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# Final Report: Control of grape powdery mildew with synthetic, biological and organic fungicides: 2018 field trials

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## Report Summary

Powdery mildew is caused by the biotrophic fungus *Erysiphe necator* (1); this polycyclic disease of grape causes losses to crop quality and yield and is considered one of the most economically important disease of grapes worldwide. This report details the findings of our annual powdery mildew fungicide trials on grapevine (*Vitis vinifera*, Cultivar Chenin blanc – 4- yrs-old). Along with Chardonnay, Muscat blanc, Roussanne and Carignan, Chenin blanc is one of the highly susceptible wine varieties (2). This trial was conducted at the research station at the Plant Pathology Department, University of California, Davis in 2018. Treatments were placed in two adjacent trials in the vineyard in a complete randomized block design. Spraying commenced on April 24th. Due to late onset of infection, all untreated controls as well as randomly-spaced untreated vines were inoculated with powdery mildew conidial inoculum on June 11th. Conidial suspensions for the artificial infections were produced by washing infected clusters into a two gallon pump sprayer with 0.1% Tween 20. Conidia were dispersed by gentle shaking. The suspension was sprayed on the untreated vines using a Roundup two-gallon pump sprayer. By late June, mildew was evident on untreated clusters and to a degree on treated clusters. By the time of disease evaluation, disease incidence in some untreated plots reached 100%. Spraying was completed at veraison on July 25<sup>th</sup>, and treatments were evaluated for disease incidence and severity on July 30<sup>th</sup>-August 3<sup>rd</sup>.

The trials consisted of soft chemistry products and synthetic fungicides. Spray frequencies varied from weekly applications to 21-day intervals.

## Materials and Methods

### A. Experimental design

Experimental design	Complete randomized block design with 4 replicates.		
Experimental unit	2 adjacent vines = 1 plot		
Plot area	154 ft <sup>2</sup> (row spacing = 11 ft, vine spacing = 7 ft)		
Area/treatment	616 ft <sup>2</sup> (4 reps x 2 vines = 1 treatment)	Area/treatment	0.014 acre/treatment
Volume water/acre	100 gallons (pre-bloom to pea-sized berries, late April – early June) = 1.4 gallons/4 reps 150 gallons (late season) = 2.1 gallons/4 reps		
Application method	STIHL SR 430 Backpack Sprayer		

### B. Experimental treatments

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.

## Trial 1

Trt No.	Flag	Treatment	Interval (days)	Rate	FP/4 reps
1	GS	MBI-10612	14	1 qt/A	13.4 ml
2	GKS	MBI-10612 + JMS Stylet Oil	14	1 qt/A + 1% v/v	13.4 ml + 53.5 ml or 81.3 ml
3	YKD	1) MBI-1062	14	1 qt/A	13.4 ml
		2) Inspire Super + JMS Stylet Oil	21	10.5 fl oz/A	4.4 ml + 53.5 ml or 81.3 ml
		3) Luna Experience	21	6 fl oz/A	2.5 ml
4	PKC	Mastercop	7 (3x)	1.5 qt/A	20.1 ml
5	B	Mastercop	7 (3x)	1 pt/A	6.7 ml
6	BKS	Kocide 3000	7 (3x)	1.5 lb/A	9.6 g
7	BD	Badge X2	7 (3x)	1 lb/A	6.4 g
8	YD	Silmatrix	14	1% v/v	53.5 ml or 81.3 ml
9	Y	OSO 5% SC + Kinetic	14	6.5 fl oz + 0.125% v/v	4.0 ml + 6.7 ml or 10.1 ml
10	P	Silmatrix alt OSO 5% SC + Kinetic	14	1% v/v alt 6.5 fl oz + 0.125% v/v	53.5 ml or 81.3 ml alt 4.0 ml + 6.7 ml or 10.1 ml
11	OKS	T2	14	500 ppm	premeasured
12	K	T3	14	250 ppm	premeasured
13	YC	T4	14	250 ppm	premeasured
14	OKD	1) Torino + Sonata + Syl-Coat	14	3.4 fl oz + 64 fl oz + 4 fl oz	2.1 ml + 26.8 ml + 2.5 ml
		2) Prolivo + Sonata + Syl-Coat		5 fl oz + 64 fl oz + 4 fl oz	3.1 ml + 26.8 ml + 2.5 ml
		3) Laguna + Sonata Syl-Coat		5 fl oz + 64 fl oz + 4 fl oz	3.1 ml + 26.8 ml + 2.5 ml
		4) Quintec + Sonata + Syl-Coat		5 fl oz + 64 fl oz + 4 fl oz	3.1 ml + 26.8 ml + 2.5 ml
		5) Luna Experience + Sonata + Syl-Coat		5 fl oz + 64 fl oz + 4 fl oz	3.1 ml + 26.8 ml + 2.5 ml
		6) Prolivo + Sonata + Syl-Coat		5 fl oz + 64 fl oz + 4 fl oz	3.1 ml + 26.8 ml + 2.5 ml
		7) Sonata + SylCoat®		96 fl oz + 4 fl oz	59.6 ml + 2.5 ml
15	KC	1) Torino + Sulfur DF + Syl-Coat	14	3.4 fl oz + 5 lb + 4 fl oz	2.1 ml + 32.1 g + 2.5 ml
		2) Prolivo + Sulfur DF + Syl-Coat		5 fl oz + 5 lb + 4 fl oz	3.1 ml + 32.1 g + 2.5 ml
		3) Laguna + Sulfur DF + Syl-Coat		5 fl oz + 5 lb + 4 fl oz	3.1 ml + 32.1 g + 2.5 ml
		4) Quintec + Sulfur DF + Syl-Coat		5 fl oz + 5 lb + 4 fl oz	3.1 ml + 32.1 g + 2.5 ml
		5) Luna Experience + Sulfur DF + Syl-Coat		5 fl oz + 5 lb + 4 fl oz	3.1 ml + 32.1 g + 2.5 ml
		6) Prolivo + Sulfur DF + Syl-Coat		5 fl oz + 5 lb + 4 fl oz	3.1 ml + 32.1 g + 2.5 ml
		7) Sulfur DF Syl-Coat		5 lb + 4 fl oz	32.1 g + 2.5 ml
16	GKC	1) Sonata + Sulfur DF + Syl-Coat	10	1) 96 fl oz + 6 lb + 4 fl oz	1) 59.6 ml + 38.5 g + 2.5 ml
		2) Sonata + Sulfur DF + Syl-Coat		2) 96 fl oz + 6 lb + 4 fl oz	2) 59.6 ml + 38.5 g + 2.5 ml

