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	14d and + index	1.5 14	lb oz	Y
5	lab	Rally	10-14d	4.0	oz	Y
6	lab	Quintec	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 400	14d/season	27.3	fl oz	N
14	Bayer	Scala 400+ Flint 50WG	14d/season	20.5 1.5	fl oz oz	N
15	BASF	BAS51604F		1.46	lb	N
16	IR4	BAS51604F		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	Source1
Valent	V-10116 1.67SC			N	Valent
	V-10114 1.67FL			N	
Bayer	Scala 400	Pyremethinal	400g/L	N	Bayer
	Flint 50WG	Trifloxystrobin	50%	N	
UCB	Thiram 65WSB	Thiram	65%	Y	UCB
	Thiram L				
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%.

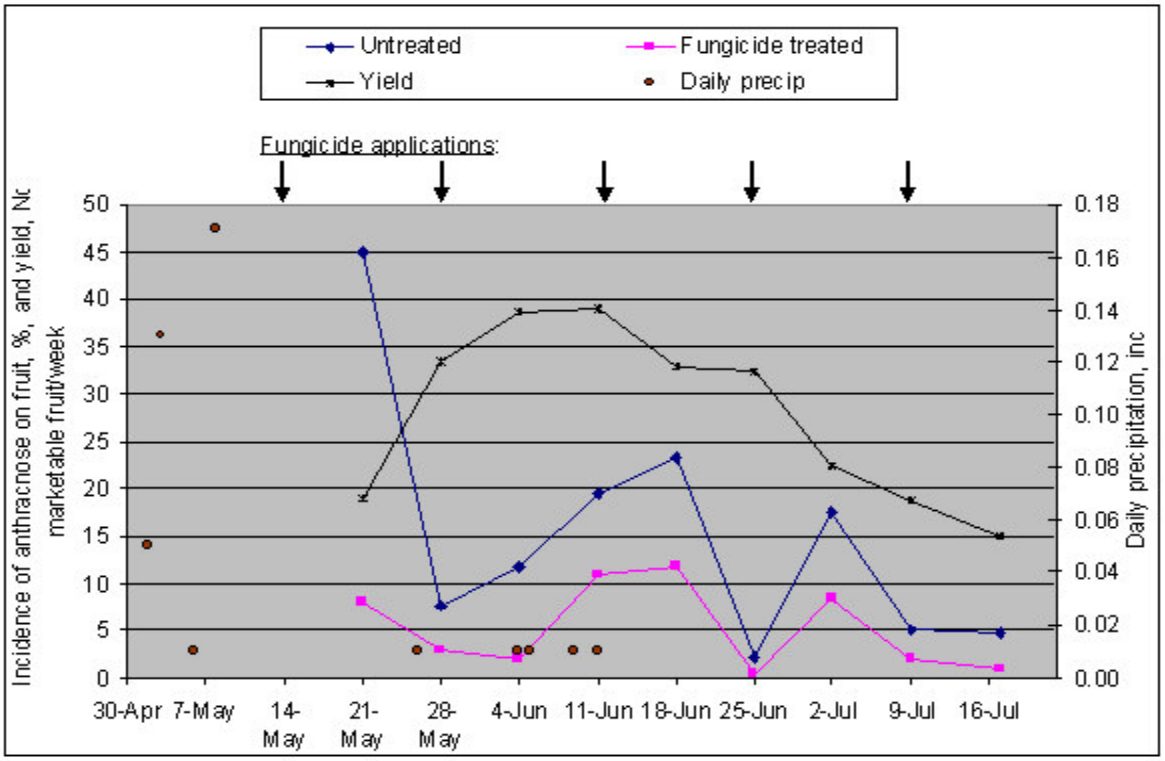

Figure 5. Fungicide applications, precipitation, yield, and anthracnose fruit disease at MBA, 2003.

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 $p \leq 0.05$.