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# Evaluation of fungicide programs for management of Botrytis bunch rot of grapes: 2010 field trial

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## Report Summary

Bunch rot of grapes is caused by *Botrytis cinerea*, a fast-growing pathogen infecting numerous crops of commercial value. Bunch rot can potentially lead 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 ground or on canes. The disease can 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 humidities exceeding 90% and temperatures between 15-27°C (Flaherty et al. 1992, Bulit and Dubos 1988, Gubler et al. 2008). 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 21 fungicide treatment programs for control of *Botrytis* bunch rot in Clone 4 Chardonnay grapes in Carneros, Napa County, California in 2010. Materials included synthetic, biological, and organic treatments. Four applications were made between June and September 2010.

## Materials and Methods

The field trial was conducted using a completely randomized design, with plots 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 tank mixed and applied with backpack sprayers. Four applications were made during the growing season: 4 June (bloom), 22 June (pre-close, berries pea-sized), 19 August (early veraison) and 17 September (pre-harvest). 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.

Disease was assessed on 28 September 2010, near the date of harvest in the commercially-grown block. Twenty to thirty clusters were evaluated in each plot for bunch rot symptoms (visible mycelium, slip skin and purpling of berries). Disease severity (percentage of symptomatic berries) was assessed for each plot by averaging severity estimates for each rated cluster.

**Table 1.** Experimental fungicide treatments. “alt” = alternated with; “FP” = formulated product

No.	Flag	Product(s)	FP <sup>1</sup> /Acre	FP/Treatment
1	W	Unsprayed control	none	none
2	Y	Exp. 2	20 fl oz	6.0 ml
3	RKS	Exp. 2	24 fl oz	7.2 ml
4	YKS	Pristine 38 WG (1x) then Elevate 50 WG (1x) then Pristine (2x)	18.5 oz alt 1 lb	5.3 g then 4.6 g
5	GD	Vanguard 75 WG (1x) then Elevate 50 WG (1x) then Vanguard (2x)	10 oz alt 1 lb	2.9 g then 4.6 g
6	GKC	Inspire Super 2.82 EW (1x) then Elevate 50 WG then Inspire Super (2x)	20 fl oz alt 1 lb	6.0 ml then 4.6 g
7	RKD	Inspire Super 2.82 EW + Actigard 50 WG (1x) then Elevate 50 WG + Actigard (1x) then Elevate 50 WG (2x)	20 fl oz + 0.25 oz then 1 lb + 0.25 oz then 1 lb	6.0 ml + .07 g then 4.6g + .07 g then 4.6g
8	KS	Switch	14 oz	4.0 g
9	KC	Inspire Super	20 fl oz	6.0 ml
10	KD	Pristine	18.5 oz	5.3 g
11	BD	Vanguard	10 oz	2.9 g
12	YD	Sonata ASO	4 qt	38.2 ml
13	OD	Serenade ASO	4 qt	38.2 ml
14	YC	Sonata ASO + Serenade ASO	2 qt + 2 qt	19.1 ml + 19.1 ml
15	YKC	Elevate	16 oz	4.6 g
16	OS	Pristine + Hi-Wett	23 oz + 2 fl oz	6.6g + 0.6ml
17	YS	V-10135 (50% conc. of A.I.)	.188 lb AI/A	1.8 ml
18	OKD	S-2200 (30% conc. of A.I.)	.100 lb AI/A	1.7 ml
19	PKS	Quash (50% conc. of A.I.)	.080 lb AI/A	0.8 g
20	GS	V-10135 + S2200	.188 lb AI/A + .100 AI/A	1.8ml + 1.7ml
21	OKS	V-10135 + Quash	.0188 lb AI/A + 0.080 lb AI/A	1.8ml + 0.8g
22	RC	Elevate + V10135	16 oz + .188 lb AI/A	4.6g + 1.8ml

