

**Assessment of interactions between sulfur and DMI fungicides to control powdery mildew in the presence of a DMI-resistant *Erysiphe necator* population in Georgia, 2020.**

Three DMI fungicides (Rally 40WSP, Elite 45WP, and Cevya) were tested at their low and high commercially labeled rates +/- Microthiol Disperss (sulfur) for their performance in controlling grapevine powdery mildew (PM) on *Vitis vinifera* L. cv. ‘Chardonnay’ at the University of Georgia Mountain Research and Education Center in Blairsville, GA. The experimental design utilized a randomized complete block with five replications per treatment; single plants were utilized for each replicate unit. Unsprayed buffer rows allowed for increased powdery mildew disease pressure. Treatments were applied with a CO<sub>2</sub> backpack sprayer, and rates were calculated to correspond with a 50 gal per acre total spray volume; applications were made six times (27 Apr, 11 May, 26 May, 8 Jun, 22 Jun, and 6 Jul). Cultural practices mimicked those observed in commercial vineyards. Fruit clusters (five per plant) were rated for PM incidence (% of clusters infected) and severity (% of cluster covered by powdery mildew) on 29 Jun, 8 Jul, and 16 Jul using the Powdery Mildew Assessment Tool developed by Adelaide Research and Innovation Pty Ltd. On 23 Jul and 5 Aug, 25 leaves were collected from each vine and assessed for powdery mildew incidence (% leaves infected) and severity (% leaf area with powdery mildew). SAS version 9.4 was used for data analysis, and Tukey’s HSD was utilized for treatment means separation using the GLIMMIX procedure.

Three different DMI (FRAC 3) chemicals [Rally 40WSP (myclobutanil), Elite 45WP (tebuconazole), and Cevya (mefentrifluconazole)] were mixed with the lowest labeled rate of Microthiol Disperss (3 lb) to test for an interaction or additive effect of sulfur and DMIs. The Y136F mutation in the 14 $\alpha$ -demethylase (CYP51) gene associated with DMI tolerance has been found in high numbers in this research vineyard in both 2019 and 2020. However, cross-resistance can vary among DMIs, and interaction of DMIs with sulfur has been shown to provide positive efficacy against powdery mildew in other crop systems. The results obtained do not support the hypothesis of sulfur and DMI fungicides interacting in a synergistic fashion; rather, the results show a minimal additive role for sulfur. When comparing treatments with myclobutanil and tebuconazole plus sulfur, the treatments with added sulfur were not statistically different from sulfur on its own. Mefentrifluconazole, however, provided much better control overall.

Treatment and amount/A	Application timing *	Powdery mildew incidence on leaves 23 Jul**	Powdery mildew incidence on leaves 5 Aug**	Powdery mildew severity on leaves 23 Jul**	Powdery mildew severity on leaves 5 Aug**
Untreated	---	48.8 a	82.9 a	12.5 a	31.8 a
Microthiol Disperss 3lb	ABCDEF	1.6 bc	40.0 bc	0.2 bc	9.0 cb
Rally 40WSP 5oz	ABCDEF	13.4 b	58.3 ab	3.6 ab	15.6 bc
Rally 40WSP 3 oz + Microthiol Disperss 3 lb	ABCDEF	0.0 c	39.7 bc	0.0 c	8.2 cd
Rally 40WSP 5 oz + Microthiol Disperss 3 lb	ABCDEF	1.0 bc	50.3 bc	0.1 bc	13.4 bcd
Elite 45 WP 4 oz	ABCDEF	18.5 ab	67.3 ab	3.2 b	22.5 ab
Elite 45 WP 2.4 oz + Microthiol Disperss 3 lb	ABCDEF	1.5 bc	42.0 bc	0.2 bc	11.4 bcd
Elite 45 WP 4 oz + Microthiol Disperss 3 lb	ABCDEF	0.9 bc	24.3 cd	0.1 bc	5.0 de
Cevya 5 fl oz	ABCDEF	0.0 c	8.2 de	0.0 c	1.0 ef
Cevya 3 fl oz + Microthiol Disperss 3 lb	ABCDEF	0.0 c	3.1 e	0.0 c	0.3 ef
Cevya 5 fl oz + Microthiol Disperss 3 lb	ABCDEF	0.0 c	0.6 e	0.0 c	0.1 f

\*Treatment dates: A = 27 Apr (pre-bloom), B = 11 May (bloom 1), C = 26 May (bloom 2), D = 8 Jun (post-bloom), E = 22 Jun (bunch closure), and F = 6 Jul (first cover)

\*\*Powdery mildew incidence (% infected leaves) and severity (% of leaf covered by powdery mildew) were calculated from 25 leaves per treated plant. Means following the same letter are not significantly different from one another when using Tukey’s HSD ( $P \leq 0.05$ ). All data was arcsine square root transformed before analysis. Back-transformed means are shown.