		3) Sonata + Sulfur DF + Syl-Coat		3) 96 fl oz + 6 lb + 4 fl oz	3) 59.6 ml + 38.5 g + 2.5 ml
		4) Sonata + Purespray + Syl-Coat		4) 96 fl oz + 1 gal + 4 fl oz	4) 59.6 ml + 53.5 ml + 2.5 ml
		5) Sonata + Purespray + Syl-Coat		5) 96 fl oz + 1 gal + 4 fl oz	5) 59.6 ml + 53.5 ml + 2.5 ml
		6) Sonata + Purespray Syl-Coat		6) 96 fl oz + 1 gal + 4 fl oz	6) 59.6 ml + 53.5 ml + 2.5 ml
17	BC	Trabon	7 - 14	4.5 fl oz/25 gal	11.2 ml or 16.8 ml
18	Pu	Trabon	7 - 14	8 fl oz/25 gal	20 ml or 30 ml
19	PKS	Trabon	7 - 14	12 fl oz/25 gal	30 ml or 40 ml
20	RKD	Quintec alt Flint	14	6.6 fl oz alt 2 oz	4.0 ml alt 0.8 g
21	BS	Biosa Probiotic	7	1:10	534 ml or 801 ml
22	GKD	Biosa Probiotic	7	1:20	267 ml or 411 ml
23	W	Untreated Control (UTC)			

## Trial 2

Trt No.	Flag	Treatment	Interval (Days)	Rate	FP/4 reps
1	GS	1) Luna Experience + Syl-Coat	14	1) 8.6 fl oz + 4 fl oz/100 gal	1) 5.4 ml + 2.5 ml or 3.8 ml
		2) Quintec + Syl-Coat		2) 5 fl oz + 4 fl oz/100 gal	2) 3.1 ml + 2.5 ml or 3.8 ml
		3) Flint Extra + Syl-Coat		3) 3.8 fl oz + 4 fl oz/100 gal	3) 2.4 ml + 2.5 ml or 3.8 ml
		4) Torino + Syl-Coat		4) 3.4 fl oz + 4 fl oz/100 gal	4) 1.4 ml + 2.5 ml or 3.8 ml
		5) Flint Extra + Syl-Coat		5) 3.8 fl oz + 4 fl oz/100 gal	5) 2.4 ml + 2.5 ml or 3.8 ml
		6) Mettle + Syl-Coat		6) 4 fl oz + 4 fl oz/100 gal	6) 2.5 ml+ 2.5 ml or 3.8 ml
2	GKS	1) Luna Experience + Syl-Coat	14	1) 8.6 fl oz + 4 fl oz/100 gal	1) 5.4 ml + 2.5 ml or 3.8 ml
		2) Quintec + Syl-Coat		2) 5 fl oz + 4 fl oz/100 gal	2) 3.1 ml + 2.5 ml or 3.8 ml
		3) Flint Extra + Serenade Opti + Syl-Coat		3) 3.8 fl oz + 4 oz + 4 fl oz/100 gal	3) 2.4 ml + 1.6 g 2.5 ml or 3.8 ml
		4) Torino + Syl-Coat		4) 3.4 fl oz + 4 fl oz/100 gal	4) 1.4 ml + 2.5 ml or 3.8 ml
		5) Flint Extra + Serenade Opti + Syl-Coat		5) 3.8 fl oz + 4 oz + 4 fl oz/100 gal	5) 2.4 ml + 1.6 g + 2.5 ml or 3.8 ml
		6) Mettle + Syl-Coat		6) 4 fl oz + 4 fl oz/100 gal	6) 2.5 ml+ 2.5 ml or 3.8 ml
3	YKD	Luna Tranquility + Sylcoat	14	14 fl oz + 4 fl oz/100 gal	8.7 ml + 2.5 ml or 3.8 ml
4	PKC	Quintec alt Flint	14	6.6 fl oz alt 2 oz	4.1 ml alt 0.8 g
5	B	Rhyme	14	5 fl oz	3.1 ml
6	BKS	1) Inspire Super	14	1) 20 fl oz	1) 12.4 ml
		2) Inspire Super		2) 20 fl oz	2) 12.4 ml
		3) Quintec		3) 4 fl oz	3) 2.5 ml
		4) Quintec		4) 4 fl oz	4) 2.5 ml
		5) Luna Experience + Kinetic		5) 8.6 fl oz + 0.25% v/v	5) 5.3 ml + 13.4 ml or 20.1 ml
		6) Luna Experience + Kinetic		6) 8.6 fl oz + 0.25% v/v	6) 5.3 ml + 13.4 ml or 20.1 ml
7	BD	1) Rhyme	14	1) 5 fl oz	1) 3.1 ml
		2) Rhyme		2) 5 fl oz	2) 3.1 ml
		3) Quintec		3) 4 fl oz	3) 2.5 ml
		4) Quintec		4) 4 fl oz	4) 2.5 ml
		5) F4406 + Kinetic		5) 6 fl oz + 0.25% v/v	5) 3.7 ml + 13.4 ml or 20.1 ml
		6) F4406 + Kinetic		6) 6 fl oz + 0.25% v/v	6) 3.7 ml + 13.4 ml or 20.1 ml
8	YD	1) Inspire Super	14	1) 20 fl oz	1) 12.4 ml
		2) Inspire Super		2) 20 fl oz	2) 12.4 ml
		3) Quintec		3) 4 fl oz	3) 2.5 ml
		4) Quintec		4) 4 fl oz	4) 2.5 ml
		5) F4406 + Kinetic		5) 6 fl oz + 0.25% v/v	5) 3.7 ml + 13.4 ml or 20.1 ml
		6) F4406 + Kinetic		6) 6 fl oz + 0.25% v/v	6) 3.7 ml + 13.4 ml or 20.1 ml
9	Y	1) Rhyme (Drip)	14	1) 5 fl oz	1) 3.1 ml
		2) Rhyme (Drip)		2) 5 fl oz	2) 3.1 ml
		3) Quintec		3) 4 fl oz	3) 2.5 ml
		4) Quintec		4) 4 fl oz	4) 2.5 ml
		5) F4406 + Kinetic		5) 6 fl oz + 0.25% v/v	5) 3.7 ml + 13.4 ml or 20.1 ml
		6) F4406 + Kinetic		6) 6 fl oz + 0.25% v/v	6) 3.7 ml + 13.4 ml or 20.1 ml
10	P	Rhyme (Drip) (6x)	14	5 fl oz	3.1 ml
11	OKS	Rhyme (Drip) (3x)	14	5 fl oz	3.1 ml

