

Fungicide comparisons for powdery mildew management in a fungicide-resistant *Erysiphe necator* population, 2020.

Eleven fungicides were tested for their performance in controlling grapevine powdery mildew (PM) on *Vitis vinifera* L. cv. ‘Merlot’ 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 CO₂ 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. Treatments and modes of action were as follows: 1) Abound (QoI) 2) Aprovia (SDHI) 3) Inspire Super (DMI + AP) 4) Luna Experience (DMI + SDHI) 5) Microthiol Disperss (M6) 6) Pristine (SDHI + QoI) 7) Quintec (unknown) 8) Rally 40WSP (DMI) 9) Stylet Oil (not classified) 10) Torino (unknown) 11) Vivando (cytoskeleton and motor protein inhibition), and 12) an untreated control (no active PM treatment applied). Fruit clusters (five per plant) were rated for PM incidence (% of clusters infected) and severity (% of cluster covered by powdery mildew) on 8, 16, and 27 Jul using the Powdery Mildew Assessment Tool by the Adelaide Research and Innovation Pty Ltd. On 5 and 19 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.

In this study, leaf data was taken four and six weeks after the last spray date due to lack of visible PM until this timeframe. As a result, long-term activity of products was reviewed on leaves, whereas standard powdery mildew activity was reviewed for fruit clusters. Even after four weeks, good to excellent efficacy on leaves was observed with Pristine, Vivando, Inspire Super, Quintec, Microthiol Disperss, Aprovia, Luna Experience, and Torino. Neither Stylet Oil, Rally nor Abound provided efficacy; the lack of control by these products is likely due to the products being contact protectants (Stylet Oil) or resistance development. In 2019 and 2020, a total of ninety-five PM samples were taken and genotyped for resistance associated alleles. In this population, we found a high population of the G143A mutation in the mitochondrial cytochrome b gene and the Y136F mutation in the 14 α -demethylase (CYP51) gene associated with QoI resistance and DMI tolerance, respectively. These results correlate with the level of control observed in the field, as Abound (QoI) and Rally 40WSP (DMI) did not perform significantly better than the untreated control. Fungicides also ranked similarly relative control of PM on fruit clusters, though Microthiol Disperss ranked lower for fruit as compared to leaf PM control.

Treatment and amount/A	Application timing *	Powdery mildew leaf incidence		Powdery mildew leaf severity	
		5 Aug **	19 Aug **	5 Aug **	19 Aug **
Untreated	---	60.8 a	99.3 a	15.3 a	48.2 a
Abound 15.5 fl oz	ABCDEF	60.4 a	87.6 abc	34.3 a	41.7 a
Rally 40WSP 5oz	ABCDEF	51.9 a	97.7 ab	8.1 ab	51.5 a
Stylet-Oil 2 gal./100 gal	ABCDEF	47.9 ab	99.1 a	9.3 ab	48.6 a
Torino 3.4 fl oz	ABCDEF	14.2 bc	95.2 abc	2.0 bc	37.1 ab
Luna Experience 8.6 fl oz	ABCDEF	6.3 c	91.0 abc	0.6 c	24.2 bc
Aprovia 10.5 fl oz	ABCDEF	5.3 c	78.2 cd	0.7 c	19.1 bc
Microthiol Disperss 10 lb	ABCDEF	11.0 c	89.1 abc	1.2 c	31.4 ab
Quintec 6.6 fl oz	ABCDEF	11.0 c	83.2 bcd	1.0 c	20.0 bc
Inspire Super 20 fl oz	ABCDEF	5.8 c	80.1 bcd	0.7 c	25.4 bc
Vivando (R) 15.4 fl oz	ABCDEF	3.4 c	77.8 cd	0.4 c	20.6 bc
Pristine 12.5 oz	ABCDEF	1.6 c	56.2 d	0.2 c	12.3 c

*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	Powdery mildew	Powdery mildew
		<u>incidence on fruit</u>	<u>incidence on fruit</u>	<u>incidence on fruit</u>
		8 Jul**	16 Jul**	27 Jul**
Untreated	---	69.6 a	81.0 a	90.5 a
Abound 15.5 fl oz	ABCDEF	48.0 ab	65.5 a	85.0 a
Rally 40WSP 5oz	ABCDEF	39.6 abc	57.2 a	74.0 a
Stylet-Oil 2 gal./100 gal.	ABCDEF	26.8 abcd	52.0 a	60.4 ab
Microthiol Disperss 10 lb	ABCDEF	12.3 abcd	33.8 ab	70.3 a
Torino 3.4 fl oz	ABCDEF	3.4 bcd	0.0 b	0.9 c
Inspire Super 20 fl oz	ABCDEF	0.0 d	0.0 b	3.4 bc
Luna Experience 8.6 fl oz	ABCDEF	0.0 d	0.0 b	0.0 c
Quintec 6.6 fl oz	ABCDEF	0.0 d	0.0 b	0.0 c
Vivando (R) 15.4 fl oz	ABCDEF	0.9 cd	0.0 b	0.0 c
Pristine 12.5 oz	ABCDEF	0.0 d	0.9 b	0.9 c
Aprovia 10.5 fl oz	ABCDEF	0.0 d	0.0 b	0.0 c

*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	Powdery mildew	Powdery mildew
		<u>severity on fruit</u>	<u>severity on fruit</u>	<u>severity on fruit</u>
		8 Jul**	16 Jul**	27 Jul**
Untreated	---	3.9 a	7.8 a	12.5 a
Abound 15.5 fl oz	ABCDEF	1.8 ab	4.2 ab	7.8 a
Rally 40WSP 5oz	ABCDEF	2.0 ab	3.1 ab	5.7 a
Stylet-Oil 2 gal./100 gal.	ABCDEF	1.2 abc	2.7 ab	4.8 ab
Microthiol Disperss 10 lb	ABCDEF	0.5 bc	1.9 bc	4.5 ab
Torino 3.4 fl oz	ABCDEF	0.2 bc	0.0 c	0.0 c
Inspire Super 20 fl oz	ABCDEF	0.0 c	0.0 c	0.2 bc
Luna Experience 8.6 fl oz	ABCDEF	0.0 c	0.0 c	0.0 c
Quintec 6.6 fl oz	ABCDEF	0.0 c	0.0 c	0.0 c
Vivando (R) 15.4 fl oz	ABCDEF	0.0 c	0.0 c	0.0 c
Pristine 12.5 oz	ABCDEF	0.0 c	0.0 c	0.0 c
Aprovia 10.5 fl oz	ABCDEF	0.0 c	0.0 c	2.2 c

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

** Powdery mildew severity (% 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.