Evaluation of fungicide programs for management of Botrytis bunch rot of grapes: 2016 field trial

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Grape Botrytis Bunch Rot field trial, 2016. Department of Plant Pathology, University of California, Davis.

Summary

Bunch rot of grapes is caused by *Botrytis cinerea*, a fast-growing pathogen infecting numerous crops of commercial value. Bunch rot leads to a reduction in the yield and quality of table, raisin, and wine grapes, with high economic losses in some locations or years (Flaherty et al. 1992). Botrytis overwinters as sclerotia in mummified berries on the vine or ground or on dormant canes. The disease may first appear as shoot blight following frequent spring rains; flowers can become infected during bloom (Bulit and Dubos 1988). In infected fruits, disease symptoms are latent until late in the season. As sugar concentration increases in the berry, the fungus resumes growth and infects the entire fruit, often resulting in berry splitting and sporulation on the fruit surface (Flaherty et al. 1992). Free water is a requirement for the pathogen, and favorable conditions include humidity's exceeding 90% and temperatures between 15-27° (Bulit and Dubos 1988, Gubler et al. 2008, Steel et al., 2011). Along with leaf removal and other cultural controls, good spray coverage with a synthetic fungicide is currently the most effective form of disease management.

We examined the efficacy of 31 fungicide treatment programs for control of Botrytis bunch rot in Chardonnay grapes in Napa County, California in 2016. Materials included synthetic, biological, and organic treatments. Three applications were made between May and August 2016. Overall disease pressure was high.

Materials and Methods

A. Experimental design

The field trial were conducted using completely randomized design, with plot consisting of 2 adjacent vines (11 ft row spacing and 5 ft vine spacing). Each treatment consisted of 4 replicates (0.0101 acres). Fungicides were applied with backpack sprayers. Three applications were made during the growing season: May 11 (bloom), Jun 13 (pre-close), Aug 4 (veraison). Each application was made in 200 gallons/acre of water (2.0 gallons/treatment). Other pesticides were applied between bloom and harvest by the commercial vineyard managers for control of powdery mildew and vine mealy bug.

B. Experimental treatments

Table 1: Experimental fungicide treatments. "alt" = alternated with; "FP" = formulated product