12	K	Rhyme (Drip) (2x)	14	5 fl oz	3.1 ml
13	YC	Luna Experience	14	6 fl oz	3.7 ml
14	OKD	Lifegard WG	14	4.5 oz/100 gal	1.8 g or 2.7 g
15	KC	Lifegard WG alt Luna Experience	14	4.5 oz/100 gal alt 6 fl oz	1.8 g or 2.7 g alt 3.7 ml
16	GKC	1) Merivon	14	1) 5.5 fl oz	1) 3.4 ml
		2) Vivando + Sulfur DF + Kinetic		2) 15 fl oz + 3 lb + 0.125% v/v	2) 9.3 ml + 19.2 g + 6.7 ml or 10.1 ml
		3) Pristine + Kinetic		3) 23 oz + 0.125% v/v	3) 9.2 g + 6.7 ml or 10.1 ml
		4) BAS 750 07F + Kinetic		4) 5 fl oz + 0.125% v/v	4) 3.1 ml + 6.7 ml or 10.1 ml
		5) Vivando + Kinetic		5) 15 fl oz + 0.125% v/v	5) 9.3 ml + 6.7 or 10.1 ml
		6) Merivon		6) 5.5 fl oz	6) 3.4 ml
17	BC	1) Sulfur to 12-18 in	14	1) 5 lb	1) 32.1 g
		2) Rally + Kinetic		2) 5 oz + 0.125% v/v	2) 2 g + 6.7 ml or 10.1 ml
		3) Quintec + Kinetic		3) 6.5 fl oz + 0.125% v/v	3) 4.0 ml + 6.7 ml or 10.1 ml
		4) Torino + Kinetic		4) 3.4 fl oz + 0.125% v/v	4) 2.1 ml + 6.7 ml or 10.1 ml
18	Pu	1) Sulfur to 12-18 in	14	1) 5 lb	1) 32.1 g
		2) Rally + Kinetic		2) 5 oz + 0.125% v/v	2) 2 g + 6.7 ml or 10.1 ml
		3) Quintec + Kinetic		3) 6.5 fl oz + 0.125% v/v	3) 4.0 ml + 6.7 ml or 10.1 ml
		4) Luna Experience + Kinetic		4) 6 fl oz + 0.125% v/v	4) 3.7 ml + 6.7 or 10.1 ml
19	PKS	1) Sulfur to 12-18 in	14	1) 5 lb	1) 32.1 g
		2) Rally + Kinetic		2) 5 oz + 0.125% v/v	2) 2 g + 6.7 ml or 10.1 ml
		3) Quintec + Kinetic		3) 6.5 fl oz + 0.125% v/v	3) 4.0 ml + 6.7 ml or 10.1 ml
		4) Pristine + Kinetic		4) 12.5 oz + 0.125% v/v	4) 5 g + 6.7 ml + 10.1
20	RKD	1) Sulfur to 12-18 in	14	1) 5 lb	1) 32.1 g
		2) Rally + Kinetic		2) 5 oz + 0.125% v/v	2) 2 g + 6.7 ml or 10.1 ml
		3) Quintec + Kinetic		3) 6.5 fl oz + 0.125% v/v	3) 4.0 ml + 6.7 ml or 10.1 ml
		4) Merivon + Kinetic		4) 4 oz + 0.125% v/v	4) 2.5 ml + 6.7 ml or 10.1 ml
21	BS	1) Miravis Prime + Kinetic	14	1) 11. 4 fl oz + 0.125% v/v	1) 7.1 ml + 6.7 ml or 10.1 ml
		2) Miravis Prime + Kinetic		2) 11. 4 fl oz + 0.125% v/v	2) 7.1 ml + 6.7 ml or 10.1 ml
		3) Quintec + Kinetic		3) 4 fl oz + 0.125% v/v	3) 2.5 ml + 6.7 ml or 10.1 ml
		4) Miravis Prime + Kinetic		4) 11. 4 fl oz + 0.125% v/v	4) 7.1 ml + 6.7 ml or 10.1 ml
		5) Miravis Prime + Kinetic		5) 11. 4 fl oz + 0.125% v/v	5) 7.1 ml + 6.7 ml or 10.1 ml
22	GKD	1) Miravis Prime + Kinetic	14	1) 13.5 fl oz + 0.125% v/v	1) 8.4 ml + 6.7 ml or 10.1 ml
		2) Miravis Prime + Kinetic		2) 13.5 fl oz + 0.125% v/v	2) 8.4 ml + 6.7 ml or 10.1 ml
		3) Quintec + Kinetic		3) 4 fl oz + 0.125% v/v	3) 2.5 ml + 6.7 ml or 10.1 ml
		4) Miravis Prime + Kinetic		4) 13.5 fl oz + 0.125% v/v	4) 8.4 ml + 6.7 ml or 10.1 ml
		5) Miravis Prime + Kinetic		5) 13.5 fl oz + 0.125% v/v	5) 8.4 ml + 6.7 ml or 10.1 ml

