Fungicide control of apple scab: 2005 trial results

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Apple scab trial, 2005

A. Introduction

Location	HoneyBear Ranch, near Camino, El Dorado County, California
Principle investigator	W. Douglas Gubler, Ph.D.
Cooperators	Jack Franklin, Charlene Carveth, Lynn Wunderlich (UC Farm Advisor)
Crop	Apple (*Malus* x *domestica*), Red Delicious variety
Disease	Apple scab (*Venturia inequalis*)

B. Material and methods

1. Trial layout

Experimental design	Complete block design with 4 replicates per treatment.		
Experimental unit	2 trees = 1 plot		
Row spacing	16 ft	Tree spacing within row	8 ft
Plot unit area	256 ft^2		
Area/treatment	1024 ft^2 (4 reps.=1 treatment)	Area/treatment	0.0235 acre/treatment
Volume water/acre	150 gallons	Vol. water/treatment	14.0 liters
Applications	A and B = pink bud, C = early bloom, D = late bloom, E = petal fall		
Application method	Stihl SR400 backpack sprayers.		
Disease evaluation	Disease incidence was evaluated about 6 weeks following the final fungicide application (8 June 2005) by rating both leaves and fruit. Fifty fruits were evaluated for the presence or absence of scab lesions. Incidence = proportion of 50 fruits infected.		
Data transformation	Untransformed data analyzed. Various transformations did not substantially improve the distribution of residuals in residual plots.		
Statistical analysis	Type III ANOVA performed on scab incidence with block and fungicide treatment as factors. *A posteriori* comparison of treatment means with a Tukey HSD test at α=0.05.		

2. Experimental treatments

Trt no.	Flag	Product(s)	Applications	FP/Acre	FP/Treatment	Notes
1	W	Unsprayed control	none	none	none	
2	Y	Dithane 75DF + Rally 40W	ABCDE	3.0 lb 4.0 oz	33.7 g 2.8 g	
3	R	Flutriafol 125	ABCDE	13 fl oz	9.5 ml	
4	B	Flutriafol 125 + Dithane 75DF	ABCDE	13 fl oz 3.0 lb	9.5 g 33.7 g	
5	O	Scala and Flint	ABCE D	10 fl oz 2.0 oz	7.3 ml 1.4 g	
6	O/B	Pristine 38WG	ABCDE	14.5 oz	10.3 g	
7	YBS	Champion WP followed by Kumulus DF	AB CDE	12.0 lb 15.0 lb	135 g 168 g	organic products
8	GBD	Procure 480SC + Dithane 75DF	BCDE	16.0 fl oz 3.0 lb	11.7 ml 33.7 g	
9	R/W	Procure 480SC alt Flint	BD CE	16.0 fl oz 2.0 oz	11.7 ml 1.4 g	

Notes: The treatments described in this report were conducted for experimental purposes only and crops treated in a similar manner may not be suitable for commercial or other use. FP=formulated product (FP/Treatment numbers include an extra 5%); alt=alternated with.

3. Materials

Product	Active Ingredient(s)	Concentration	Mechanism(s) of activity	Tol
Dithane 75DF	mancozeb	75 %	interference with cell respiration (probably)	Y
Flint 50WG	trifloxystrobin	50 %	cytochrome b disruption	Y
Flutriafol 125SC	flutriafol	125 g/L	DMI	N
Pristine	pyraclostrobin + boscalid	12.8 % 25.2 %	cytochrome b disruption undetermined	N
Procure 480SC	triflumizole	42.14 %	DMI; prevents sterol synthesis	Y
Rally 40W	myclobutanil	40 %	DMI; prevents sterol synthesis	Y
Scala 600SC	pyremethanil	600 g/L	methionine disruption	Y

Note: Tol denotes EPA approval for harvest for apples.