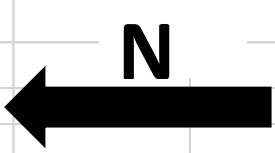
No.	Flag	Product(s)	FP[1]/Acre	FP/Treatment
1	W	Untreated	none	none
2	GS	Elevate (standard)	16 oz	4.6 g
3	KD	Serenade Opti (standard)	20 oz	5.7 g
4	K	Howler + Capsil	7.5 g/L + 6 fl oz/100 gal	57.0 g + 3.5 ml
5	YD	Elevate + Howler + Capsil	8 oz + 7.5 g/L + 6 fl oz/100 gal	2.3 g + 57.0 g + 3.5 ml
6	BS	Fracture then Vangard then Elevate	24.4 fl oz then 10 oz then 16 oz	7.3 ml then 2.9 g then 4.6 g
7	PKS	Vangard then Fracture then Elevate	10 oz then 24.4 fl oz then 16 oz	2.9 g then 7.3 ml then 4.6 g
8	YS	ARY-0438-005 + Latron B-1956	6.2 oz + 0.25% (v/v)	1.8 g + 18.9 ml
9	OS	F1757aa + Latron B-1956	18 fl oz + 0.25% (v/v)	5.4 ml + 18.9 ml
10	BKS	ARY-0438-005 +F1757aa + Latron B-1956	6.2 oz + 9 fl oz + 0.25% (v/v)	1.8 g + 2.7 ml + 18.9 ml
11	RKS	F1173aa + Syl-Coat	16 oz + 0.25% (v/v)	4.6 g + 18.9 ml
12	GD	F1173aa + F1757aa + Syl-Coat	16 oz + 9 fl oz + 0.25% (v/v)	4.6 g + 2.7 ml + 18.9 ml
13	YKS	UBI-4319-01 + F1173aa + Syl-Coat	6 fl oz + 16 oz + 0.25% (v/v)	1.8 ml + 4.6 g + 18.9 ml
14	RD	ARY-0438-005 + F1173aa + Syl-Coat	6.2 oz + 16 oz + 0.25% (v/v)	1.8 g + 4.6 g + 18.9 ml
15	YC	Pristine + Syl-Coat	23 oz + 4 fl oz/100 gal	6.6 g + 2.4 ml
16	RKD	(Pristine then Elevate then Switch) + Syl-Coat	(23 oz then 16 oz then 14 oz) + 4 fl oz/100 gal	(6.6 g then 4.6 g then 4.0 g) + 2.4 ml
17	RC	(Luna Exp then Scala then Flint) + Syl-Coat	(8.6 fl oz then 18 oz then 3 oz) + 4 fl oz/100 gal	(2.6 ml then 5.2 g then 0.9 g) + 2.4 ml
18	YKC	(Luna Exp (2x) then Scala + Serenade Opti) + Syl-Coat	(8.6 fl oz (2x) then 9 oz + 8 oz) + 4 fl oz/100gal	(2.6 ml (2x) then 2.6 g + 2.3 g) + 2.4 ml
19	KC	Scala alt Luna Exp	18 fl oz alt 8.6 fl oz	5.4 ml alt 2.6 ml
20	G	MBI-110AF5	2 qt	19.1 ml
21	Pu	MBI-110AF5	4 qt	38.2 ml
22	GKD	Pyraziflumid + Syl-Coat	1.7 fl oz + 0.25% (v/v)	0.5 ml + 18.9 ml
23	KS	Pyraziflumid + Syl-Coat	3.38 fl oz + 0.25% (v/v)	1.0 ml + 18.9 ml
24	RD/YS	Switch + Syl-Coat	14 oz + 0.125% (v/v)	4.0 g + 9.5 ml
25	O	A20560 + Syl-Coat	11.4 fl oz + 0.125% (v/v)	3.4 ml + 9.5 ml
26	GKC	A20560 + Syl-Coat	13.5 fl oz + 0.125% (v/v)	4.0 ml + 9.5 ml
27	OKS	A19649 + Syl-Coat	8.55 fl oz + 0.125% (v/v)	2.6 ml + 9.5 ml
28	RD/GD	Botector	8 oz	2.3 g
29	GKD/OS	BCP511B	50 g/ha	0.2 g
30	RD/GKD	BCP511B	200 g/ha	0.8 g
31	KC/PKS	BCP511B	400 g/ha	1.6 g

Note: 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.

C. Trial Map

Table 2: Map layout

			RD/GD	
	W	KD	RKS	
GS	Pu	YKC	KC	
KD	RD/GD	Pu	K	RD/GD
K	BS	YD	RD/GKD	YD
YD	YKC	BKS	GKC	GKD
BS	RC	BS	YKS	RD/YS
PKS	RKS	PKS	O	G
YS	K	W	GS	YKC
OS	OKS	RKD	YC	O
BKS	KD	KC/PKS	K	KC
RKS	YD	OS	PKS	GD
GD	GKD/OS	OKS	W	OS
YKS	O	GD	OKS	RD
RD	RD	KS	Pu	YS
YC	W	G	RKD	BKS
RKD	KS	RD	GKC	KS
RC	KC	RD/YS	RC	YKS
YKC	G	RC	KC/PKS	KD
KC	YKS	YS	YC	GS
G	KC/PKS	GKD	RD/GKD	RKS
Pu	RKD	GKD/OS	GKD/OS	
GKD	RD/GKD	GS	BS	
KS	GKD	YS		
RD/YS	BKS	YC		
O	GKC	PKS		
GKC	OS			
OKS	GD			
RD/GD	RD/YS			
GKD/OS				
RD/GKD				
KC/PKS				



D. Disease and Statistical Analysis

Disease was assessed on Sep 28, 2016. Botrytis bunch rot incidence and severity were assessed in each plot by evaluating twenty five random clusters from the 2 vine plots. Incidence was defined as the number of clusters in a plot having some Botrytis bunch rot over the clean clusters in the same 2 vine plots. Severity was determined by estimating the percentage of berries in each cluster. 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 along with standard error were computed. Trial models were analyzed using the ANOVA Tests for data. Means comparisons were made using Fisher's LSD test at α=0.05.

E. Weather and Disease

Figure 1: Precipitation history from April 1 to Sep 30, 2016. Data are from a CIMIS station 109 (http://www.cimis.water.ca.gov). Six precipitation events were recorded as follows: Apr 8, 9 and 10 (0.25, 1.27 and 0.25 mm, respectively), Apr 22 (5.33 mm) and May 6 and 7 (0.51 and 2.79 mm, respectively).

