubigan 1EC Latron B-1956	5.5 mL 5.0 mL						
W /BK	13	GWN-4350 Latron B-1956	6.4 mL 5.0 mL						
BD	14	Rubigan 1EC Latron B-1956	2.7 mL 5.0 mL						
BBKD	15	Rubigan 1EC Latron B-1956	5.5 mL 5.0 mL						
OC	16								
YBKC	17								
OBKD	18	Sovran 50WG	2.8 g						
W / B	19	Sovran 50WG	2.8 g						
W / O	20	Sovran 50WG	2.8 g						
YBKD	21					Canada Oil	242 mL		
BC	22			EM-1	128 mL			EM-1	128 mL

Date App.# Stage Vol/trt Color	Trt#	11 Jul F BBCH 79 4.25 gal	FP/trt	15 Jul F BBCH 79 4.25 gal	FP/trt	17 Jul F BBCH 81 4.25 gal	FP/trt	18 Jul F BBCH 81 4.25 gal	FP/trt
W	1	----		----		----		----	
GD	2	Abound 2.08F	15 mL						
W / G	3					EM-1	128 mL		
B	4	Quintec 250SC	3.7 mL						
Y /BK	5					Quintec 250SC	5.5 mL		
P	6	Rally 40W	3.5 g						
PU	7					Quintec 250SC	5.5 mL		
L	8	Quintec 250SC	3.7 mL						
R	9					Rally 40W	4.3 g		
OD	10							Quintec 250SC	3.7 mL
O /BK	11								
BKD	12			Rubigan 1EC Latron B-1956	5.5 mL 5.0 mL				
W /BK	13			GWN-4350 Latron B-1956	6.4 mL 5.0 mL				
BD	14			Rubigan 1EC Latron B-1956	2.7 mL 5.0 mL				
BBKD	15			Rubigan 1EC Latron B-1956	5.5 mL 5.0 mL				
OC	16								
YBKC	17								
OBKD	18								
W / B	19	Sovran 50WG	2.8 g						
W / O	20	Sovran 50WG	2.8 g						
YBKD	21							Canada Oil	242 mL
BC	22					EM-1	128 mL		

Date App.# Stage Vol/trt Color	Trt#	24 Jul F BBCH 81 4.25 gal	FP/trt	25 Jul F BBCH 83 4.25 gal	FP/trt
W	1	----		----	
GD	2			Abound 2.08F	15 mL
W / G	3	EM-1	128 mL		
B	4			Quintec 250SC	3.7 mL
Y /BK	5				
P	6			Quintec 250SC	3.7 mL
PU	7				
L	8			Quintec 250SC	3.7 mL
R	9				
OD	10				
O /BK	11	Quintec 250SC	4.6 ml		
BKD	12				
W /BK	13				
BD	14				
BBKD	15				
OC	16				
YBKC	17				
OBKD	18				
W / B	19				
W / O	20			Sovran 50WG	2.8 g
YBKD	21			Sovran 50WG	2.8 g
BC	22	EM-1	128 mL		

Calendar of events

Date	Activity
	Sulfur dust applied by grower on rows 24, 25
4 Apr 03	KD,EE; sulfur rows 22,23; 4:00-5:30PM, clear, 65F, calm, shoots 6”-10”, 4.25gal/trt at 200 psi with #5 ceramic nozzle.
	Sulfur dust applied by grower on rows 24, 25
14 Apr	KD, EE; sulfur rows 22, 23; 10:00AM-3:00PM, 62-65F, 5-10 mph west breeze, PC-overcast, BBCH 1-5, 8”-14” shoots, same spray parameters as previous
15 Apr	KD, EE; sulfur rows 24, 25; 10AM-12N, 62F, 5-15 mph westerly breeze, BBCH 1-5, 8”-14” shoots
23 Apr	Grower-applied sulfur dust to new guard rows #26, 27; flagged Trial 2
24 Apr	Rain; postponed spraying
28 Apr	Rain; postponed spraying
29 Apr	‘A3’; KD, EE; 7:30-10:15AM; 55-60F, 0-10 mph south breeze; partly overcast, shoot 10”-14”, sprinkles began at 11:40AM; sulfur guard rows 26, 27 except NE half of row 27
8 May	‘A4’; KD, EE; 7:30-10:00AM; 50-55F, 0-5 mph west breeze; overcast; BBCH 57
13 May	‘B’; KD, EE; 10:00-10:15AM; 70F, calm to 5 mph north breeze; clear; BBCH 57
16 May	‘B’; KD, EE; 10:00AM-12:30PM; 70-74F; calm to 5 mph N breeze; clear to high clouds; BBCH 57-61
20 May	‘C’; KD, EE; 10:45-11:00 AM; 80F; clear, slight W breeze; BBCH 61-69 (avg 67)
30 May	‘C’; KD, EE; 10:00-12:00; 68-72F; overcast, calm; BBCH 69 avg
3 Jun	‘D’; KD, EE; 1:00-1:15PM; 84F; clear, 8 mph W breeze; BBCH 71
5 Jun	‘D’; KD, EE; 8:00AM-12:00N; 66-74F; clear, 5-10 mph W breeze; BBCH 71
10 Jun	‘D’; EE; 1:45-2:00PM; 75F; clear, 5-10 mph W wind; BBCH 71-73
12 Jun	‘D’ EE, BE; 12:45-1:15PM; 75F; clear, 5-10 mph W wind; BBCH 71-73
13 Jun	KD, EE; 7:30-9:15AM; 62-74F; clear, 5-10 mph SW breeze; BBCH 73-77 (mostly 73-75)
19 Jun	KD, EE; 9:15-9:30AM; 66F; clear, 10-15 mph W wind; BBCH 75-79 (mostly 77)
23 Jun	‘F’; KD, EE; 11:30AM-12:30PM; 70F; clear, 5-10 mph NW breeze; BBCH 77-79; sprayed all skipped vines w/ 2% Stylet Oil + Flint (1.5 oz/A)
24 Jun	‘F’; KD, EE; 9:45-10:00AM; 70F; clear, 5-10 mph N wind; BBCH 77-79
26 Jun	‘F’; EE, JO; 7:00-8:30AM; 68-70F; clear, calm; BBCH 79
27 Jun	‘F’; KD, EE; 7:15-8:15AM; 68-72F; clear, calm; BBCH 79
3 Jul	‘F’; EE, PO; 6:30-6:45AM; 65F; clear, calm; BBCH 79
8 Jul	‘F’; EE, PO; 7:30-7:45AM; 66F; clear, 5-10 mph W wind; BBCH 79
10 Jul	‘F’; EE, PO; 7:15-7:30AM; 64F, clear, calm; BBCH 79
11 Jul	‘F’; EE, KD; 8:15-9:00AM; 64-68F; clear, calm; BBCH 79
15 Jul	‘F’; EE; 8:45-9:30AM; 68F; clear, 5-10mph breeze; BBCH 79
17 Jul	‘F’; EE, PO; 10:00AM-1:00PM; 72-90F; clear, calm-5 mph W breeze; BBCH 81
18 Jul	‘F’; EE; 7:30-8:00AM; 68F; clear, calm; BBCH 81
24 Jul	‘F’; EE, PO; 7:15-7:45AM; 68F; overcast; BBCH 81-83
25 Jul	‘F’; EE, PO; 7:30-8:30AM; 66-68F; clear BBCH 83
29 Jul	Lab rate; 7.5 brix
28-29 Aug	EE; crop drop: B, P, L, R, PU, OD, Y/BK, O/BK (Quintec)
9 Sep	EE; map bad vines for next season; remove flagging tape

Trial 2 treatment results- full season applications

#	Color	Materials	Application	Severity (%)		Incidence (%)	
10	OD	Sulfur DF, 4 lb Quintec 250SC, 4 foz	ABCD EFGHI	0.6	h	30.0	h
4	B	Sulfur DF, 4 lb Quintec 250SC, 4 foz	ABCD EFGHIJ	0.7	h	31.3	h
5	Y/BK	Sulfur DF, 4 lb Quintec 250SC, 6 foz	ABCD EFGH	0.9	gh	39.4	gh
6	P	Sulfur DF, 4 lb Rally 40W, 4 foz Quintec 250SC, 4 foz	ABCD EGI FH	1.8	fgh	61.3	ef
20	W/O	Sulfur DF, 4 lb Sovran 50WG, 3.2 oz	ABCD EFGHIJ	1.8	fgh	57.5	fg
11	O/BK	Sulfur DF, 4 lb Quintec 250SC, 5 foz	ABCD EFGH	2.4	efg	70.0	def
8	L	Sulfur DF, 4 lb Rally 40W, 4 oz Quintec 250SC, 4 foz	ABCD EH FGIJ	3.4	def	70.6	cdef
2	GD	Sulfur DF, 4 lb Abound 2.08F, 15.4 foz	ABCD EFGHIJ	4.3	cdef	81.9	abcd
13	W/BK	Sulfur DF, 4 lb Sovran 50WG, 3.2 oz GWN-4350, 4 foz + Latron, 5.5 foz	ABCD E FGHI	4.9	cde	82.5	abcd
14	BD	Sulfur DF, 4 lb Sovran 50WG, 3.2 oz Rubigan 1EC, 3 foz + Latron, 5.5 foz	ABCD E FGHI	5.2	cde	79.4	bcde
15	BBKD	Sulfur DF, 4 lb Sovran 50WG, 3.2 oz Rubigan 1EC, 4 foz + Latron, 5.5 foz	ABCD EG FH	5.4	cde	82.5	abcd
21	YBKD	Sulfur DF, 4 lb Sovran, 3.2 oz Oil, 1.5%	AB CDGHK EFIJ	5.7	cde	76.3	bcdef
9	R	Sulfur DF, 4 lb Rally 40W, 4 oz Quintec 250SC, 6 foz Rally 40W, 5 oz	ABCD E FG H	7.4	cd	89.4	abcd
12	BKD	Sulfur DF, 4 lb Sovran 50WG, 3.2 oz Rubigan 1EC, 3 foz + Latron, 5.5 foz	ABCD E FGHI	8.0	cd	91.9	ab
7	PU	Sulfur DF, 4 lb Rally 40W, 5 oz Quintec 250SC, 6 foz	ABCD EG FH	8.1	c	90.0	abc
3	W/G	Sulfur DF, 4 lb Flint 50WG, 1.5 oz EM-1, 0.8%	ABCD E FGHIJKLM	24.6	b	100	a
22	BC(a)	Sulfur DF, 4 lb Untreated EM-1, 0.8%	AB CD EFGHIJKLM	72.1	a	100	a
1	W	Untreated		93.2	a	100	a

