

Supplemental Data for:

Kwasniewski, M.T., G.L. Sacks, and W.F. Wilcox. 2014.

Persistence of elemental sulfur spray residue on grapes during ripening and vinification.

Am. J. Enol. Vitic. 65:453-462. doi: 10.5344/ajev.2014.14027.

Supplemental Table 1 Sulfur residue concentrations on Chardonnay grape clusters taken in 2009.

Treatment	Microthiol application rate (kg/ha)	Days before harvest ^a	Unsettled must ^b Mean ± SD (µg/g) ^c	Fruit Mean ± SD (µg/g) ^c
0	–	Control	0 ± 0 a ^d	0 ± 0 a
1	2.69	68	0.1 ± 0.1 a	0.2 ± 0.2 ab
4	5.38	68	0 ± 0 a	0.2 ± 0.7 ab
2	2.69	40	0.4 ± 0.1 b	1.5 ± 0.4 b
5	5.38	40	0.4 ± 0.3 a	1.3 ± 0.7 b
3	2.69	12	6.8 ± 0.7 c	43.4 ± 7.5 c
6	5.38	12	5.2 ± 0.9 c	51.6 ± 8.1 c

^aA single application of a micronized formulation of S⁰ microthiol was made either 12, 40, or 68 days preharvest, at a rate of either 2.69 or 5.38 kg/ha.

^bSulfur residue levels for unsettled must were taken immediately after pressing fruit.

^cMean values are for sulfur residue measured on five-cluster samples taken from each of the six treatment panel replicates.

^dMeans within a column not followed by a common letter are significantly different ($p < 0.05$) according to the Games–Howell test which was performed following confirmation by two-way ANOVA that variables contributed to differences at a significant level ($p < 0.01$).

Supplemental Table 2 Sulfur residue levels on Chardonnay grape clusters taken in 2010.

Treatment number	Last application date ^b	Days before harvest	Formulation	Rate (kg/ha)	Sample Date ^a								
					30-Aug	1-Sep	3-Sep	7-Sep	11-Sep	15-Sep	24-Sep	29-Sep	1-Oct
					Days before harvest								
					32	30	28	24	20	16	7	2	0
					Mean ^c ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
1	12-Aug	50	Micronized	2.69	3.5 ± 2.0 e ^d	4.0 ± 1.7 D	4.2 ± 1.4 e	3.0 ± 1.0 e	2.8 ± 0.7 d	1.4 ± 0.8 g	0.8 ± 0.5 e	0.3 ± 0.4 d	0.2 ± 0.2 e
2	27-Aug	35	Micronized	5.38	28.6 ± 4.5 abc	21.9 ± 3.6 a	17.3 ± 3.3 abc	11.8 ± 1.8 abc	8.8 ± 0.9 c	9.3 ± 0.7 de	10.0 ± 3.0 c	5.1 ± 1.5 c	4.6 ± 0.5 d
3			WP	5.38	34.9 ± 6.6 a	20.8 ± 3.7 a	6.9 ± 2.8 de	8.7 ± 2.9 bcd	9.0 ± 1.1 c	7.9 ± 0.9 e	2.7 ± 0.7 d	1.5 ± 0.8 d	1.2 ± 0.7 e
4			WP	2.69	20.9 ± 3.1 bcd	17.5 ± 4.4 ab	7.9 ± 2.6 de	8.3 ± 2.3 cd	4.0 ± 1.3 d	3.6 ± 0.6 f	2.6 ± 0.9 de	0.7 ± 0.4 d	0.6 ± 0.3 e
5	9-Sep	22	Micronized	5.38	24.5 ± 2.3 abcd	19.9 ± 3.5 a	19.2 ± 1.9 a	15.2 ± 1.1 a	49.5 ± 2.2 a	52.5 ± 5.4 a	28.3 ± 6.2 b	24.2 ± 3.1 b	19.1 ± 3.7 bc
6			WP	5.38	30.8 ± 5.0 ab	14.8 ± 2.2 ab	10.4 ± 4.4 bcde	10.5 ± 2.6 abcd	54.7 ± 7.0 a	30.7 ± 5.2 b	20.9 ± 3.2 b	18.2 ± 4.2 b	14.3 ± 2.2 c
7			WP	2.69	19.9 ± 2.7 cd	6.8 ± 1.6 cd	10.0 ± 3.4 cde	5.7 ± 2.0 de	24.5 ± 5.1 b	14.7 ± 3.2 cd	11.5 ± 1.4 c	7.7 ± 1.6 c	6.4 ± 2.6 d
8	23-Sep	8	Micronized	5.38	28.3 ± 1.8 abc	21.3 ± 2.0 a	18.7 ± 2.7 ab	14.1 ± 1.4 ab	49.7 ± 4.5 a	50.2 ± 6.8 a	66.7 ± 7.2 a	48.4 ± 6.6 a	39.0 ± 5.6 a
9			WP	5.38	37.6 ± 7.3 a	15.6 ± 1.7 abc	11.5 ± 2.5 cd	9.5 ± 1.3 cd	57.0 ± 4.2 a	35.1 ± 3.9 b	85.9 ± 9.3 a	54.6 ± 3.8 a	27.2 ± 5.6 ab
10			WP	2.69	19.6 ± 2.6 d	6.5 ± 1.7 bcd	6.6 ± 1.6 de	6.6 ± 1.0 d	20.8 ± 4.5 b	19.5 ± 3.6 c	30.0 ± 7.5 b	17.8 ± 2.6 b	14.3 ± 2.2 c

^aAll treatments were sampled at each sampling date.