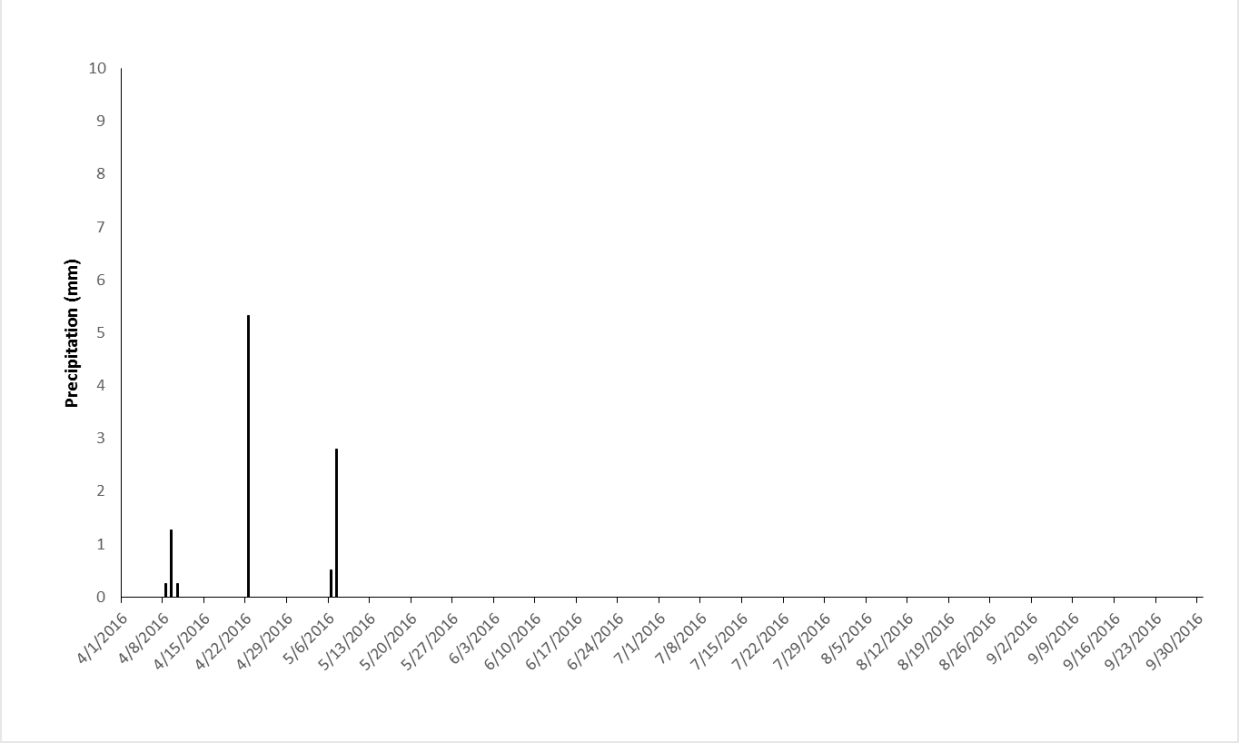
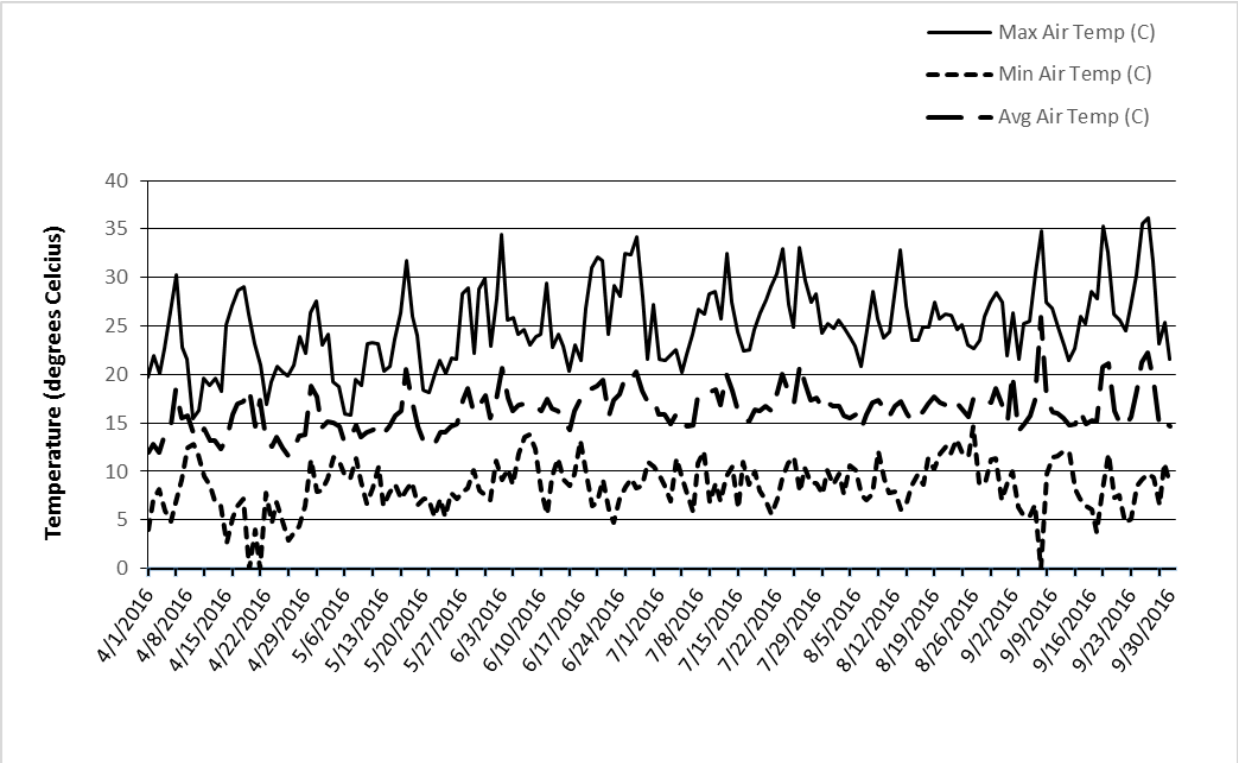