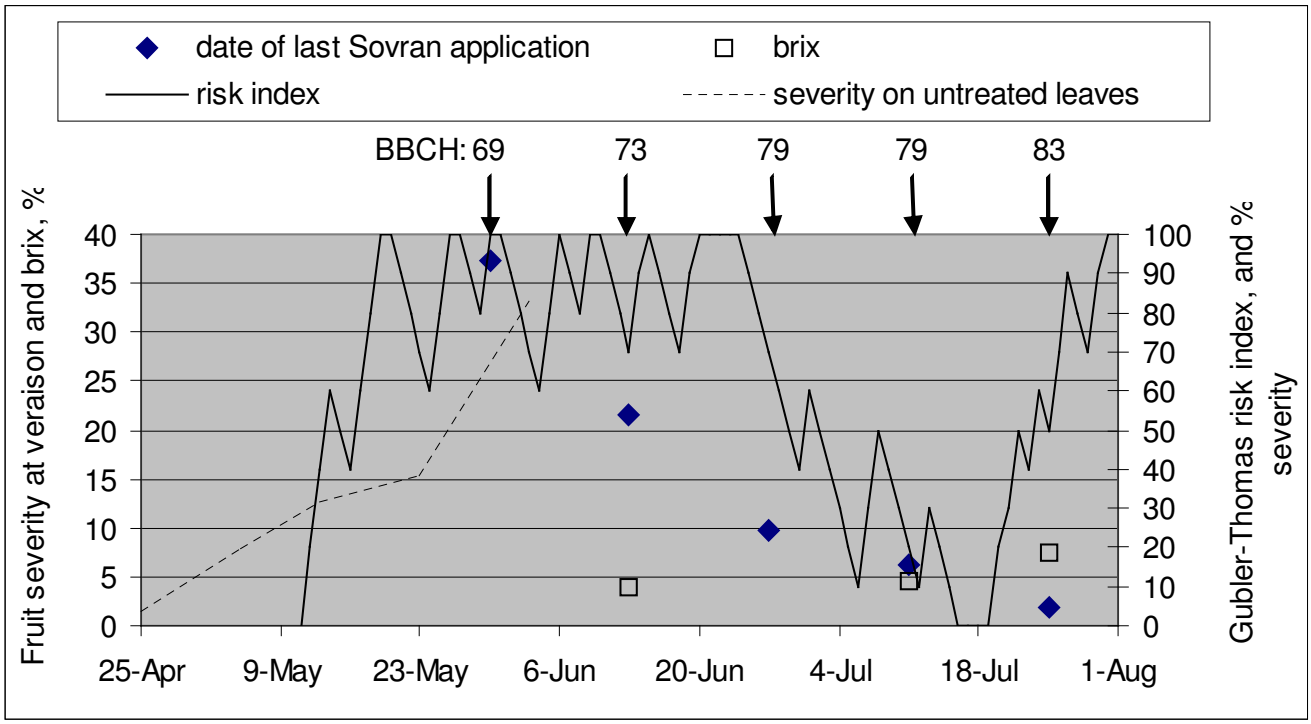
Note: Applications are listed in alphabetical sequence, and each letter corresponds to one application. Severity values were log(Y+1) transformed prior to statistical analysis due to heterogeneity of variance; values shown are back-transformed. Values in a column followed by the same letter are not significantly different according to Fisher's LSD t test, P=0.05.

Trial 2 treatment results- staggered cutoff applications

Note: Applications are listed in alphabetical sequence, and each letter corresponds to one application.

#	Color	Materials	Application	Severity (%)		Incidence (%)	
20	W/O	Sulfur DF, 4 lb Sovran 50WG, 3.2 oz	ABCD EFGHIJ	1.9	c	57.5	b
2	GD	Sulfur DF, 4 lb Abound 2.08F, 15.4 foz	ABCD EFGHIJ	4.6	c	81.9	a
19	W/B	Sulfur DF, 4 lb Sovran 50WG, 3.2 oz	ABCD EFGHI	6.2	c	80.0	a
18	OBKD	Sulfur DF, 4 lb Sovran 50WG, 3.2 oz	ABCD EFGH	9.8	c	80.6	a
17	YBKC	Sulfur DF, 4 lb Sovran 50WG, 3.2 oz	ABCD EFG	21.6	bc	88.8	a
16	OC	Sulfur DF, 4 lb Sovran 50WG, 3.2 oz	ABCD EF	37.3	b	100.0	a
1	W	Untreated		93.8	a	100.0	a

Figure 1. Powdery mildew relationship to duration of fungicide application.



BBCH scale: 69=end of flowering; 73=berries groat sized, bunches begin to hang; 75=berries pea size, bunches hang; 79=bunch close; 83=berries begin to brighten in color.

Cooperative Research Project, Doug Gubler, U.C. Davis Dept. of Plant Pathology

Trial name.....	Grape powdery mildew fungicide Trial 2003
Location.....	Courtland, Sacramento Co. (Herzog Ranch)
Investigators	Doug Gubler, 530.752.0304; Ken Dell, Eugene Erickson 752.4982
Cooperators	John Baranek, Tom Herzog
Crop.....	Grape 'Chardonnay'
Disease.....	Powdery mildew, *Uncinula necator*

Trial 3 layout and method

Objective	Efficacy of fungicides for control of powdery mildew		
Experimental design	Treatments are field applications to 4 vine plots, in a randomized complete block design, with 4 replications.		
Application method	high pressure hand gun sprayer		
Vine spacing	7'	Row spacing	12'
Treatment unit	4 vines	Treatment unit area.....	336 ft^2
Area/Treatment, sq ft...	1344	Area/Treatment, acre	0.0308539
Vol. Water/acre, gal.....	138	Vol. water/trt, gal.....	4.25
Apps timing	A=shoot growth, B = pre-bloom; C=bloom, D=berry set, E=preclose, F,G=veraison		
		Evaluation stage.....	1 week after final app.

Treatments protocol, Trial 3

#	Color	Sponsor	Materials	App code	Interval	FP/A		Tol
1	W	Syngenta	Untreated					Y
2	P	Syngenta	Sulfur dust Sulfur 80DF Vangard 75DF	A1,A2 A3-B C-G	7d 7-10d 14d	 4 10	 lb oz	Y Y
3	B	Syngenta	Sulfur dust Sulfur 80DF Elevate 50WG	A1,A2 A3-B C-G	7d 7-10d 14d	 4 1.5	 lb lb	Y Y
4	PU	Lab	Sulfur dust Sulfur 80DF Flint 50WG	A1,A2 A3-B C-G	7d 7-10d 14-17d	 4 1.5	 lb oz	Y Y

Notes:

1. Tol indicates whether all products in the treatment have an EPA tolerance for grapes, and the crop can be harvested.
2. A slash '/' in a sequence of materials means 'followed by'.

Materials list

Sponsor	Product	Active Ingr.	Conc.	Tol.	Mfr
Syngenta	Vangard 75DF	Cyprodinil	75%	Y	Syngenta
	Elevate 50WG	Fenhexamid	50%	Y	Arvesta
Lab	Flint 50WG	Trifloxystrobin	50%	Y	Bayer

Application schedule

Date App.# Stage Vol/trt Color	Trt#	7 Apr 03	FP/trt	14 Apr A1	FP/trt	23 Apr 03 A2 19, 55, 57 4.25 gal	FP/trt	29 Apr 03 A3 19, 55, 57 4.25 gal	FP/trt
W	1	-----		-----		-----			
P	2	Sulfur dust		Sulfur dust		Sulfur dust or Sulfur 80DF	66 g	Sulfur 80DF	66 g
B	3	Sulfur dust		Sulfur dust		Sulfur dust or Sulfur 80DF	66 g	Sulfur 80DF	66 g
PU	4	Sulfur dust		Sulfur dust		Sulfur dust or Sulfur 80DF	66 g	Sulfur 80DF	66 g

Date App.# Stage Vol/trt Color	Trt#	8 May 03 A4 BBCH 57 4.25 gal	FP/trt	16 May 03 B BBCH 57-61 4.25 gal	FP/trt	23 May 03 C BBCH 67 4.25 gal	FP/trt	5 Jun 03 D BBCH 71 4.25 gal	FP/trt
W	1	-----		-----		-----		-----	
P	2	Sulfur 80DF	66 g	Sulfur 80DF	66 g	Vangard 75DF	8.75 g	Vangard 75DF	8.75 g
B	3	Sulfur 80DF	66 g	Sulfur 80DF	66 g	Elevate 50WG	21 g	Elevate 50WG	21 g
PU	4	Sulfur 80DF	66 g	Sulfur 80DF	66 g	Flint 50WG	1.3 g	Flint 50WG	1.3 g