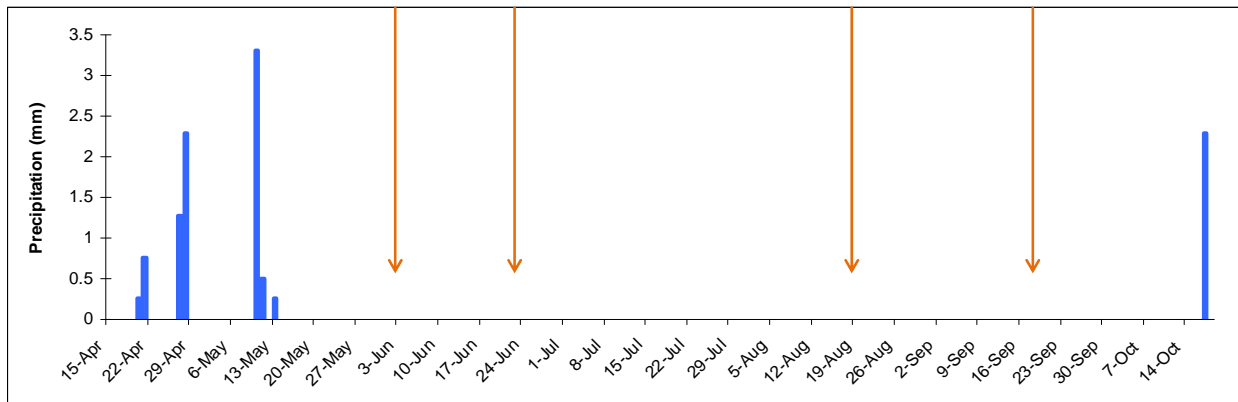
**Note:** The treatments described in this report were conducted for **experimental purposes only** and crops treated in a similar manner may not be suitable for commercial or other use.

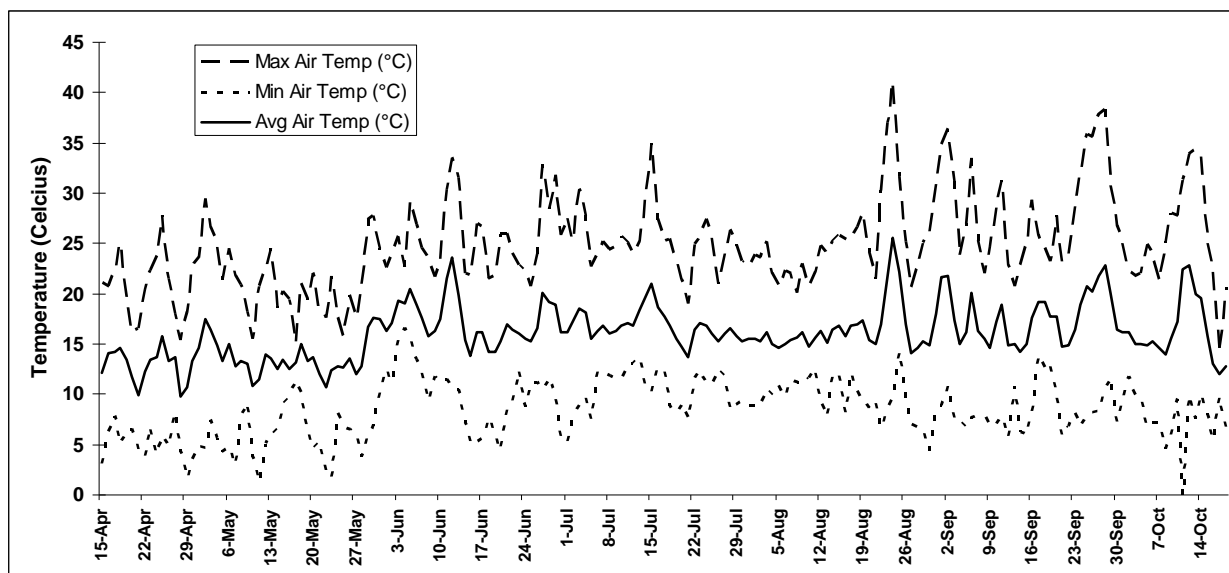
**Figure 1.** Layout of plots in the experimental area.