Figure 2: Air temperature history from Apr 1 to Sep 30, 2016. Data are from a CIMIS station 109 (http://www.cimis.water.ca.gov).



Results

Table 3: Botrytis bunch rot incidence and severity. Product names are followed by rate (per acre). Treatment means followed by the same letter are not significantly different according to Fisher's LSD test at α=0.05; alt =alternated with.

Treatment	Severity (%)		Incidence (%)	
A20560 13.5 fl oz + Syl-Coat 0.125% (v/v)	0.1	I	7.0	G
A20560 11.4 fl oz + Syl-Coat 0.125% (v/v)	0.3	I	10.0	EFG
A19649 8.55 fl oz + Syl-Coat 0.125% (v/v)	0.6	I	10.0	EFG
Switch 14 oz + Syl-Coat 0.125% (v/v)	1.5	HI	10.0	EFG
(Luna Experience 8.6 fl oz then Scala 18 oz then Flint 3 oz) + Syl-Coat 4 fl oz/100 gal	1.7	FGHI	13.0	DEFG
Scala 18 fl oz alt Luna Experience 8.6 fl oz	2.1	GHI	8.0	FG
Pyraziflumid 1.7 fl oz + Syl-Coat 0.25% (v/v)	2.5	FGHI	15.0	DEFG
F1173aa 16 oz + Syl-Coat 0.25% (v/v)	3.6	EFGHI	19.0	DEFG
ARY-0438-005 6.2 oz + Latron B-1956 0.25% (v/v)	3.6	EFGHI	14.0	DEFG
(Luna Experience 8.6 fl oz (2x) then Scala 9 oz + Serenade Opti 8 oz) + Syl-Coat 4 fl oz/100 gal	4.2	DEFGHI	23.0	CDEFG
Pristine 23 oz + Syl-Coat 4 fl oz/100 gal	4.3	DEFGHI	14.0	DEFG
F1173aa 16 oz + F1757aa 9 fl oz + Syl-Coat 0.25% (v/v)	4.5	DEFGHI	17.0	DEFG
F1757aa 18 fl oz + Latron B-1956 0.25% (v/v)	4.7	DEFGHI	23.0	CDEFG
Fracture 24.4 fl oz then Vangard 10 oz then Elevate 16 oz	5.0	DEFGHI	16.0	DEFG
BCP511B 400 g/ha	5.2	DEFGHI	19.0	DEFG
Elevate 8 oz + Howler 7.5 g/L + Capsil 6 fl oz/100 gal	5.4	DEFGHI	17.0	DEFG
Pyraziflumid 3.38 fl oz + Syl-Coat 0.25% (v/v)	5.5	DEFGHI	26.0	BCDE
(Pristine 23 oz then Elevate 16 oz then Switch 14 oz) + Syl-Coat 4 fl oz/100 gal	5.6	DEFGHI	24.0	CDEFG
Vangard 10 oz then Fracture 24.4 fl oz then Elevate 16 oz	5.7	DEFGHI	27.0	BCDE
Elevate 16 oz	6.2	DEFGHI	23.0	CDEFG
Howler 7.5 g/L + Capsil 6 fl oz/100 gal	6.5	DEFGHI	17.0	DEFG
Botector 8 oz	7.6	DEFGHI	25.0	BCDEF
ARY-0438-005 6.2 oz + F1173aa 16 oz + Syl-Coat 0.25% (v/v)	8.2	DEFGH	24.0	CDEFG
UBI-4319-01 6 fl oz + F1173aa 16 oz + Syl-Coat 0.25% (v/v)	8.2	DEFGH	29.0	BCD
BCP511B 50 g/ha	8.6	CDEFG	26.0	BCDE
ARY-0438-005 6.2 oz + F1757aa 9 fl oz + Latron B-1956 0.25% (v/v)	9.2	CDEF	29.0	BCD
MBI-110AF5 4 qt	10.2	BCDE	30.0	BCD
MBI-110AF5 2 qt	10.9	BCD	37.0	BC
Serenade Opti 20 oz	15.3	ABC	37.0	BC
BCP511B 200 g/ha	16.5	AB	42.0	B
Untreated control	19.7	A	60.0	A