Date App.# Stage Vol/trt Color	Trt#	19 Jun 03 F BBCH 77 4.25 gal	FP/trt	3 Jul 03 F BBCH 79 4.25 gal	FP/trt	17 Jul 03 F BBCH 79 4.25 gal	FP/trt	21 Jul 03 F BBCH 81 4.25 gal	FP/trt
W	1	-----							
P	2	Vangard 75DF	8.75 g	Vangard 75DF	8.75 g	Vangard 75DF	8.75 g		
B	3	Elevate 50WG	21 g	Elevate 50WG	21 g	Elevate 50WG	21 g		
PU	4	Flint 50WG	1.3 g	Flint 50WG	1.3 g			Flint 50WG	1.3 g

Calendar of events

Date	Activity
twice	Grower-applied sulfur dust on rows 24-27
23 Apr	Grower-applied sulfur dust to new guard rows 26, 27
29 Apr	KD, EE;
8 May	KD, EE; 'A4' spray; 11:00-11:30; 55F; 0-10 mph west breeze; clear to P.C.; BBCH 57
16 May	KD, EE; 'B' spray; 7:00-7:20AM; 62F; calm; clear; BBCH 57-61
23 May	KD, EE; 'C' spray; 11:00-11:30AM; 82-84F; clear, calm to slight W breeze; BBCH 61-69 (avg 67)
5 Jun	KD, EE; 'D' spray; 9:00-9:30AM; 64-66F; clear, 5-10 mph W wind; BBCH 71
19 Jun	KD, EE; 'E' spray; 9:00-9:30AM; 62F; clear, 10 mph W wind; BBCH 75-79 (mostly 77)`
23 Jun	'F'; KD, EE; 10:00-10:30AM; 70F; clear, 5-10 mph NW breeze; BBCH 78; sprayed all skipped vines w/ 2% Stylet Oil + Flint (1.5 oz/A)
3 Jul	'F'; EE, PO; 7:00-7:30AM; 65F; clear, calm, BBCH 79
17 Jul	'F'; EE, PO; 12:30-12:50PM; 90F; clear, calm; BBCH 79
21 Jul	'F'; EE; 11:15-11:30AM; 90F; clear, calm; BBCH 81
29 Jul	Lab rate; 7.5 brix
9 Sep	EE; map bad vines for next season; remove flagging tape

Trial 3 treatment results

#	Color	Materials, rate/A	Applications	Severity (%)		Incidence (%)	
4	PU	Sulfur dust Sulfur 80DF 4 lb Flint 50WG 1.5 oz	AB CDEF GHIJK	2.7	c	65.6	b
2	P	Sulfur dust Sulfur 80DF 4 lb Vangard 75DF 10 oz	AB CDEF GHIJK	22.9	b	98.1	a
3	B	Sulfur dust Sulfur 80DF 4 lb Elevate 50WG 1.5 lb	AB CDEF GHIJK	29.2	b	98.1	a
1	W	Untreated		100	a	100.0	a

Note: Applications are listed in alphabetical sequence, and each letter corresponds to one application. Values in a column followed by the same letter are not significantly different according to Fisher's LSD t test, P=0.05.

GRAPE BUNCH ROT

GRAPE BUNCH ROT TRIALS
MATERIALS AND COOPERATORS

Thanks to the following companies for donating materials and providing funding to support this trial:

B.A.S.F. Corp.
Bayer Crop Science
Dow AgroSciences LLC
JMS Flower Farms, Inc.
Syngenta Crop Protection Inc.
Valent Agricultural Products

Cooperative Research Project, Doug Gubler, U.C. Davis Dept. of Plant Pathology
Final report

Trial name.....	Grape bunch rot fungicide trial, 2003		
Location.....	Valley Foothills Vineyard, Philo, Mendocino County, CA 95466		
Investigators	Doug Gubler, 530.752.0304; Ken Dell, Eugene Erickson 530.752.4982		
Cooperators	Ted Bennett and Jim Klein, Navarro Vineyards Dave Olson, Valley Foothills Vineyard		
Crop.....	Grape, 'Johannesburg Riesling'	Disease	Bunch Rot, *Botrytis cinerea*

Trial layout and method

Objective	Efficacy of fungicides for control of *Botrytis* bunch rot		
Experimental design	Treatments are field applications to 4 vine plots, in a randomized complete block design, with 4 replications.		
Application method	high pressure hand gun sprayer		
Vine spacing	8'	Row spacing	12'
Treatment unit	4 vines	Treatment unit area.....	384 sq ft
Area/Treatment, sq ft...	1536	Area/Treatment, acre	0.0352617
Vol. Water/acre, gal.....	113 - 142	Vol. water/trt, L	15.1 – 18.9
Apps timing	A=bloom; B=close; C=veraison; D= preharvest (if needed)		
Treatment interval.....	Approx 3 weeks	Evaluation stage.....	immediately prior to harvest

Treatments protocol

#	Color	Materials	Timing	FP/A		Tol
1	W	Untreated				Y
2	OD	Rovral 50WP Rovral 75WG	A BCD	1.0 10.7	lb oz	Y
3	GD	V-10116 1.67SC	ABCD	6.13	floz	N
4	W/R	V-10116 1.67SC	ABCD	8.20	floz	N
5	W/G	V-10114 1.67FL	ABCD	13.8	floz	N
6	WOC	V-10114 1.67FL	ABCD	26.8	floz	N
7	W/B	Pristine 38WG	ABCD	1.44	lb	Y
8	OBKD	Stylet Oil	ABCD	1.0	%	Y
9	YBKC	Stylet Oil + Vangard 75WG	ABCD	1.0 5	% oz	Y
10	Y/BK	Vangard 75WG	ABCD	5	oz	Y
11	W/BK	Flint 50WG Flint 50WG Elite 45DF	A C BD	1.5 3.0 4.0	oz oz oz	Y
12	WBKC	Spiroxamine 300CS Flint 50WG Elite 45WP	A BC D	18.0 3.0 4.0	foz oz oz	N
13	W/O	Vangard 75WG	AC	10	oz	Y
14	WBC	Flint 50WG	A BCD	2.0 3.0	oz oz	Y
15	B	Scala 60SC	ABCD	18.0	foz	N
16	RD	Scala 60SC + Elite 45WP	ABCD	9.0 4.0	foz oz	N
17	PPC	Scala 60SC + Flint 50WG	ABCD	9.0 2.0	foz oz	N

18	O/BK	Scala 60SC +	AB	9.0	foz	N
		Rovral 75WG		10.7	oz	
		Scala 60SC +	C	9.0	foz	
		Flint 50WG		2.0	oz	
		Scala 60SC +	D	9.0	foz	
		Elite 45WP		4.0	oz	

Notes: 1. Tol indicates whether all products in the treatment have an EPA tolerance for grapes, and the crop can be harvested.

Materials list

Sponsor	Product	Active Ingr.	Conc.	Tol	Mfr
BASF	Pristine 38WG	BAS516	38%	Y	BASF
	Latron B-1956	Non-ionic surfactant		Y	DowAgro
Bayer	Spiroxamine 300SC	Spiroxamine	300 g/L	N	Bayer
	Elite 45WP	Tebuconazole	45%	Y	Bayer
	Flint 50WG	Trifloxystrobin	50%	Y	Bayer
	Scala 60SC	Pyrimethinal	60 g/L	N	Aventis
JMS	Stylet Oil	Mineral oil	99%	Y	JMS
	Vangard 75WG	Cyprodinil	75%	Y	Syngenta
Syngenta	Vangard 75WG	Cyprodinil	75%	Y	Syngenta
Valent	V-10116 1.67SC	V-10116		N	Valent
	V-10114 1.67FL	V-10114		N	Valent
Lab	Rovral 75WG	Iprodione	50%	Y	Bayer
	Vangard 75WG	Cyprodinil	75%	Y	Syngenta

Application schedule

Date	18 Jun 03		17 Jul 03		26 Aug 03		27 Aug 03	
App.#	A		B		C		C	
Stage	BBCH 68		BBCH 75-79		BBCH 83-85		BBCH 83-85	
Vol/trt ...	15L		15L		20L		20L	
Trt#1	----		----		----			
2	Rovral 50	16 g	Rovral 75	10.7 g	Rovral 75	10.7 g		
3	V-10116	6.4 ml	V-10116	6.4 ml	V-10116	6.4 ml		
4	V-10116	8.6 ml	V-10116	8.6 ml	V-10116	8.6 ml		
5	V-10114	14.4 ml	V-10114	14.4 ml	V-10114	14.4 ml		
6	V-10114	28.0 ml	V-10114	28.0 ml	V-10114	28.0 ml		
7	Pristine	23.2 g	Pristine	23.2 g	Pristine	23.2 g		
8	Stylet Oil	151 ml	Stylet Oil	151 ml	Stylet Oil	189 ml		
9	Stylet Oil + Vangard 75	151 ml 5.0 g	Stylet Oil + Vangard 75	151 ml 5.0 g	Stylet Oil + Vangard 75	189 ml 5.0 g		
10	Vangard 75	5.0 g	Vangard 75	5.0 g	Vangard 75	5.0 g		
11	Flint 50WG	1.5 g	Flint 50WG	3.0 g	Flint 50WG	3.0 g		
12	KWG 4168	18.8 ml	Flint 50WG	3.0 g	Flint 50WG	3.0 g		
13	Vangard 75	10.0 g		--	Vangard 75	10.0 g		
14	Flint 50WG	2.0 g	Flint 50WG	3.0 g	Flint 50WG	3.0 g		
15	Scala 60SC	18.8 ml	Scala 60SC	18.8 ml			Scala 60SC	18.8 ml
16	Scala 60SC + Elite 45WP	9.4 ml 4.0 g	Scala 60SC + Elite 45WP	9.4 ml 4.0 g			Scala 60SC + Elite 45WP	9.4 ml 4.0 g
17	Scala 60SC + Flint 50WG	9.4 ml 2.0 g	Scala 60SC + Flint 50WG	9.4 ml 2.0 g			Scala 60SC + Flint 50WG	9.4 ml 2.0 g
18	Scala 60SC + Rovral 75	9.4 ml 10.7 g	Scala 60SC + Rovral 75	9.4 ml 10.7 g			Scala 60SC + Flint 50WG	9.4 ml 2.0 g