Treatment and amount/A	Application timing *	Powdery mildew incidence on fruit 29 Jun**	Powdery mildew incidence on fruit 8 Jul**	Powdery mildew incidence on fruit 16 Jul**
Untreated	---	100.0 a	100.0 a	100.0 a
Microthiol Disperss 3lb	ABCDEF	99.1 a	100.0 a	100.0 a
Rally 40WSP 5oz	ABCDEF	94.8 a	100.0 a	100.0 a
Rally 40WSP 3 oz + Microthiol Disperss 3 lb	ABCDEF	99.1 a	100.0 a	100.0 a
Rally 40WSP 5 oz + Microthiol Disperss 3 lb	ABCDEF	90.5 a	100.0 a	100.0 a
Elite 45 WP 4 oz	ABCDEF	95.2 a	96.9 a	98.1 a
Elite 45 WP 2.4 oz + Microthiol Disperss 3 lb	ABCDEF	100.0 a	100.0 a	100.0 a
Elite 45 WP 4 oz + Microthiol Disperss 3 lb	ABCDEF	100.0 a	100.0 a	100.0 a
Cevya 5 fl oz	ABCDEF	23.7 b	12.6 b	44.0 b
Cevya 3 fl oz + Microthiol Disperss 3 lb	ABCDEF	7.3 b	23.0 b	34.2 b
Cevya 5 fl oz + Microthiol Disperss 3 lb	ABCDEF	15.7 b	30.8 b	30.8 b

\*Treatment dates: A = 27 Apr (pre-bloom), B = 11 May (bloom 1), C = 26 May (bloom 2), D = 8 Jun (post- bloom), E = 22 Jun (bunch closure), and F = 6 Jul (first cover)

\*\*Powdery mildew incidence (% infected clusters) was calculated from 5 clusters per treated plant. Means following the same letter are not significantly different from one another when using Tukey's HSD ( $P \leq 0.05$ ). All data was arcsine square root transformed before analysis. Back-transformed means are shown.

Treatment and amount/A	Application timing *	Powdery mildew severity on fruit 29 Jun**	Powdery mildew severity on fruit 8 Jul**	Powdery mildew severity on fruit 16 Jul**
Untreated	---	28.5 a	38.3 a	54.5 a
Microthiol Disperss 3lb	ABCDEF	7.4 abcd	17.3 ab	24.2 b
Rally 40WSP 5oz	ABCDEF	7.8 abcd	16.0 ab	24.2 b
Rally 40WSP 3 oz + Microthiol Disperss 3 lb	ABCDEF	7.1 abcd	10.2 bc	24.3 b
Rally 40WSP 5 oz + Microthiol Disperss 3 lb	ABCDEF	4.9 bcd	9.5 bc	17.7 bc
Elite 45 WP 4 oz	ABCDEF	12.0 abc	22.0 ab	25.4 b
Elite 45 WP 2.4 oz + Microthiol Disperss 3 lb	ABCDEF	16.8 ab	26.2 ab	40.8 ab
Elite 45 WP 4 oz + Microthiol Disperss 3 lb	ABCDEF	13.5 abc	24.6 ab	31.3 ab
Cevya 5 fl oz	ABCDEF	1.2 cd	0.6 c	4.2 cd
Cevya 3 fl oz + Microthiol Disperss 3 lb	ABCDEF	0.3 d	1.4 c	2.5 d
Cevya 5 fl oz + Microthiol Disperss 3 lb	ABCDEF	0.7 cd	1.1 c	1.9 d

\*Treatment dates: A = 27 Apr (pre-bloom), B = 11 May (bloom 1), C = 26 May (bloom 2), D = 8 Jun (post- bloom), E = 22 Jun (bunch closure), and F = 6 Jul (first cover)

\*\*Powdery mildew (% of cluster covered by powdery mildew) was calculated from 5 clusters per treated plant. Means following the same letter are not significantly different from one another when using Tukey's HSD ( $P \leq 0.05$ ). All data was arcsine square root transformed before analysis. Back-transformed means are shown.