4. Fungicide applications

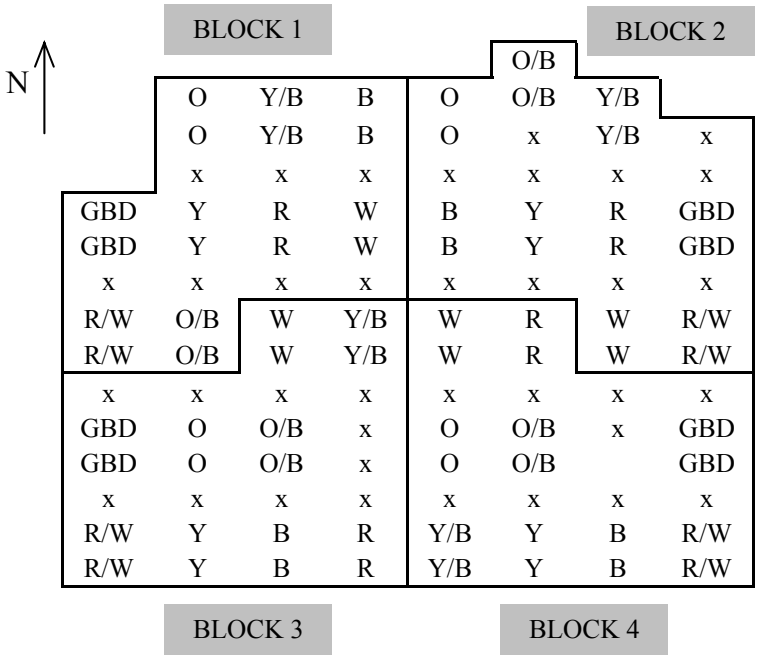
Date App. Stage	17 March A Tight cluster (pink)	24 March B Pink (tight cluster, bloom)	2 April C 30% bloom	12 April D Full bloom (pink, petal fall)	23 April E After petal fall
1	--	--	--	--	--
2	Dithane, 32 g + Rally, 2.7 g	Dithane, 32 g + Rally, 2.7 g	Dithane, 32 g + Rally, 2.7 g	Dithane, 32 g + Rally, 2.7 g	Dithane, 32 g + Rally, 2.7 g
3	Flutriafol, 9.1 ml	Flutriafol, 9.1 ml	Flutriafol, 9.1 ml	Flutriafol, 9.1 ml	Flutriafol, 9.1 ml
4	Flutriafol, 9.1 ml + Dithane, 32 g	Flutriafol, 9.1 ml + Dithane, 32 g	Flutriafol, 9.1 ml + Dithane, 32 g	Flutriafol, 9.1 ml + Dithane, 32 g	Flutriafol, 9.1 ml + Dithane, 32 g
5	Scala, 7.0 ml	Scala, 7.0 ml	Scala, 7.0 ml	Flint, 1.3 g	Scala, 7.0 ml
6	Pristine, 9.8 g	Pristine, 9.8 g	Pristine, 9.8 g	Pristine, 9.8 g	Pristine, 9.8 g
7	Champion, 128 g	Champion, 128 g	Kumulus, 168 g	Kumulus, 168 g	Kumulus, 168 g
8	--	Procure, 11.1 ml + Dithane, 32 g	Procure, 11.1 ml + Dithane, 32 g	Procure, 11.1 ml + Dithane, 32 g	Procure, 11.1 ml + Dithane, 32 g
9	--	Procure, 11.1 ml	Flint, 1.3 g	Procure, 11.1 ml	Flint, 1.3 g

5. Research calendar

Date	Research activities and observations
17 March	Setup and first fungicide application made 9:00-10:30AM (95 seconds/plot). Weather calm and cloudy. Trees at pink stage but weather dry to this date. No scab observed.
24 March	2nd application made, 8:30-10:30AM with full tanks (14L), 95 sec/plot. A few spots were observed in unsprayed treatment; these collected for culture. No obvious scab observed. Treatments 8 and 9 added to first border row on east and west.
2 April	3rd application made, 8:30-10:30AM. Weather: slight SW breeze, dry. Plants at early bloom, some trees varied to full bloom. Disease observed in untreated trees. Phytotoxicity observed in YBS treatment – leaves stunted, curled, pale, and with necrotic spots and margins.
12 April	4th application made, 9:00-11:00AM with plants at full bloom (pink, petal fall). Weather: calm, clear, and dry.
23 April	5th application made, 10:00-12:00PM. Weather: calm and cloudy. First cover spray due to possibility of rain. Light sprinkles during last application but not enough to affect application; dry following spraying for at least one hour.

6. Map of the experimental area

Figure 1. Two-tree plots were arranged with at least one untreated tree between plots. x = untreated tree.



C. Results

There was a significant treatment effect on apple scab incidence in the trial ($F_{8,24}$=47.5, p<0.0001). Further comparison of treatment means via Tukey's HSD test showed that all fungicide treatments reduced scab incidence below that of unsprayed trees, which exhibited lesions on all fruits in each replicate plot (Figure 2). Incidence was reduced below 10% in five of the eight fungicide treatments: Procure + Dithane, Flutriafol, Flutrifol + Dithane, Pristine, and Procure alternated with Flint. However, these treatments were not statistically different from fungicides with less effective scab control: Rally + Dithane (10.5% disease incidence), Champion followed by Kumulus (25.0%), and Scala/Flint (32.0%). The presence of disease on leaves among treatments mirrored that of fruit: leaves from unsprayed control plots showed a relatively high level of disease coverage whereas all fungicide-treated leaves showed a lower level of scab (data not shown).

Figure 2. Variability in daily temperature (mean, high and low) and precipitation at Camino, California for March through June 2005 (data from Station 13 of CIMIS). Letters above the figure refer to the five fungicide applications. Hail occurred on 9 and 10 May 2005.