Calendar of events

Date	Activity
18 Jun	KD, EE, app. #1; 11:45-3:15PM; 68F; clear, 5-18 mph W wind; BBCH 63-69 (mostly 68). No disease observed.
7 Jul	EE; checked berries for progress, BBCH 73
17 Jul	EE app. #2; 9:00AM-1:30PM; 66-80F; clear, calm-10 mph W breeze; BBCH 75-79
6 Aug	EE; checked berries, BBCH 81; 2 symptomatic berries in one check cluster.
13 Aug	EE; checked berries, BBCH 81; symptomatic berry on an unsprayed vine in Row 10 on the hillside
17 Aug	EE; checked berries, BBCH 81-83
26 Aug	KD, EE app. #3, 10am – 1pm, clear, calm; BBCH 83-85. Pump gearbox break, 5 trts unfinished.
27 Aug	KD, app #3 finish, 12pm – 2pm; clear, calm.
3 Sep	rain
9 Sep	rain
9 Sep	Chuck Olson: berries at 17 Brix; Jim Klein: harvest in about 3 wks
29 Sep	Chuck: berries at 22.5 Brix, probably harvest between 3 and 6 Oct
1 Oct	EE, KD, Connie, José; rate 45 clusters/rep, drop crop (GD, W/R, W/G, WOC, WBKC, B, RD, PPC, O/BK), remove flags. Harvest to start 3 Oct.

Results and discussion

Disease was first observed in August, and remained at low levels during the trial. The plots were rated as close to harvest as possible, on 1 Oct. with harvest set to begin within a couple of days. An average of 1.6% of each cluster surface in untreated plots was infected with Botrytis grey mold. Treatments were not a significant effect on fruit bunch rot severity or incidence, according to ANOVA, $p \leq 0.05$, when all treatments were analyzed together (Table 1). However, when five treatments were excluded from the analysis due to high variability, the remaining data set showed significant treatment effects according to ANOVA, $p \leq 0.05$, and the means were separated by Fisher's LSD t Test at $p \leq 0.05$ (Table 2).

Table 1. Grape bunch rot fungicide trial, results of all treatments.

#	Materials, rate/A	Timing[1]	Severity[2] (%)	Incidence[3] (%)
1	Untreated		1.64	22.8
2	Rovral 50WP, 1 lb Rovral 75WG, 19.7 oz	A BC	1.55	18.9
3	V-10116 1.67SC, 6.13 foz	ABC	2.86	24.4
4	V-10116 1.67SC, 8.20 foz	ABC	0.66	16.1
5	V-10114 1.67FL, 13.8 foz	ABC	0.65	7.2
6	V-10114 1.67FL, 26.8 foz	ABC	0.60	9.6
7	Pristine 38WG, 1.44 lb	ABC	0.82	11.1
8	Stylet Oil, 1%	ABC	2.46	23.9
9	Stylet Oil, 1% + Vangard, 5.0 oz	ABC	1.22	20.0
10	Vangard, 5.0 oz	ABC	1.36	16.1
11	Flint 50WG, 1.5 oz Elite 45DF, 4.0 oz Flint 50WG, 3.0 oz	A B C	0.79	13.9
12	Spiroxamine 300, 18 foz Flint 50WG, 3.0 oz	A BC	2.64	21.7
13	Vangard, 10.0 oz	AC	0.90	13.9
14	Flint 50WG 2.0 oz Flint 50WG 3.0 oz	A BC	0.97	16.1
15	Scala 60SC, 18.0 foz	ABC	0.80	11.7
16	Scala 60SC, 9.0 foz + Elite 45WP, 4 oz	ABC	0.69	16.7
17	Scala 60SC, 9.0 foz + Flint 50WG, 2.0 oz	ABC	0.86	11.1
18	Scala 60SC, 9.0 foz + Rovral 75WG, 10.7 oz Scala 60SC, 9.0 foz + Flint 50WG, 2.0 oz	AB C	0.68	15.0

[1] Treatments were applied at bloom (A), berry touch (B), and veraison (C).
[2] Forty-five clusters per replicate plot were rated for percent of surface area with symptoms of grey mold rot; severity is the average percent cluster surface area infected.
[3] Incidence is the percent of clusters rated with any Botrytis grey mold infection.

Table 2. Grape bunch rot fungicide trial, results of a subset of treatments which was analyzed for statistical differences.

#	Materials, rate/A	Timing[1]	Severity[2] (%)		Incidence[3] (%)	
6	V-10114 1.67FL, 26.8 foz	ABC	0.47	d[4,5]	9.6	de[5]
5	V-10114 1.67FL, 13.8 foz	ABC	0.55	cd	7.2	e
4	V-10116 1.67SC, 8.20 foz	ABC	0.62	cd	16.1	abcd
16	Scala 60SC, 9.0 foz + Elite 45WP, 4 oz	ABC	0.63	cd	16.7	abcd
18	Scala 60SC, 9.0 foz + Rovral 75WG, 10.7 oz Scala 60SC, 9.0 foz + Flint 50WG, 2.0 oz	AB C	0.66	cd	15.0	bcde
7	Pristine 38WG, 1.44 lb	ABC	0.72	bcd	11.1	cde
17	Scala 60SC, 9.0 foz + Flint 50WG, 2.0 oz	ABC	0.73	bcd	11.1	cde
11	Flint 50WG, 1.5 oz Elite 45DF, 4.0 oz Flint 50WG, 3.0 oz	A B C	0.77	bcd	13.9	cde
13	Vangard, 10.0 oz	AC	0.80	bcd	13.9	cde
2	Rovral 50WP, 1 lb Rovral 75WG, 19.7 oz	A BC	1.13	abcd	18.9	abc
10	Vangard, 5.0 oz	ABC	1.20	abc	16.1	abcd
1	Untreated		1.50	ab	22.8	ab
8	Stylet Oil, 1%	ABC	1.93	a	23.9	a
	Fisher's Least Significant Difference				8.66	

[1] Treatments were applied at bloom (A), berry touch (B), and veraison (C).

[2] Forty-five clusters per replicate plot were rated for percent of surface area with symptoms of grey mold rot; severity is the average percent cluster surface area infected.

[3] Incidence is the percent of clusters rated with any Botrytis grey mold infection.

[4] Severity values were log (y+1) transformed prior to statistical analysis due to heterogeneity of variance; values shown are back-transformed.

[5] Values in a column with the same letter are not significantly different according to Fisher's protected LSD t Test, $p \leq 0.05$.

STRAWBERRY

STRAWBERRY TRIALS MATERIALS AND COOPERATORS

Thanks to the following companies for donating materials and providing funding to support this trial:

Arvesta Corp.
B.A.S.F. Corp.
Bayer Crop Science
Cerexagri, Inc.
Dow AgroSciences LLC
Syngenta Crop Protection Inc.
Uniroyal Chemical Inc.

Cooperative Research Project, Doug Gubler, U.C. Davis Dept. of Plant Pathology

Trial name.....	Santa Maria Strawberry Powdery Mildew Trial, 2003
Location.....	DB Specialty Farms, Prell Rd., Santa Maria
Investigators	Doug Gubler, 530.752.0304; Ken Dell, 752.4982, Frank Laemmlen 805.934.6240
Cooperators	Darren Gee, Hank Guerrero
Crop.....	Strawberry cv 'Ventana'
Disease.....	Powdery mildew (*Sphaerotheca macularis* f. sp. *fragariae)*

Trial layout and method

Objective	Efficacy of fungicides for control of fruit and/or leaf powdery mildew		
Experimental design	Treatments consist of fungicide applications to single bed plots, in a randomized complete block design, with 4 replications in trial 1 and 5 replications in trial 2.		
Application method	CO_2 Sprayer (R&D sprayer) at 50 psi, 16" T-wand w/4 nozzle TX6 sprayjet tips		
Plant spacing.....	16" / 4 plants	Bed spacing	64", 48" tops, 4 row beds
Treatment unit	20 plants trial 1, 16 plts trial 2	Treatment unit area.....	T1: 64" x 80" T2: 64"x 64"
Area/Treatment, sq ft...	142.2 ft^2	Area/Treatment, acre	0.003265
Vol. Water/acre, gal.....	150	Vol. water/trt, liter	1.85 (150 gpa)
Apps. Start	21 Feb	Apps. End	6 apps; 31 April
Treatment interval.....	10 - 14 days	Evaluation stage.....	14 May
Evaluation method.....	mildew severity on leaves and fruit, horticultural symptoms on plots.		