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Appendix: Materials

Product	Active Ingredient(s) and Concentration	Chemical Class (after Adaskaveg et al. 2008)	Manufacturer or Distributor
A19649	proprietary	N/A	proprietary
A19649	proprietary	N/A	proprietary
ARY-0438-005	proprietary	N/A	proprietary
Botector	proprietary	N/A	proprietary
BCP511B	proprietary	N/A	proprietary
Capsil	Polyether-polymethylsiloxane-copolymer and nonionic surfactant (100%)	adjuvant	Aquatrols
Elevate 50 WDG	fenhexamid (50%)	hydroxyanilide (17)	Arysta Life Science
F1173aa	proprietary	N/A	proprietary
F1757aa	proprietary	N/A	proprietary
Flint	trifloxystrobin (50%)	QoI (11)	Bayer CropScience
Fracture	BLAD (20%)	plant extract	FMC Corporation
MBI-110AF5	proprietary	N/A	proprietary
Howler	proprietary	N/A	proprietary

Latron B-1956	modified phthalic glycerol alkyd resin (77.0%)	adjuvant	Dow AgroSciences LLP
Luna Experience	fluopyram (17.54%) tebuconazole (17.54%)	SDHI (7)/ DMI-triazole (3)	Bayer CropScience
Pristine	pyraclostrobin (12.8%) boscalid (25.2%)	SDHI (7)/QoI(11)	BASF
Pyraziflumid	proprietary	N/A	proprietary
Serenade Opti	QST 713 strain of *Bacillus subtilis* (26.2%)	biological	Bayer CropScience
Switch	cyprodinil (37.5%), fludioxonil (25%)	anilinopyrimidine (9)/phenylpyrrole (12)	Syngenta Crop Protection
Syl-Coat	polyether-polymethylsiloxane-copolymer and polyether (100%)	adjuvant	Wilbur-ellis
Scala	pyrimethanil (54.6%)	AP (9)	Bayer CropScience
UBI-4319-01	proprietary	N/A	proprietary

Appendix sources: (1) Adaskaveg, et al. 2012. Efficacy and timing of fungicides, bactericides and biologicals for deciduous tree fruit, nut, strawberry, and vine crops 2012, available at http://ucanr.edu/sites/plp/files/146650.pdf (2) Gubler lab fungicide trials 2013, available at http://plantpathology.ucdavis.edu/Cooperative_Extension/Gubler/2013_Fruit_Crop_Fungicide_Trials/ (3) product-specific MSDS and/or labels.