^bSequential sprays were applied to designated vines on 12 Aug, 27 Aug, 9 Sep, and 23 Sep, with the final application for each treatment as noted. Within a timing regime, treatments varied by S⁰ formulation and application rate.

^cMean values represent sulfur residue measured on five-cluster samples taken from each of the six replicate treatment panels per treatment. Measurements are given in µg S⁰ g cluster weight.

^dMeans within a column not followed by a common letter are significantly different ($p < 0.05$) according to the Games-Howell test. Games-Howell analysis was performed following confirmation by two-way ANOVA that variables contributed to differences at a significant level ($p < 0.01$).

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Supplemental Table 3 Sulfur residue concentrations on Riesling grape clusters taken in 2011.

Treatment number	Last application date ^b	Days before harvest	Formulation	Application rate	Sample Date ^a									
					15-Aug	24-Aug	30-Aug	6-Sep	15-Sep	22-Sep	29-Sep	9-Oct	16-Oct	
					Days before harvest									
					62	53	47	40	31	24	17	9	0	
Mean ^c ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD				
1	23-Aug	54	Micronized	4.48kg/ha	13.3 ± 3.5 a ^d	9.4 ± 1.0 bc	8.1 ± 0.5 b	5.8 ± 0.8 abc	4.3 ± 0.8 e	6.4 ± 0.8 d	3.1 ± 0.5 de	4.0 ± 0.9 d	3.7 ± 0.9 d	
2			WP	4.48kg/ha	11.3 ± 2.3 a	15.6 ± 3.2 ab	6.6 ± 2.1 abcd	6.0 ± 1.5 abc	5.4 ± 0.8 de	7.5 ± 1.7 c	4.5 ± 0.4 c	2.2 ± 0.6 d	1.9 ± 0.6 e	
3	8-Sep	38	Micronized	4.48 and 2.24kg/ha ^e	11.1 ± 2.4 a	8.4 ± 0.9 c	2.4 ± 0.3 be	4.3 ± 0.6 c	3.8 ± 1.2 e	3.8 ± 0.5 c	2.8 ± 0.5 d	3.9 ± 0.6 d	3.7 ± 0.6 de	
4			Micronized	4.48kg/ha	11.5 ± 1.9 a	10.3 ± 1.6 bc	4.8 ± 1.3 cde	5.3 ± 1.0 abc	7.0 ± 1.4 bcd	5.9 ± 0.9 c	4.7 ± 0.5 c	4.1 ± 0.7 d	3.7 ± 0.7 de	
5			WP	4.48kg/ha	11.0 ± 1.1 a	15.0 ± 3.5 abc	7.0 ± 0.6 bc	7.5 ± 0.8 ab	9.4 ± 1.0 ab	8.6 ± 1.9 c	1.7 ± 0.3 e	4.2 ± 1.1 d	4.3 ± 1.1 d	
6	21-Sep	25	Micronized	4.48kg/ha	10.1 ± 1.8 a	10.0 ± 1.5 bc	8.5 ± 1.5 ab	4.5 ± 1.2 bc	6.1 ± 1.5 cde	22.9 ± 2.2 b	9.3 ± 2.1 b	10.1 ± 0.9 c	7.5 ± 0.9 c	
7			WP	4.48kg/ha	11.0 ± 2.3 a	18.0 ± 1.3 a	10.4 ± 1.1 a	7.6 ± 1.5 ab	13.5 ± 2.4 a	32.1 ± 3.5 a	20.1 ± 2.0 a	13.4 ± 1.2 b	12.7 ± 1.2 b	
8	6-Oct	12	Micronized	4.48kg/ha	10.1 ± 1.1 a	11.4 ± 0.6 bc	5.0 ± 0.6 d ab	4.9 ± 2.4 abc	7.7 ± 0.8 bc	29.7 ± 1.3 a	8.2 ± 1.0 b	31.5 ± 2.7 a	24.2 ± 2.7 a	
9			WP	4.48kg/ha	10.4 ± 1.3 a	16.0 ± 2.2 a	8.1 ± 1.5	8.4 ± 1.9 a	12.1 ± 1.8 a	25.7 ± 2.7 ab	20.6 ± 4.4 a	18.3 ± 2.9 b	16.7 ± 2.9 b	

^aAll treatments were sampled at each sampling date.

^bSequential sprays were applied to designated vines on 10 Aug, 23 Aug, 8 Sep, 21 Sep, and 6 Oct with the final application for each treatment as noted. Within a timing regiment, treatments varied by S⁰ formulation and application rate.

^cMean values represent sulfur residue measured on five-cluster samples taken from each of the six replicate treatment panels per treatment. Measurements are given in µg S⁰ g cluster weight.

^dMeans within a column not followed by a common letter are significantly different ($p < 0.05$) according to the Games–Howell test. Games–Howell analysis was performed following confirmation by two-way ANOVA that variables contributed to differences at a significant level ($p < 0.01$).

^eThis treatment received microthiol applications at 4.48kg/ha for the first application and 2.24kg/ha on 23 Aug and 8 Sep.