Treatments protocol

trial 1:

#	Sponsor	Materials	Interval / timing	FP/ac		Tol
1	Lab	Non-treated				Y
2	Lab	Quintec 250SC	10-28 index	4.0	fl oz	N
3	Uniroyal	Procure 50WS	10-14d	6.0	oz	Y
4	Uniroyal	Procure 50WS	10-14d	8.0	oz	Y
5	Dow	Quintec 250SC	10-14d	4.0	fl oz	N
6	Dow	Quintec 250SC	10-14d	6.0	fl oz	N
7	Dow	Rally 40W	10-14d	4.0	oz	Y
8	Dow	Rally 40W alt/w Quintec 250SC	10-14d	4.0 4.0	oz fl oz	N
9	Arvesta	TM402	10-14d	1.5	lb	Y
10	Arvesta	TM-45002	10-14d	5.25	lb	N
11	Bayer	Scala 400L+ Flint 50WG	14d	20.5 1.5	fl oz oz	N
12	Syngenta	Switch 62.5WG	10-14d	10	oz	Y
13	Syngenta	Switch 62.5WG	10-14d	14	oz	Y
14	Syngenta	Switch 62.5WG alt/w Quadris 2.08F	10-14d	14 15	oz fl oz	Y

trial 2:

#	Sponsor	Materials	Interval	FP/ac		Tol
15	IR4	BAS516 38WG	10-14d	18.9	oz	Y
16	BASF	BAS516 38WG	10-14d	23.2	oz	Y
17	Labstd	Rally 40W	10-14d	4.0	oz	Y
18	Lab	Non-treated				Y

Note: 'Tol' denotes Federal tolerance for the active ingredient on the specified crop. Treatments marked with a 'N' will be crop destruct.

Materials list

Trt sponsor	Product name	Active Ing.	Conc. AI	Tol	Mfr
Arvesta	TM402	Fenhexamid	50%	Y	Arvesta
	TM-45002	TM-45002	n/a	N	Arvesta
	Microthiol Special	Sulfur	80%	Y	Cerexagri
Dow Agro	Quintec 250SC	Quinoxyfen	250g/L	N	Dow Agro
	Rally 40W	Myclobutanil	40%	Y	Dow Agro
Uniroyal	Procure 50WS	Triflumizol	50%	Y	Uniroyal
Lab	Rally 40WP	Myclobutanil	40%	Y	Dow Agro
	Quintec	Quinoxyfen	250g/L	N	Dow Agro
Bayer	Scala 400	Pyremethinal	400g/L	N	Bayer
	Flint 50WG	Trifloxystrobin	50%	N	Bayer
Syngenta	Switch 62.5WG	Cyprodinil +	37.5%	Y	Syngenta
		Fludioxinil	25%	Y	
	Quadris 2.08F	Azoxystrobin	2.08lb/gal	Y	Syngenta
IR4	BAS516 04 F	Pyraclostrobin + Boscalid	38%	Y	BASF
BASF	BAS516 04 F	Pyraclostrobin + Boscalid	38%	Y	BASF

Application schedule

Date	21 Feb		7 Mar		21 Mar		2 Apr	
App.#	1		2		3		4	
Stage	Bearing		fruit/ high flower		fruit/flower		fruit/flower	
Vol/trt	1.9 L		1.9 L		1.9L		1.9L	
Trt#								
1	--		--		--		--	
2	Quintec	0.39ml			Quintec	0.39ml	Quintec	0.39ml
3	Procure	0.56g	Procure	0.56g	Procure	0.56g	Procure	0.56g
4	Procure	0.74g	Procure	0.74g	Procure	0.74g	Procure	0.74g
5	Quintec	0.39ml	Quintec	0.39ml	Quintec	0.39ml	Quintec	0.39ml
6	Quintec	0.58ml	Quintec	0.58ml	Quintec	0.58ml	Quintec	0.58ml
7	Rally	0.37g	Rally	0.37g	Rally	0.37g	Rally	0.37g
8	Rally	0.37g	Quintec	0.39ml	Rally	0.37g	Quintec	0.39ml
9	TM402	2.22g	TM402 Microthiol	2.22g 5.9g	TM402	2.22g	TM402	2.22g
10	TM45002	7.78g	TM45002 Microthiol	7.78g 5.9g	TM45002	7.78g	TM45002	7.78g
11	Scala Flint	1.98ml 0.14g	Scala Flint	1.98ml 0.14g	Scala Flint	1.98ml 0.14g	Scala Flint	1.98ml 0.14g
12	Switch	0.93g	Switch	0.93g	Switch	0.93g	Switch	0.93g
13	Switch	1.30g	Switch	1.30g	Switch	1.30g	Switch	1.30g
14	Switch	1.30g	Quadris	1.45ml	Switch	1.30g	Quadris	1.45ml
15			BAS516	1.75g	BAS516	1.75g	BAS516	1.75g
16			BAS516	2.14g	BAS516	2.14g	BAS516	2.14g
17			Rally	0.37g	Rally	0.37g	Rally	0.37g
18			--		--		--	

Date	17 Apr		31 Apr	
App.#	5		6	
Stage	Bearing		Bearing	
Vol/trt ...	1.9 L		1.9 L	
Trt#				
1	--		--	
2	--		Quintec	0.39ml
3	Procure	0.56g	Procure	0.56g
4	Procure	0.74g	Procure	0.74g
5	Quintec	0.39ml	Quintec	0.39ml
6	Quintec	0.58ml	Quintec	0.58ml
7	Rally	0.37g	Rally	0.37g
8	Rally	0.37g	Quintec	0.39ml
9	TM402	2.22g	TM402	2.22g
10	TM45002	7.78g	TM45002	7.78g
11	Scala Flint	1.98ml 0.14g	Scala Flint	1.98ml 0.14g
12	Switch	0.93g	Switch	0.93g
13	Switch	1.30g	Switch	1.30g
14	Switch	1.30g	Quadris	1.45ml
15	BAS516	1.75g	BAS516	1.75g
16	BAS516	2.14g	BAS516	2.14g
17	Rally	0.37g	Rally	0.37g
18	--		--	