23	YKS	1) Aprovia Top + Kinetic	14	1) 13.5 fl oz + 0.125% v/v	1) 8.4 ml + 6.7 ml or 10.1 ml
		2) Aprovia Top + Kinetic		2) 13.5 fl oz + 0.125% v/v	2) 8.4 ml + 6.7 ml or 10.1 ml
		3) Quintec + Kinetic		3) 4 fl oz + 0.125% v/v	3) 2.5 ml + 6.7 ml or 10.1 ml
		4) Aprovia Top + Kinetic		4) 13.5 fl oz + 0.125% v/v	4) 8.4 ml + 6.7 ml or 10.1 ml
		5) Aprovia Top + Kinetic		5) 13.5 fl oz + 0.125% v/v	5) 8.4 ml + 6.7 ml or 10.1 ml
24	KS	1) Luna Experience + Kinetic	14	1) 6 fl oz + 0.125% v/v	1) 3.7 ml + 6.7 ml or 10.1 ml
		2) Luna Experience + Kinetic		2) 6 fl oz + 0.125% v/v	2) 3.7 ml + 6.7 ml or 10.1 ml
		3) Quintec + Kinetic		3) 4 fl oz + 0.125% v/v	3) 2.5 ml + 6.7 ml or 10.1 ml
		4) Luna Experience + Kinetic		4) 6 fl oz + 0.125% v/v	4) 3.7 ml + 6.7 ml or 10.1 ml
		5) Luna Experience + Kinetic		5) 6 fl oz + 0.125% v/v	5) 3.7 ml + 6.7 ml or 10.1 ml
25	O	SA-0040105	14	3.2 fl oz	2.0 ml
26	KD	Mettler 125 ME	14	4 fl oz	2.5 ml
27	W				

### C. Maps

Trial 1



7	RKD	OKS	PKC	Y	K	BS	KC	OS	P	BD	YC	PKS	W	GKD	YKD	•			
6	YD	•	•	GS	•	•	O	•	•	BKS	GKS	Pu	OKD	GKC	BC	B	BC	KC	•
5	B	GKD	BS	O	GS	PKC	Pu	OKS	PKS	GKS	BD	OS	GKC	K	YKD	•			
4	YC	OKD	W	•	•	Y	YD	P	BKS	RKD	O	GKD	W	BC	GKC	RKD	•		
3	Pu	OKD	KC	BKS	Y	BD	P	PKC	GKS	OKS	B	YKD	OS	K	PKS	•			
2	YC	•	YD	GS	BS	GKC	•	GKC	K	RKD	OS	YKD	GS	BC	YD	Pu	GKS	•	
1	GKD	OKS	BKS	PKC	OKD	W	O	KC	B	YC	BD	P	PKS	BS	Y	•			

x

Trial 2

16	BS	•	•	•	•	P	•	•	PKC	•	•	•							
15	KS	B	GKC	BKS	GD	YC	•	GKS	•	•	KC	RKD	GS	PKS	Pu	YD	GKD		
14	BS	K	PKC	BC	YKS	•	BD	W	OKD	O	Y	YKD	YS	OKS	KD	K			
13	OKD	B	•	•	KS	•	•	GD	OKS	BD	•	O	YKD	YD	GKD	•	Y	KD	•
12	•	OKD	RKD	GKS	BKS	YKS	P	YS	BC	Pu	YC	GS	W	KC	GKC	PKS			
11	K	GD	PKC	Pu	PKS	KD	B	GKS	BC	P	YS	GKC	KS	•	BKS	YKD			
10	•	YC	GS	•	YKS	YD	OKS	GKD	W	Y	•	BS	RKD	BD	O	•	KC	•	
9	GD	Y	YC	GKC	GS	•	•	OKD	BD	KD	•	W	Pu	PKC	BC	PKS	KC		
8	P	YKS	YKD	K	KS	GKS	BKS	O	B	GKD	YD	BS	OKS	YS	RKD	•			