RC	KS	OKD	RC	YS	OS	GKC	PKS
YC	GS	OS	YKC	KC	KS	GD	W
OKS	OKD	GKC	KS	RKD	PKS	RC	YC
YKS	RKS	OKS	W	YKC	OKS	KS	RKD
GKC	YD	KD	YS	YD	Y	RKS	GS
OS	W	RKD	YC	GKC	GS	OKS	KD
BD	KD	PKS	YKS	RC	YC	YKC	KC
PKS	YS	YD	Y	KD	GD	BD	YD
GD	RKD	RKS	GS	OKD	YKS	YKS	Y
OD	YKC	KC	GD	OD	BD	OS	OD
Y	KC	OD	BD	W	RKS	OKD	YS

## Results and discussion

**Figure 2.** Precipitation history from 15 April to 18 October 2010 near the trial location. Data are from CIMIS station 109 in Carneros (<http://www.cimis.water.ca.gov>). Dates of fungicide applications are indicated by the arrows.





**Table 1.** Botrytis incidence (means  $\pm$  SE). Product names are followed by rate (per acre). Treatment means followed by the same letter are not significantly different according to Fisher's protected LSD test at  $\alpha=0.05$ ; alt=alternated with.

<b>Treatment</b>	<b>Incidence (%)</b>	
Untreated Control	40.8 $\pm$ 9.0	a
Serenade, 4 qt	25.0 $\pm$ 4.4	b
Sonata, 4 qt	22.5 $\pm$ 10.1	bc
Inspire Super, 20 fl oz	21.7 $\pm$ 5.5	bc
Pristine, 18.5 oz	20.0 $\pm$ 4.9	bcd
Sonata, 2 qt + Serenade, 2 qt	19.2 $\pm$ 4.4	bcde
Vanguard, 10 oz	15.0 $\pm$ 2.9	bcdef
Inspire Super, 20 fl oz (1x) then Elevate, 1 lb (1x) then Inspire Super, 20 fl oz (2x)	14.2 $\pm$ 4.4	bcdef
Pristine, 23 oz + Hi-Wett, 2 fl oz	14.2 $\pm$ 4.4	bcdef
S-2200, 0.1 lb	12.5 $\pm$ 2.1	bcdef
Switch, 14 oz	12.5 $\pm$ 2.8	bcdef
Inspire Super, 20 fl oz + Actigard, 0.25 oz (1x) then Elevate, 1 lb + Actigard, 0.25 oz (1x) then Elevate, 1 lb (2x)	12.5 $\pm$ 2.5	bcdef
Experimental 2, 20 fl oz	11.7 $\pm$ 5.2	cdef
Experimental 2, 24 fl oz	8.3 $\pm$ 2.9	def
V-10135, 0.188 lb	7.5 $\pm$ 1.6	def
V-10135, 0.188 lb + S2200, 0.1 lb	7.5 $\pm$ 2.1	def
V-10135, 0.188 lb + Quash, 0.08 lb	6.7 $\pm$ 2.7	ef
Pristine, 18.5 oz (1x) then Elevate, 1 lb (1x) then Pristine, 18.5 oz (2x)	5.8 $\pm$ 3.7	f
Elevate, 1 lb	4.4 $\pm$ 1.1	f
Vanguard, 10 oz (1x) then Elevate, 1 lb (1x) then Vanguard, 10 oz (2x)	5.8 $\pm$ 3.4	f
Elevate, 1 lb + V10135, 0.188 lb	5.8 $\pm$ 2.8	f
Quash, 0.08 lb	5.8 $\pm$ 2.5	f
Elevate, 1 lb	4.4 $\pm$ 1.1	f

**Table 2.** Botrytis severity (means  $\pm$  SE). Product names are followed by rate (per acre). Treatment means followed by the same letter are not significantly different according to Fisher's protected LSD test at  $\alpha=0.05$ ; alt=alternated with.