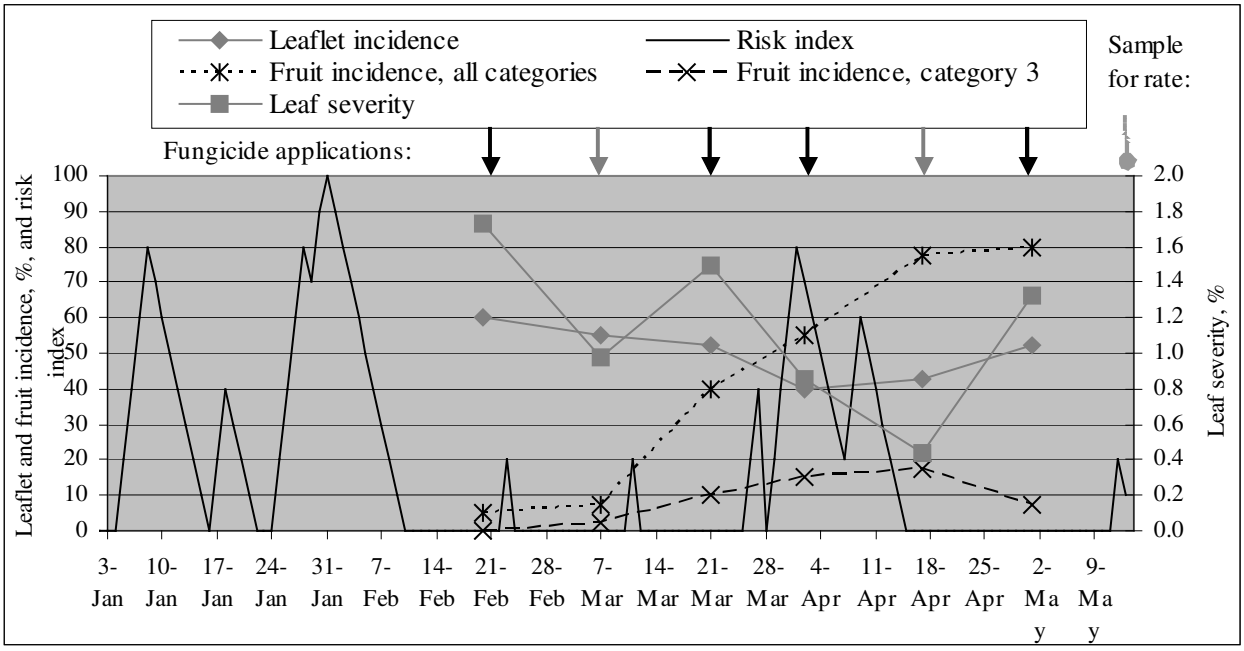
Calendar of events

Date	Activity
Dec'02- Feb'03	Grower applied fungicides: 12/13 Topsin M 70W 1.0 lb + Rally 40W 4.0 oz + Elevate 50WDG 1.5 lb 1/11 Rovral 4F 1.0 qt + Quadris 12.0 oz/ac 1/18 Rovral 4F 1.0 qt/ac 1/29 Microthiol 4.0 lb/ac 2/13 Topsin M 70W 1.0 lb/ac + Captan 50WP 3.0 lb/ac 2/21 Elevate 50WDG 1.5 lb/ac + Microthiol 3.0 lb/ac (not to trial plots)
20 Feb	Set up plot at Donovan Ranch; mildew scouting: 10/20 leaf , 1/20 fruit infected (2 others with possible old infection sites);. Rosemary ranch scouting: 1/30 leaf, 0/25 fruit infected. Set up Adcon station ' Blosser'
21 Feb	Treat Donovan plots 7:45 – 9am. Calm. 70F, sunny. Sample from untreated plots 5 lvs/plot selected at random (rated later = 90% incidence). Plots w/o tol. marked yellow 'do not pick' tape, crop to be dropped.
7 Mar	KD, FL. Trial 1: App. #2; trial 2: establish and app. #1. Application 8 – 9:30am; clear, 70F, calm. Count freshly opened flowers and collect and rate 10 fruit/plot from trt 1 trial 1 w/Eric; Eric to continue weekly. Collect 10leaflets/plot from trt 1 trial 1 for later rate. Flower count = avg 27 flowers/20 plants. Treatment 9 and 10 + microthiol @3.25lb/A
21 Mar	KD, FL; trial 1 App #3; trial 2 app #2. 7:30-9am, calm, 70F, clear. Count flowers, sample 10 fruit & 10 leaflets/ plot 1,15,30,46. Tag flowers plots 77-88; agar plates placed plots 1, 15, 30, 46, 77, 81, 84, 87. Adcon stn new leaf wetness sensors (slope NNW) installed (cable bad on old lower) lower to I/O B, upper to I/O A.
2 Apr	KD, FL; app #4 & 3; index 80 so app to trt #2. Count flowers, sample 10 fruit, 10 leaflets plots 1,15,30,46. Tag flowers plots 77-88; BSTM plates placed plots 1, 15, 30, 46, 77, 81, 84, 87.
17 Apr	KD, FL app #5; 7-9am, 65F, calm, clear. Flower count, leaflet and fruit sample, BSTM plates.
31 Apr	KD; app #6; 7-8:30am, 60F, cloudy, calm, dry. Flower count, leaflet and fruit sample dis prog.
15 May	KD, FL sample fruit and leaves for later rate.
21 May	KD, EE rate fruit.

Results

Disease progress. Disease levels on untreated foliage and fruit were monitored biweekly by observing the abaxial surface of 40 leaflets and estimating the percent of leaflet surface affected by mildew (severity), and observation of 40 fruit with rating as above. Disease levels on foliage were high initially and trended downward while disease levels on fruit were low initially and trended upward. At trials' end, 80% of fruit were infected with powdery mildew, and at the peak, 17% of fruit were infected severely (category 3). Environmental conditions, as measured by an experimental index (modified Gubler-Thomas grape powdery mildew risk index), were favorable for powdery mildew during January, unfavorable during February and March, and briefly favorable during early April (Figure 1).

Figure 1. Powdery Mildew on untreated leaves and fruit, and experimental risk index. Fungicide application arrows in grey indicate a skip for treatment #2 (application interval lengthened to 28 days when the risk index is below 30).



Fungicide applications. Fungicides were applied 6 times at 14 day intervals to all treatments in trial 1 except treatment #2, Quintec at 10-28 day intervals according to the risk index, which was applied 4 times. If the index was below 30 at the time of normal application, treatment #2 was withheld until either a 28 day interval or the index had risen. Treatments 9 and 10 included micronized sulfur @ 3.25lb/A at application #2 (7 March). In trial 2, fungicides were applied 5 times at 14 day intervals.

Fruit rating. Twenty red fruit from each plot were sampled at random on 15 May, 2003. Fruit samples were wrapped in a paper towel and placed inside a plastic bag and stored in a refrigerator until rating approx. 1 week later. Fruit were inspected by eye under close illumination, and suspected mildew was confirmed with a hand lens or microscope. Mildew infection severity on fruit was categorized as follows: 1 to 4 achenes infected (or an equivalent fruit surface area) = category 1; 5 to 9 achenes infected = category 2; 10 or more achenes infected = category 3. Severity and incidence (the % of fruit with any mildew) ratings were averaged for each plot and analyzed by analysis of variance. Treatment effects that were found to be significant by ANOVA at P=0.05 were separated by Fisher's LSD test at P=0.05.

Trial 1. Treatments were found to be a significant effect on both mildew severity and incidence, and all treatments significantly reduced disease compared to untreated plots (Table 1). Quintec treatments reduced disease to low levels at both 4.0 and 6.0 fluid ounces per acre. Quintec applied according to the risk index (trt #2) was applied four times compared to six calendar applications, and resulted in an approximate doubling of disease levels, although not a statistically significant increase. Switch 62.5WG was the most effective material among registered products tested.

Trial 2. Treatments were found to be a significant effect on both mildew severity and incidence. BAS516 38WG (Pristine) significantly reduced both mildew severity and incidence at both rates tested, compared to the untreated plots. The higher rate of BAS516 resulted in less disease than the lower rate, but the differences were not statistically significant. Treatment with Rally 40W resulted in a non-significant reduction compared to the untreated plots.

Table 1. Trial 1 treatment fruit rating.

Trt #	Treatment material, rate/A	Severity (%)		Incidence (%)	
5	Quintec 250SC, 4 foz	0.18	f	11.3	f
6	Quintec 250 SC, 6 foz	0.23	f	12.7	f
2	Quintec 250 SC, 4 foz, 10-28d RI	0.37	ef	24.1	ef
13	Switch 62.5WG, 14 oz	0.50	def	41.7	cde
12	Switch 62.5WG, 10 oz	0.59	def	33.9	de
11	Scala 400L, 20.5 foz + Flint 50WG, 1.5oz	0.66	cde	40.7	cde
8	Rally 40W, 4.0 oz alt/w Quintec 250SC, 4 foz	0.67	cde	31.7	de
14	Switch 62.5WG, 14 oz alt/w Quadris2.08F, 15 foz	0.78	cde	43.8	cd
7	Rally 40W, 4.0 oz	0.83	cd	46.5	bcd
4	Procure 50WS, 8 oz	0.89	cd	48.6	bcd
3	Procure 50WS, 6 oz	1.06	bc	54.2	bc
9	TM402, 1.5 lb	1.38	b	64.6	ab
10	TM-45002, 5.25 lb	1.41	b	59.0	bc
1	Non-treated	2.10	a	79.2	a
	LSD	0.43		18.6	

Values in a column followed by the same letter are not significantly different according to Fisher's LSD test at p=0.05.

Table 2. Trial 2 treatment fruit rating

Trt #	Treatment material, rate/A	Severity (%)		Incidence (%)	
16	BAS516 38WG 23.2 oz	0.37	b	23.3	b
15	BAS516 38WG 18.9 oz	0.40	b	25.0	b
17	Rally 40W 4 oz	1.03	a	58.3	a
18	Non-treated	1.26	a	71.6	a
	LSD+	0.53		17.8	

Values in a column followed by the same letter are not significantly different according to Fisher's LSD test at p=0.05.

Cooperative Research Project, Doug Gubler, U.C. Davis Dept. of Plant Pathology
Final Report

Trial name.....	MBA Strawberry Anthracnose and Botrytis Fruit Rot and Powdery Mildew Trial, 2003
Location.....	Montery Bay Academy, Watsonville, CA (La Selva Beach) , Santa Cruz County
Investigators	Doug Gubler, 530.752.0304; Ken Dell, 752.4982
Cooperators	Arturo Ramos, Luis Guerrero
Crop.....	Strawberry 'Diamante'
Disease.....	Grey mold (*Botrytis cinerea),* Anthracnose *(Colletotrichum acutatum)*

Trial layout and method

Objective	Efficacy of fungicides for control of fruit grey mold rot		
Experimental design	Treatments consist of fungicide applications to single bed plots, in a randomized complete block design, with 4 replications.		
Application method	CO_2 Sprayer (R&D sprayer) at 50 psi, 16" T-wand w/4 nozzle, #6 sprayjet tips		
Plant spacing.....	14" / 2 plants	Bed spacing	54"
Treatment unit	14 plants	Treatment unit area.....	98"x 54" = 36.8 ft^2
Area/Treatment, sq ft.....	147 ft^2	Area/Treatment, acre	0.0033746
Vol. Water/acre, gal..... ...	150	Vol. water/trt, liter	1.92 (150 gpa)
Apps. Start	May	Apps. End	Jun
Treatment interval..... ...	10-14 days	Evaluation stage.....	Weekly yield & rot, mildew at end of trial

Treatments protocol

#	Sponsor	Materials	Timing/interval	FP/ac		Tol
1	lab	non-treated				Y
2	lab	Thiram 65WSB	14d	3.0	lb	Y
3	lab	Elevate 50WDG / Switch 62.5WDG	14d	1.5 14	lb oz	Y
4	lab	Elevate 50WDG / Switch 62.5WG	14d and + index	1.5 14	lb oz	Y
5	lab	Rally 40W	10-14d	4.0	oz	Y
6	lab	Quintec 250SC	10-28d RI	4.0	foz	N
7	Valent	V-10116 1.67SC		6.13	floz	N
8	Valent	V-10116 1.67SC		8.20	floz	N
9	Valent	V-10114 1.67FL		11.50	floz	N
10	Valent	V-10114 1.67FL		19.16	floz	N
11	UCB	Thiram L	14d/season	1.5	qt	Y
12	UCB	Thiram L	14d/season	3.0	qt	Y
13	Bayer	Scala 400L	14d/season	27.3	fl oz	N
14	Bayer	Scala 400L+ Flint 50WG	14d/season	20.5 1.5	fl oz oz	N
15	BASF	BAS516 38WG		1.46	lb	N
16	IR4	BAS516 38WG		1.18	lb	N
17	Uniroyal	Procure 50WS	10-14d	6.0	oz	Y
18	Uniroyal	Procure 50WS	10-14d	8.0	oz	Y
19	Dow	Quintec 250SC	10-14d	4.0	foz	N
20	Dow	Quintec 250SC alt/w Rally 40W	10-14d 10-14d	4.0 4.0	foz oz	N
21	lab	Captan 50WP	14d	4.0	lb	Y
22	lab	Captec 4L	14d	1.85	qt	Y

1. Tol indicates whether all products in the treatment have an EPA tolerance for strawberries, and the crop can be harvested.