## E. Vine Management

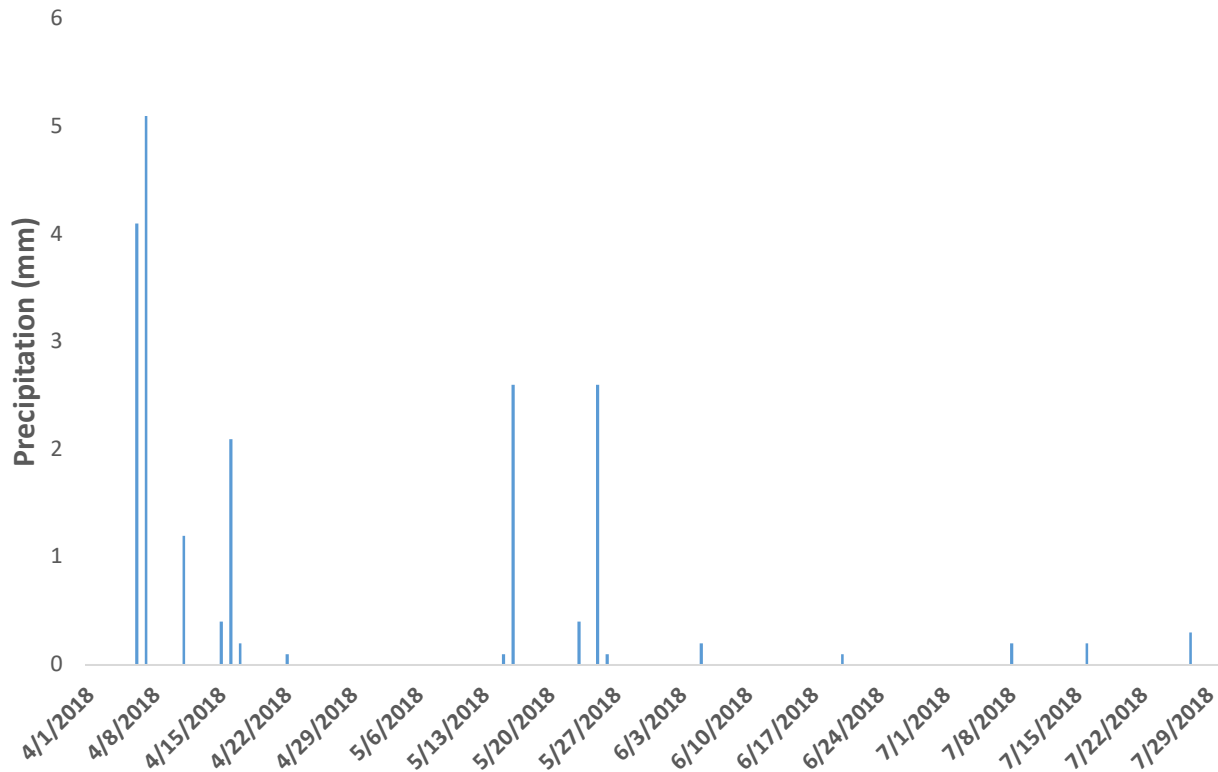
During the application period, vines were irrigated by drip irrigation. Sucker shoot removal and leafing were done during the duration of trial.

## F. Data Collection and Statistics

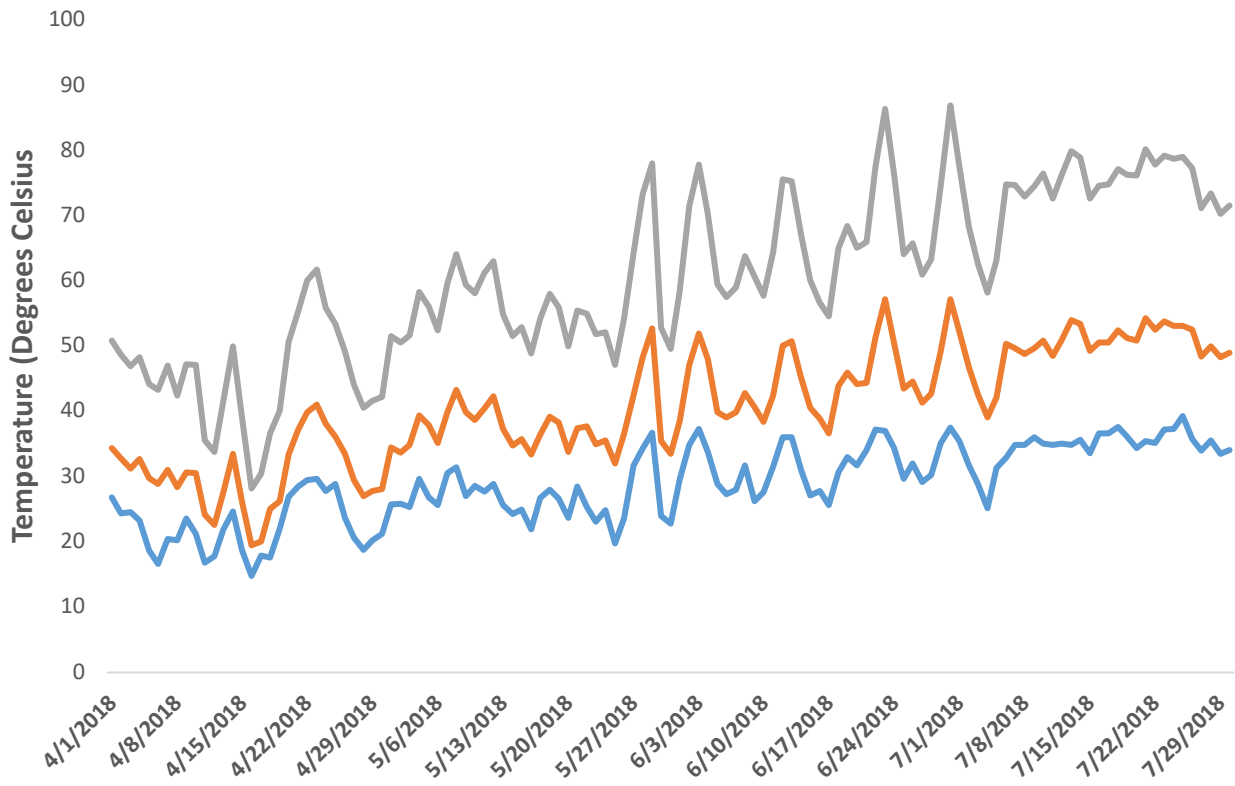
Daily temperature, precipitation and Gubler-Thomas Risk Index values were obtained from a CIMIS weather station in west Davis (CI006). The temperature data is shown in Figure 1.