<b>Treatment</b>	<b>Severity (%)</b>	
Untreated Control	8.2 $\pm$ 3.3	a
Serenade, 4 qt	5.7 $\pm$ 1.2	ab
Pristine, 18.5 oz	3.9 $\pm$ 1.1	bc
Vangard, 10 oz	3.6 $\pm$ 1.1	bcd
Sonata, 4 qt	2.8 $\pm$ 1.5	cde
Inspire Super, 20 fl oz	2.5 $\pm$ 1.1	cde
Sonata, 2 qt + Serenade, 2 qt	2.2 $\pm$ 0.9	cde
Experimental 2, 20 fl oz	2.1 $\pm$ 1.0	cde
Inspire Super, 20 fl oz (1x) then Elevate, 1 lb (1x) then Inspire Super, 20 fl oz (2x)	2.0 $\pm$ 0.7	cde
V-10135, 0.188 lb + Quash, 0.08 lb	1.9 $\pm$ 0.6	cde
Switch, 14 oz	1.6 $\pm$ 0.2	cde
Inspire Super, 20 fl oz + Actigard, 0.25 oz (1x) then Elevate, 1 lb + Actigard, 0.25 oz (1x) then Elevate, 1 lb (2x)	1.4 $\pm$ 0.5	cde
S-2200, 0.1 lb	1.3 $\pm$ 0.8	cde
Pristine, 23 oz + Hi-Wett, 2 fl oz	1.2 $\pm$ 0.4	cde
Experimental 2, 24 fl oz	1.0 $\pm$ 0.7	cde
V-10135, 0.188 lb + S2200, 0.1 lb	1.0 $\pm$ 0.6	de
V-10135, 0.188 lb	0.7 $\pm$ 0.2	e
Pristine, 18.5 oz (1x) then Elevate, 1 lb (1x) then Pristine, 18.5 oz (2x)	0.6 $\pm$ 0.5	e
Elevate, 1 lb	0.5 $\pm$ 0.3	de
Vangard, 10 oz (1x) then Elevate, 1 lb (1x) then Vanguard, 10 oz (2x)	0.5 $\pm$ 0.3	e
Elevate, 1 lb + V10135, 0.188 lb	0.5 $\pm$ 0.2	e
Quash, 0.08 lb	0.2 $\pm$ 0.1	e

## Acknowledgements

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## Appendix: Materials

Product	Active ingredient(s) and concentration	Class	Manufacturer or Distributor
Switch	cyprodinil (37.5%), fludioxonil (25.0%)	anilino-pyrimidine	Syngenta Crop Protection, Inc.
Elevate	fenhexamid (50%)	hydroxyanilide	Arysta Life Science
HiWett	polysiloxane polyether copolymer, polyoxyethylene-polyoxypropylene copolymer, & alcohol ethoxylate (100%)	adjuvant	First Choice
Pristine	Pyraclostrobin	QoI-strobilurin + carboximide	BASF
Vanguard	cyprodinil (75%)	anilino-pyrimidine	Syngenta Crop Protection, Inc.
Actigard	acibenzolar-S-methyl	benzothiadiazole	Syngenta Crop Protection, Inc.
Serenade ASO	<i>Bacillus subtilis</i> QST 713 (1.34%)	biological - microbial	AgraQuest, Inc.
Sonata	<i>Bacillus pumilus</i> QST 2808 (1.38%)	biological - microbial	AgraQuest, Inc.
Inspire Super	difenoconazole (8.4%), cyprodinil (24%)	DMI, aniline-primidine	Syngenta Crop Protection, Inc.
Quash	metconazole (50%)	triazole	Valent
S-2200	N/A	N/A	Valent
V-10135	N/A	N/A	Valent