2. Index refers to Broome Botrytis daily severity index for infection.
3. Application is a banded spray covering 40" out of 54" row spacing, or 74% area coverage.

Materials list

Sponsor	Product	Active Ing.	A.I. conc.	Tol	Manufctr
Lab	Elevate 50WDG	Fenhexamid	50%	Y	Arvesta
	Switch 62.5WDG	Cyprodinil + Fludioxinil	37.5% 25%	Y Y	Syngenta
	Rally 40WP	Myclobutanil	40%	Y	Dow Agro
	Captan 50WP	Captan	50%	Y	MicroFlo
	Captec 4L	Captan	4lb/gal	Y	MicroFlo
	Thiram 65WSB	Thiram	65%	Y	UCB
Valent	V-10116 1.67SC			N	Valent
	V-10114 1.67FL			N	Valent
Bayer	Scala 400	Pyremethinal	400g/L	N	Bayer
	Flint 50WG	Trifloxystrobin	50%	N	Bayer
UCB	Thiram 65WSB	Thiram	65%	Y	UCB
	Thiram L				UCB
BASF	BAS516 38WG	Pyraclostrobin + Boscalid	12.8% 25%	N	BASF
IR4	BAS516 38WG	Pyraclostrobin + Boscalid	12.8% 25%	N	BASF
Uniroyal	Procure 50WS	Triflumizol	50%	N	Uniroyal
Dow Agro	Quintec 250SC	Quinoxyfen	250g/L	N	Dow Agro
	Rally 40W	Myclobutanil	40%	Y	Dow Agro

Application schedule

Date	14 May		28 May		12 June		25 June	
App.#	1		2		3		4	
Stage	bearing		bearing		bearing		bearing	
Vol/trt	1.9 L		1.9 L		2.0 L		2.0 L	
Trt# 1	--		--		--		--	
2	--		Thiram 65	4.6g	Thiram 65	4.6g	Thiram 65	4.6g
3	Elevate	2.3g	Switch	1.3g	Elevate	2.3g	Switch	1.3g
4	Elevate	2.3g	Switch	1.3g	Elevate	2.3g	--	
5	Rally	.38g	Rally	.38g	Rally	.38g	Rally	.38g
6	Quintec	.40g	--	--	--	--	Quintec	.40g
7	V-10116	.61ml	V-10116	.61ml	V-10116	.61ml	V-10116	.61ml
8	V-10116	.82ml	V-10116	.82ml	V-10116	.82ml	V-10116	.82ml
9	V-10114	1.15ml	V-10114	1.15ml	V-10114	1.15ml	V-10114	1.15ml
10	V-10114	1.91ml	V-10114	1.91ml	V-10114	1.91ml	V-10114	1.91ml
11	ThiramL	4.8ml	ThiramL	4.8ml	ThiramL	4.8ml	ThiramL	4.8ml
12	ThiramL	9.6ml	ThiramL	9.6ml	ThiramL	9.6ml	ThiramL	9.6ml
13	Scala	2.7ml	Scala	2.7ml	Scala	2.7ml	Scala	2.7ml
14	Scala Flint	2.1ml .14g	Scala Flint	2.1ml .14g	Scala Flint	2.1ml .14g	Scala Flint	2.1ml .14g
15	BAS516	2.23g	BAS516	2.23g	BAS516	2.23g	BAS516	2.23g
16	BAS516	1.81g	BAS516	1.81g	BAS516	1.81g	BAS516	1.81g
17	Procure	.58g	Procure	.58g	Procure	.58g	Procure	.58g
18	Procure	.77g	Procure	.77g	Procure	.77g	Procure	.77g
19	Quintec	.40ml	Quintec	.40ml	Quintec	.40ml	Quintec	.40ml
20	Quintec	.40ml	Rally	.38g	Quintec	.40ml	Rally	.38g
21	--	--	Captan 50	6.1g	Captan 50	6.1g	Captan 50	6.1g

Date	30 June		9 July	
App.#	4		5	
Stage	bearing		bearing	
Vol/trt ...	2.0 L		2.0 L	
Trt# 1	--		--	
2	--		Thiram 65	4.6g
3	--		Elevate	2.3g
4	Switch	1.3g	--	
5	--		Rally	.38g
6	--		--	--
7	--		V-10116	.61ml
8	--		V-10116	.82ml
9	--		V-10114	1.15ml
10	--		V-10114	1.91ml
11	--		ThiramL	4.8ml
12	--		ThiramL	9.6ml
13	--		Scala	2.7ml
14	--		Scala Flint	2.1ml .14g
15	--		BAS516	2.23g
16	--		BAS516	1.81g
17	--		Procure	.58g
18	--		Procure	.77g
19	--		Quintec	.40ml
20	--		Quintec	.40ml
21	--		Captan 50	6.1g

Calendar of events

Date	Activity
20 Sept 02	Flat fumigate & tarped; 350 lb 67/33 Methyl bromide/chloropicrin
14 Nov 02	MBA planting 'Diamonte' 6 rows; rows 22-27
17 April 03	Sampled rows 22-27 in 9 blocks (3x3); no mildew on leaf or fruit; 28% botrytis fruit rot incidence.
14 May	KD treat #1. Tagged flowers purple tape trts # 1, 3, 4.
21 May	Doug rate: MBA crew harvests fruit from each plot into marketable and unmarketable buckets. Doug observes fruit and counts: 'marketable', 'botrytis', 'anthracnose', and 'other' damage.
28 May	Doug rate
29 May	KD treat #2. Added Thiram WP and Captan plots. Tagged flowers pink; missing plant count. Bot model treated due to positive index for last day available – 28th. PM model not treated due to zero index.
4 June	Doug rate
11 June	Ken rate
12 June	KD treat #3. Bot model high, treat #4, mildew model low no treat #6. Tag orange trts 1,3,4. Mildew scouted border rows leaves - none found. BSTM plates retrieved from UCCE, new plates placed tt #1 5 pm, collected early pm 13 June by Mbolda (<24hours).
18 June	Doug rate
25 June	KD treat #4 after rate, 5-9pm. Bot model low, mildew index high, treat 6 not 4. Collect fruit and leaves for photos trt 1,2,11,12,21. Leaf sample for mildew scout border rows – none found. Flower tag white
2 July	Doug rate.
30 June	KD app trt #4 due to Botrytis model firing over weekend.
9 July	KD app #5, 5-9pm. Mildew and botrytis model low, so no treat #4 and 6.
17July	Doug rate.

Method.

The trial area was fumigated on 20 Sept. 2002 with 300 lb/A of 67% methyl bromide and 33% chloropicrin. Beds were 40" wide centered 54" apart and covered with black plastic tarp. Bare root 'Diamante' strawberry plants were transplanted on 14 Nov., 2002 to two rows per bed on 14" spacing and irrigated initially by sprinkler and subsequently by 2 drip tapes. The experimental design was a randomized complete block with 4 replications. Treatment units were a single bed 98 in. long (36.8 ft^2), consisting of 14 plants. Treatments were applied by CO_2 back-pack sprayer (R & D Sprayers, Opelousas, LA), at 50 psi, in a spray volume of 150 gal/A. Treatments began on 14 May during ripe fruit harvest and continued through 9 Jul (10 weeks) with five applications on 2 week intervals. Plots were harvested weekly by a crew from Coastal Berry, and fruit were counted by the Gubler lab as either marketable, anthracnose, *Botrytis*, or other unmarketable defect. Diseased fruit counts were converted to percent, and analyzed by ANOVA; when treatment was a significant effect at $p \leq 0.05$, treatment means were separated by the the Waller-Duncan K-ratio t test at $p=0.05$. and analyzed by ANOVA, and means separated with the Waller-Duncan K-ratio t test at $p \leq 0.05$.

Results

Powdery mildew was not observed in the plots throughout the trial, and no rating for mildew was made. Botrytis and anthracnose fruit disease was evident and weekly rating data was analyzed. Botrytis fruit symptoms were not significantly affected by treatment, according to ANOVA. Treatment effects were a significant effect on anthracnose and data from 5 weekly evaluations (4 Jun to 2 Jul) were pooled and means separated. Anthracnose in untreated plots was higher than in fungicide treated plots at all evaluations (Figure 5). For the 5 evaluations analyzed, fruit incidence averaged 14.9% in untreated plots, and 6.7% in treated plots. All treatments significantly reduced average disease compared to the non-treated control (Table 8). Elevate alternated with Switch and Pristine ('BAS516') at either 1.46 or 1.18 lb/A reduced anthracnose symptoms to under 5%.