Fourteen precipitation events were recorded between April 6<sup>th</sup> through July 30<sup>th</sup> (Figure 2). Powdery mildew incidence and severity were assessed in each plot by evaluating twenty-five random clusters. Incidence was defined as the proportion of clusters in a plot having some living powdery mildew. Severity was determined by estimating the percentage of area of a cluster that was infected; the severity value of all clusters was then averaged to give a plot-wide estimate of disease severity. Mean incidence and severity values for each treatment were computed. Trial models were analyzed using the ANOVA Tests for data. Means comparisons were made using Fisher's LSD with  $\alpha=0.05$ .

**Figure 1.** Daily precipitation from April 1 to July 30, 2018 from CIMIS weather station, Davis, CA.



**Figure 2.** Temperature from April 1 to July 30, 2018 from CIMIS weather station, Davis, CA.



## Results

**Table 1.** Disease incidence and severity in trial I. Product names are followed by rate (per acre) and the frequency of application. Treatment means followed by the same letter are not significantly different according to Fisher's LSD at  $\alpha=0.05$ ; alt = alternated with; fb = followed by.

Treatment	Mean Severity (%)		Mean Incidence (%)	
Biosa probiotic, 1:10 7d	0.0	d	1.0	g
MBI 10612, 1qt, 14d then Inspire Super, 10.5 fl oz + JMS Stylet Oil, 1%, 21d then Luna Experience, 6 fl oz, 21d	0.0	d	0.0	g
Quintec, 6.6 alt Flint, 2 oz, 14d	0.0	d	3.0	g
Torino, 3.4 fl oz + Sonata, 64 fl oz fb Prolivo, 5 fl oz + Sonata, 64 fl oz fb Laguna, 5 fl oz + Sonata, 64 fl oz fb Quintec 2.08, 5 fl oz + Sonata 64 fl oz fb Luna Experience 5 fl oz + Sonata, 64 fl oz fb Prolivo, 5 fl oz + Sonata 64 fl oz fb Sonata, 64 fl oz (all + Syl-Coat, 4 fl oz) 14d	0.0	d	0.0	g
Torino, 3.4 fl oz + Sulfur DF, 5 lb fb Prolivo 5 fl oz + Sulfur DF, 5 lb fb Laguna, 5 fl oz + Sulfur DF, 5 lb fb Quintec 2.08, 5 fl oz + Sulfur, 5 lb fb Luna Experience, 5 fl oz + Sulfur DF, 5 lb fb Prolivo, 5 fl oz + Sulfur DF, 5 lb fb Sulfur DF, 5 lb (all + Syl-Coat) 14d	0.0	d	0.0	g
Sonata, 96 fl oz + Sulfur DF, 6 lb (3x) (all + Sylcoat) fb Sonata, 96 fl oz + Purespray, 1 gal (3x) (all + Syl-Coat), 10 d	0.1	d	2.0	g
MBI-10612, 1 qt + JMS Stylet Oil, 1%, 14d	0.2	d	3.0	g
Trabon, 12 fl oz/25 gal, 7-14d	0.3	d	5.0	g
MBI-10612, 1 qt, 14d	0.4	d	12.0	fg
Trabon, 4.5 fl oz/25 gal, 7-14d	0.8	d	14.0	fg
Silmatrix alt OSO 5 % SC, 6.5 fl oz + Kinetic, 0.125%, 14 d	1.1	cd	18.0	efg
Trabon, 8 fl oz/25 gal, 7-14d	1.6	cd	12.0	fg
OSO 5% SC, 6.5 fl oz + Kinetic, 0.125%, 14d	2.7	cd	36.6	def
Biosa probiotic, 1:20, 7d	2.8	cd	24.0	efg
T2, 500 ppm, 14d	2.9	cd	49.8	cd
T3, 250 ppm, 14d	3.0	cd	42.0	de
Mastercop, 1.5qt, (3x) 7d	5.1	cd	57.0	bcd
Sil-Matrix, 1%, 14d	6.8	cd	53.0	bcd
Kocide 3000, 1 lb, (3x) 7d	7.4	cd	60.1	bcd
Badge X2, 1 lb, (3x) 7d	16.3	bcd	73.0	bc
Mastercop, 1pt,(3x) 7d	18.4	bc	72.0	bc
UTC	32.3	ab	100.0	a
T4, 250 ppm, 14d	44.5	a	77.0	ab

