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

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		T
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	unknown	.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	
DK Int.	Quillaja (QL35)		35%	Y	
	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; 10th 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 9th and 10th 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.

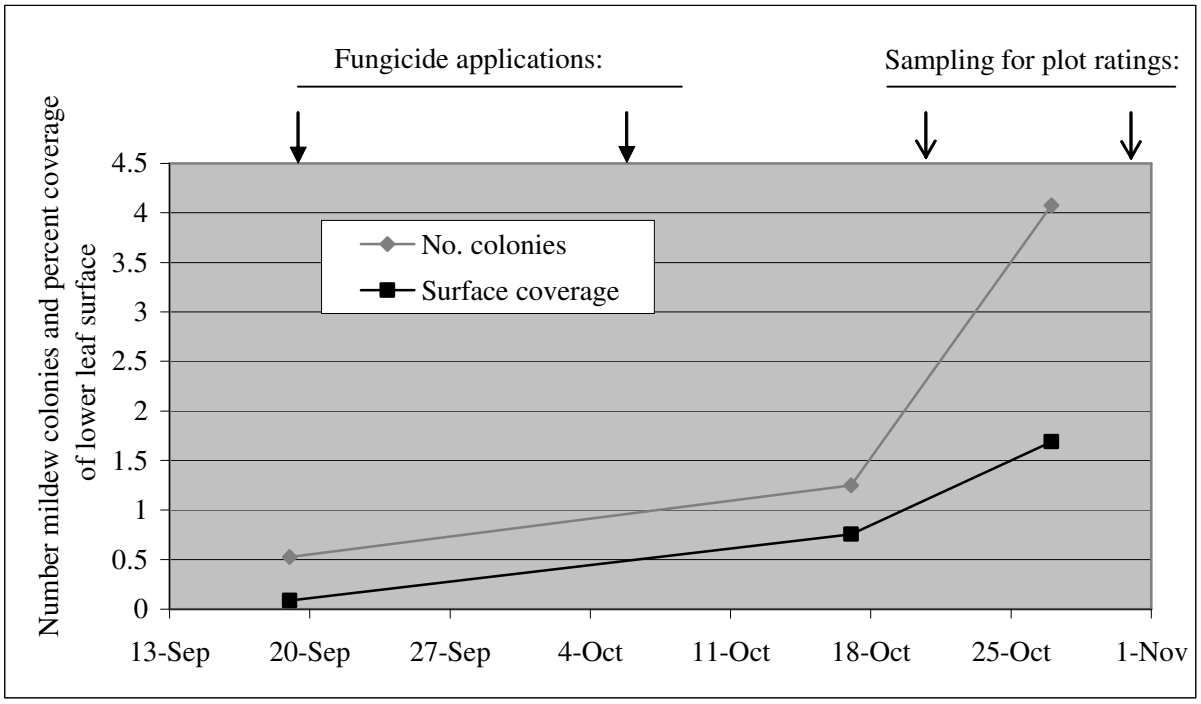

Figure 1. Disease progress in squash plots of randomly chosen leaves from border rows.

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.