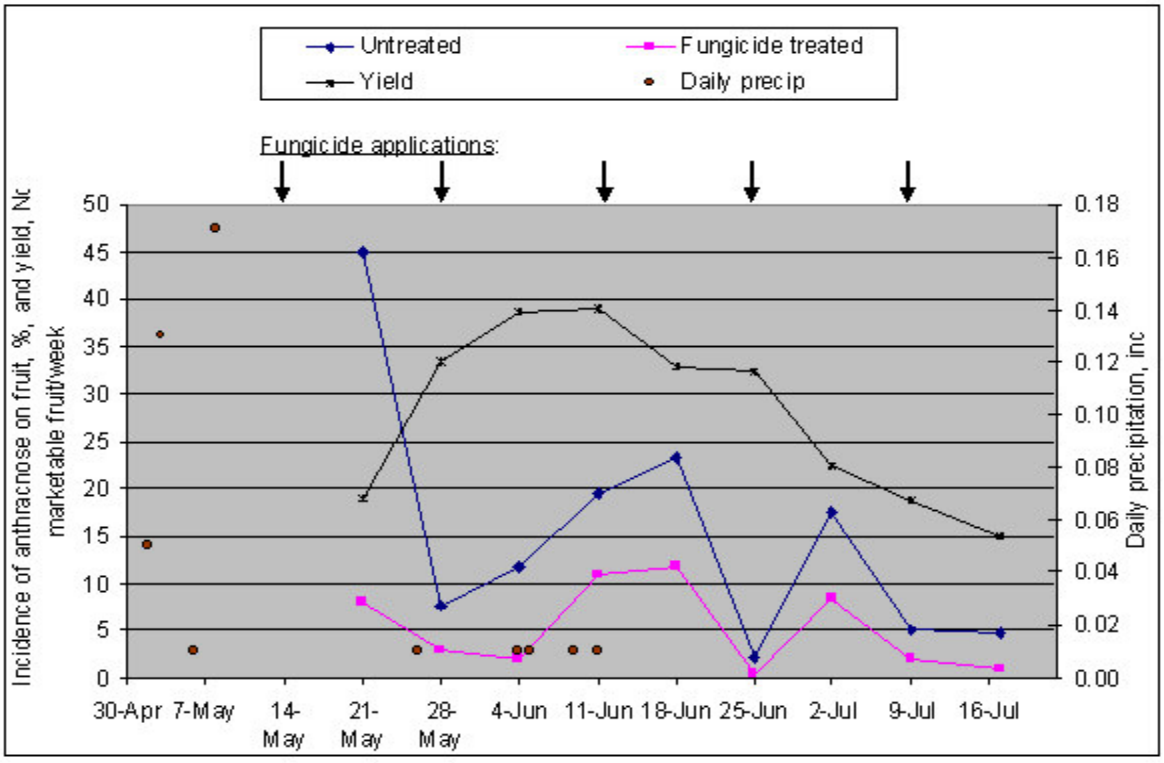


Figure 5. Fungicide applications, precipitation, yield, and anthracnose fruit disease at MBA, 2003.

Table 8. Treatment results for strawberry anthracnose fruit symptoms at MBA 2003

#	Material[1], rate/A	Anthracnose[2] (%)		Botrytis[3] (%)
3	Elevate, 1.5 lb alt/w Switch, 14 oz	3.9	d[4]	5.6[4]
15	BAS51604F, 1.46 lb	4.0	d	6.5
16	BAS51604F, 1.18 lb	4.5	cd	4.1
12	Thiram L, 3.0 qt	5.3	bcd	4.8
14	Scala, 20.5 foz + Flint, 1.5 oz	5.9	bcd	6.1
8	V-10116 1.67SC, 8.2 foz	6.6	bcd	5.8
9	V-10114 1.67FL, 11.5 foz	6.6	bcd	4.5
7	V-10116 1.67SC, 6.13 foz	7.4	bcd	6.4
10	V-10114 1.67FL, 19.2 foz	7.9	bc	4.1
11	Thiram L, 1.5 qt	8.1	bc	6.2
13	Scala 400, 27.3 foz	8.4	b	5.3
1	non-treated	14.9	a	8.5
	LSD	3.9		

[1] Fungicides were applied 5 times on 14 day intervals, from 14 May to 9 July.

[2] Anthracnose % is mean incidence of anthracnose affected fruit, % by count, from 5 weekly harvests 4 June to 2 July.

[3] Botrytis % is mean incidence of Botrytis affected fruit, % by count, from 8 weekly harvests 21 May to 17 July.

[4] Columns with the same letter are not significantly different according to Waller-Duncan K-ratio t test at $p \leq 0.05$.

APPENDIX

Products used in 2003 trials

Product	Active Ingredient	A. I. conc.	Manufacturer	Pages
Abound 2.08SC	Azoxystrobin	2.08 lb/gal	Syngenta	19,35
BAS516 38WG	Pyraclostrobin (12.8%) + Boscalid (25.2%)	38%	BASF	6,66
Captan 50WP	Captan	50%	Arvesta	6,66
Captec 4L	Captan	4 lb/gal	Micro Flo	66
Champ 2F	Copper hydroxide	2 lb/gal	Agtrol	19
Champion WP	Copper hydroxide	77%	Nufarm	6
Cuprofix Disperss 20	Copper hydroxide	20%	Griffin	19
Dithane 75DF	Mancozeb	75%	Dow Agro	6
Elevate 50WDG	Fenhexamid	50%	Arvesta	19,47,66
Elite 45WP	Tebuconazole	45%	Bayer	19,52
EM-1	Microorganisms		EMRO USA	35
Flint 50WG	Trifloxystrobin	50%	Bayer	6,19,35,47,52,59,66
GWN 4350		12.21%	Gowan	35
GX 569			Griffin	19
Kocide 101	Copper Hydroxide	77%	Griffin	19
Kocide 2000	Copper Hydroxide	53%	Griffin	19
Kumulus DF	Sulfur	80%	BASF	6
KWG 4168 300CS	Spiroxamine	31%	Bayer	19
Latron B-1956	non-ionic surfactant	77%	Dow Agro	12,19,35
Microsulf	Sulfur	80%	Agtrol	19
Microthiol	Sulfur	80%	Cerexagri	19
Microthiol Disperss	Sulfur	80%	Cerexagri	12,19
Nutrol	Monopotassium phosphate		NutrEcology	19
Oil	Petroleum oil	99%	PetroCanada	35
Pristine 38WG	Pyraclostrobin (12.8%) + Boscalid (25.2%)	38%	BASF	12,19,52
Procure 50WS	Triflumizole	50%	Uniroyal	6,12,19,59,66
Quadris 2.08F	Azoxystrobin	2.08 lb/gal	Syngenta	59
Quillaja (QL35)		35%	DK International	12
Quintec 250SC	Quinoline	250 g/L	Dow Agro	12,35,59,66
Rally 40W	Myclobutanil	40%	Dow Agro	12,19,35,59,66
Rovral 50WP	Iprodione	50%	Micro Flo	52
Rovral 75WG	Iprodione	75%	Micro Flo	52
Rubigan 1EC	Fenarimol	1 lb/gal	Dow Agro	35
Scala 400L	Pyrimethanil	400 g/L	Aventis	59,66
Scala 60SC	Pyrimethanil	60 g/L	Aventis	52
Serenade WP	*Bacillus subtilis*	10%	AgraQuest	6
Silwet L-77	Silicone-polyether copolymer	100%	Loveland	19
Sovran 50WG	Kresoxim-methyl	50%	BASF	35
Spiroxamine 300CS	Spiroxamine	31%	Bayer	52
Stylet Oil	Mineral oil	99%	JMS	19,52

Sulfur 80DF	Sulfur	80%	Quimetal	19
Sulfur 80DF	Sulfur	80%	Wilbur-Ellis	19,35,47
Switch 62.5WG	Cyprodinil (37.5%) + Fludioxinil (25%)	62.5%	Syngenta	59,66
TD 2463			Griffin	19
Thiram 65WSB	Thiram	65%	UCB Chemicals	66
Thiram L	Thiram		UCB Chemicals	66
TM 402	Fenhexamid	50%	Arvesta	59
TM 45002			Arvesta	59
V-10114 1.67FL		1.67 lb/gal	Valent	52,66
V-10116 20SC		20%	Valent	52,66
VC-01			Valent	12
Vangard 75WG	Cyprodinil	75%	Syngenta	47,52

Product manufacturers

Manufacturer	Address	
AgraQuest, Inc	1530 Drew Ave.	Davis, CA 95616
Agtrol	A Nufarm Americas company	
Arvesta Corp.	100 First St., Suite 1700	San Francisco, CA 94105
Aventis Crop Science	P.O. Box 12014	Research Triangle Park, NC 27709
B.A.S.F. Co. Agricultural Products Group	P.O. Box 13528	Research Triangle Park, NC 27709
Bayer Crop Science	P.O. Box 4913	Kansas City, MO 64120
Cerexagri, Inc.	630 Freedom Business Center, Suite 402	King of Prussia, PA 19406
DK International		
Dow AgroSciences LLC	9330 Zionsville Rd.	Indianapolis, IN 46268
EMRO USA	2440 N. Coyote Dr., Suite 126	Tucson, AZ 85745
Gowan Co.	P.O. Box 5569	Yuma, AZ 85366
Griffin Corp. LLC	P.O. Box 1847	Valdosta, GA 31603-1847
JMS Flower Fams, Inc.	1105 25th Ave	Vero Beach, FL 32960
Loveland Industries	P.O. Box 1289	Greeley, CO 80632
Micro Flo Co. LLC	P.O. Box 772099	Memphis, TN 37113
Nufarm Americas, Inc.	1333 Burr Ridge Parkway Suite 125A	Burr Ridge, IL 60521
NutrEcology		Fresno, CA
Petro Canada Lubricants	248 North Sheridan Way	Mississauga, Ontario Canada L5K 18A
Quimetal	Los Yacimientos 1301	Maipú Santiago Chile 7311826
Rotem BKG LLC	2115 Linwood Ave.	Ft. Lee, NJ 07024
Syngenta Crop Protection, Inc.	P.O. Box 18300	Greensboro, NC 27419
U.C.B. Chemicals Corp.	2000 Lake Park Dr.	Smyrna, GA 30080
Uniroyal Chemical Inc.	199 Benson Rd.	Middleburg, CT 06749
Valent Agricultural Products	P.O. Box 8025	Walnut Creek, CA 94596
Wilbur-Ellis Co.	P.O. Box 16458	Fresno, CA 93755