**Table 2.** Disease incidence and severity in trial II. Product names are followed by rate (per acre) and the frequency of application. Treatment means followed by the same letter are not significantly different according to Fisher's LSD at  $\alpha=0.05$ ; alt = alternated with; fb = followed by.

Treatment	Mean Severity (%)		Mean Incidence (%)	
Aprovia Top, 11.4 fl oz (2x) fb Quintec, 4 fl oz fb Aprovia Top, 13.5 fl oz (2x) all w/ Kinetic, 0.125% v/v 14d	0.0	c	0.0	d
Inspire Super, 20 fl oz (2x) fb Quintec, 4 fl oz (2x) fb F4406, 6 fl oz + Kinetic, 0.25% v/v (2x) 14d	0.0	c	0.0	d
Inspire Super, 20 fl oz (2x) fb Quintec, 4 fl oz (2x) fb Luna Experience, 8.6 fl oz + Kinetic, 0.25% 14d	0.0	c	1.0	d
LifegardWG, 4.5 fl oz/100 gal alt Luna Experience, 6 fl oz ,14d	0.0	c	1.0	d
Luna Experience, 6 fl oz (2x) fb Quintec, 4 fl oz fb Luna Experience, 6 fl oz (2x) all w/ Kinetic, 0.125% v/v 14d	0.0	c	1.0	d
Luna Experience, 6 fl oz, 14d	0.0	c	0.0	d
Luna Experience, 8.6 fl oz fb Quintec, 5 fl oz fb Flint Extra, 3.8 fl oz + Serenade Opti, 4 oz fb Torino, 3.4 fl oz fb Flint Extra, 3.8 fl oz + Serenade Opti, 4 oz fb Mettle, 4 fl oz (all + Sylcoat, 4 fl oz/100 gal)14d	0.0	c	0.0	d
Luna Experience, 8.6 fl oz fb Quintec, 5 fl oz fb Flint Extra, 3.8 fl oz fb Torino, 3.4 fl oz fb Flint Extra, 3.8 fl oz fb Mettle, 4 fl oz (all + Syl-Coat, 4 fl oz/100 gal)14d	0.0	c	1.0	d
Luna Tranquility, 14 fl oz + Syl-Coat, 4 fl oz/100 gal, 14d	0.0	c	0.0	d
Mettle 125 ME, 4 fl oz, 14d	0.0	c	0.0	d
Miravis Prime, 13.5 fl oz (2x) fb Quintec, 4 fl oz fb Miravis Prime, 13.5 fl oz (2x) all w/ Kinetic, 0.125% v/v 14d	0.0	c	0.0	d
Rhyme (Drip), 5 fl oz (2x) fb Quintec, 4 fl oz (2x) fb F4406, 6 fl oz + Kinetic 0.125% v/v (2x) 14d	0.0	c	0.0	d
Rhyme, 5 fl oz 14d	0.0	c	0.0	d
SA-0040105, 3.2 fl oz, 14d	0.0	c	0.0	d
Sulfur to 12-18, 5 lb fb Rally, 5 fl oz + Kinetic, 0.125% v/v fb Quintec, 6.5 fl oz + Kinetic, 0.125% v/v fb Luna Experience, 6 fl oz + Kinetic, 0.125% v/v 14d	0.0	c	0.0	d
Sulfur to 12-18, 5 lb fb Rally, 5 fl oz + Kinetic, 0.125% v/v fb Quintec, 6.5 fl oz + Kinetic, 0.125% v/v fb Pristine, 12.5 oz + Kinetic, 0.125% v/v 14d	0.0	c	0.0	d
Sulfur to 12-18, 5 lb fb Rally, 5 fl oz + Kinetic, 0.125% v/v fb Quintec, 6.5 fl oz + Kinetic, 0.125% v/v fb Torino, 3.4 fl oz + Kinetic, 0.125% v/v 14d	0.0	c	0.0	d
Miravis Prime, 11.4 fl oz (2x) fb Quintec, 4 fl oz fb Miravis Prime, 13.5 fl oz (2x) all w/ Kinetic, 0.125% v/v 14d	0.0	c	1.0	d
Rhyme, 5 fl oz (2x) fb Quintec, 4 fl oz (2x) fb F4406, 6 fl oz + Kinetic, 0.25% (2x) 14d	0.0	c	1.0	d
Sulfur to 12-18, 5 lb fb Rally, 5 fl oz + Kinetic, 0.125% v/v fb Quintec, 6.5 fl oz + Kinetic, 0.125% v/v fb Merivon, 4 oz + Kinetic, 0.125% v/v 14d	0.0	c	1.0	d
Quintec, 6.6 fl oz alt Flint, 2.0 fl oz, 14d	0.1	c	2.0	d
Lifegard-WG, 4.5 oz/100 gal, 14d	0.1	c	4.0	d
Merivon, 5.5 fl oz fb Vivando, 15 fl oz + Sulfur, 3 lb + Kinetic, 0.125% v/v fb Pristine, 23 oz + Kinetic, 0.125% v/v fb BAS 750 07F, 5 fl oz + Kinetic, 0.125% v/v fb Vivando, 15 fl oz + Kinetic, 0.125% v/v fb Merivon, 5.5 fl oz 14d	0.1	c	3.0	d
Rhyme (Drip) (2x), 5 fl oz, 14d	2.1	c	40.0	c
Rhyme (Drip) (6x), 5 fl oz, 14d	8.5	b	62.0	b
Rhyme (Drip) (3x), 5 fl oz, 14d	9.8	b	60.0	b
UTC	20.3	a	95	a