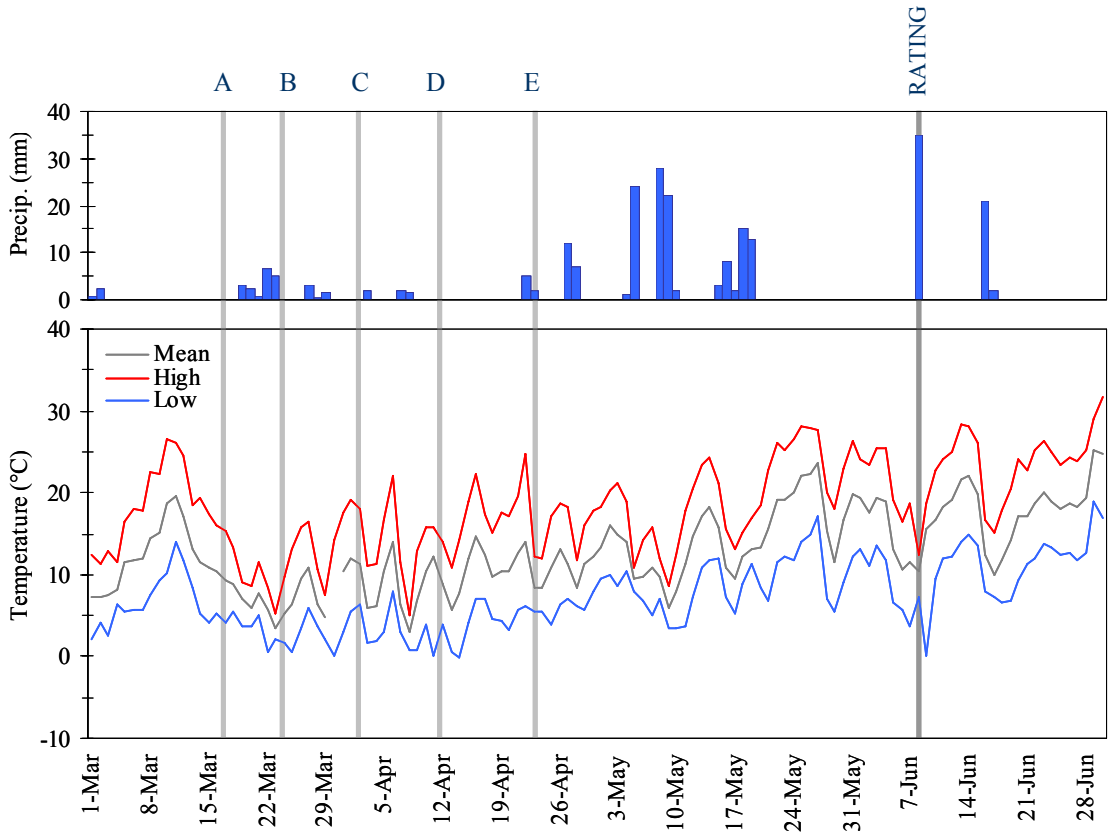
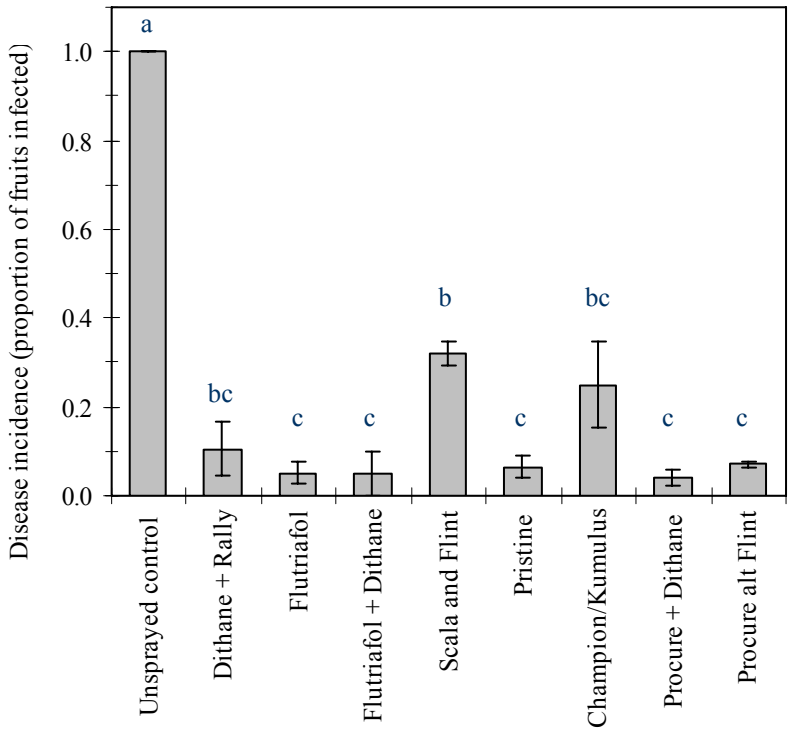


Figure 3. Disease incidence in fungicide-treated and untreated control fruits (means ±1S.E.). Letters above treatments denote significance groups (Tukey's HSD test).



D. Acknowledgements

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E. References

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