## Acknowledgements

Thanks to the various industry donors for providing testing materials.

## Appendix Materials

Product	Active ingredient(s) and concentration	Manufacturer or distributor	Chemical class (after Adaskaveg et al. 2008)
Aprovia TOP	Difenoconazole (10.95%) Benzovindiflupyr (7.30%)	Syngenta	SDHI (7)
Badge X2	Copper Oxychloride (23.82%) Copper Hydroxide (21.49%)	Gowan	Inorganic (M01)
BAS 750 07F	Proprietary	N/A	proprietary
Flint 50 WDG	Trifloxystrobin (50%)	Bayer CropScience	QoI (11)
Inspire super	Difenoconazole (8.4%), Cyprodinil (24.1%)	Syngenta Crop Protection, Inc.	DMI (3)/anilinopyrimidine (9)
JMS Stylet Oil	Paraffinic oil (97.1%)	JMS Flower Farms, Inc.	oil
Kinetic	Proprietary blend of polyalkyleneoxide modified polymethylsiloxane and nonionic surfactant (99.00%)	Helena Chemical Co.	Adjuvant
Kocide 3000	Copper Hydroxide (46.1%)	multiple	Inorganic (M01)
Laguna	Difenoconazole (23.2%)	Wilbur-Ellis	DMI-triazole (3)
Luna Experience	Fluopyram (17.54%), Tebuconazole (17.54%)	Bayer CropScience	SDHI (7)/DMI-triazole (3)
Mastercop	Copper sulfate pentahydrate (21.46%)	ADAMA	Inorganic (M01)
MBI-10612	proprietary	N/A	proprietary
Merivon	Pyraclostrobin (21.26%) / Fluxapyroxad (21.26%)	BASF	SDHI (7)/QoI (11)
Mettle 125 ME	Tetraconazole (11.6%)	Gowan Co.	DMI-triazole (3)
Miravis Prime	Fludioxonil (21.4%) Pydiflumetofen	Syngenta	SDHI (7)
OSO 5% SC	Polyoxin D zinc salt (5.0%)	Certis	peptidyl pyrimidine nucleoside (19)
Pristine	Pyraclostrobin (12.8%) boscalid (25.2%)	BASF	SDHI (7)/QoI(11)
Pristine 38 WG	Pyraclostrobin (12.8%) boscalid (25.2%)	BASF	SDHI (7)/QoI(11)
Probiotic	Proprietary	N/A	proprietary
Prolivo + NIS	Pyriofenone (27.3%)	Summit Agro USA	apressoria formation inhibitor



Purespray	Mineral oil (98%)	Petro-Canada	oil
Quintec 2.08 F	Quinoxifen (22.6%)	Dow AgroSciences LLP	quinoline (13)
Rally 40 WSP	Myclobutanil (40%)	Dow AgroSciences LLC	DMI-triazole (3)
Regalia	Extract of <i>Reynoutria sachalinensis</i> (5%)	Marrone Bio Innovations	plant extract
Rhyme	Flutriafol (22.7 %)	Cheminova Inc	DMI-triazole (3)
SA-0040105 (SC)	proprietary	N/A	proprietary
Serenade	<i>Bacillus subtilis</i> QST 713 (26%)	Bayer CropScience	biological
Sil-Matrix	Potassium silicate (29%)	Certis	Potassium silicate
Sonata	<i>Bacillus pumilus</i> QST 2808 (1.38%)	Bayer CropScience	biological
Sulfur DF	Sulfur (80%)	Wilbur-Ellis	Inorganic (M2)
Switch	Cyprodinil (37.5%), Fludioxonil (25%)	Syngenta Crop Protection	anilino-pyrimidine (9)/phenylpyrrole (12)
Sylcoat	Polyether-polymethylsiloxanecopolymer and Polyether (100%)	Wilbur-Ellis	adjuvant
T2	Proprietary	N/A	Proprietary
T3	Proprietary	N/A	Proprietary
T4	Proprietary	N/A	Proprietary
Torino SC	Cyflufenamid (10%)	Gowan Co.	phenyl-acetamide (U6)
Trabon	Soybean oil (45%)	Crop Protection Technologies PTE LTD	oil
Vivando	Metrafenone (25.2%)	BASF	benzophenone (U8)



**Figure 4:** A: Treated (Quintec alt Flint) vs. B: untreated clusters of Chenin blanc.

## Literature Cited

- 1- Wilcox, Wayne Frank, et al. Compendium of Grape Diseases, Disorders, and Pests. Second Edition. APS Press, The American Phytopathological Society, 2015.
- 2- Vasquez, Stephen. "Grape Cultivar Susceptibility to Grapevine Powdery Mildew." UC Cooperative Extension.