GRAPE (*Vitis* 'Camminare noir' 'UC Davis selection 07370-84')
Downy mildew; *Plasmopara viticola*
Bitter rot; *Greeneria uvicola*
Macrophoma rot; *Botryosphaeria dothidea*

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Efficacy and crop safety of minimal-, moderate-, and high-input disease management systems for Pierce's disease resistant hybrids, 2020.

Three different spray programs were utilized on two Pierce's disease resistant *Vitis* hybrid cultivars from the UC Davis grape breeding program, 07370-84 and 'Camminare noir'. The trial was conducted at the University of Georgia Horticulture Research Farm in Watkinsville, GA. A randomized complete block design with five replications per treatment was used to test minimal, moderate, and high input fungicide programs for their performance in controlling grapevine diseases within these two cultivars. Plots consisted of a panel of four grapevines; the two center vines were treated with fungicides, while the border plants on each side of the treated vines were left unsprayed to increase the uniformity of disease pressure within the experiment. An unsprayed buffer row was included between treatment rows, also allowing for increased and uniform disease pressure throughout the test site. Treatments were applied with a Jacto battery powered self-agitating backpack sprayer calibrated to deliver 50 gallons per acre total spray volume. Treatment applications were made seven times (27 Apr, 8 May, 21 May, 17 Jun, 6 Jul, 15 Jul, and 30 Jul). Cultural practices mimicked those observed in commercial vineyards. With each increase in fungicide inputs, treatment programs were designed to progressively be more efficacious and expensive (Table 1). Programs utilized were: 1) low input [no fungicides with significant powdery mildew activity], 2) moderate input [addition of products with more efficacious downy mildew activity], 3) high input [additional materials added for rots, powdery mildew, and downy mildew] and 4) an untreated control (Table 1). On 28 Jul and 11 Aug, 20 leaves were collected from each vine and assessed for downy mildew incidence (% leaves infected) and severity (% leaf area with downy mildew). Fruit rot was rated, but not distinguished between different causal organisms; fruit cluster rots and associated pathogens were identified as black rot [*Guignardia bidwellii*], bitter rot [*Greeneria uvicola*] and Macrophoma rot [*Botryosphaeria dothidea*]. Fruit clusters (10 per plant) were rated for rot incidence (% of clusters infected) and severity (% of fruit cluster with rot) on 28 Jul, 11 Aug, and 2 Sep. JMP Pro 15 was used for data analysis, and Tukey's HSD was utilized for treatment means separation.

Rainfall was prevalent throughout the trial period, resulting in significant disease pressure. Powdery mildew was not observed in this experiment; though some hybrids are less susceptible to powdery mildew, this was an unexpected result. For 07370-84, increased use of more efficacious downy mildew fungicides resulted in reduced downy mildew incidence and severity (Table 2). However, relative downy mildew alone, all three fungicide regimens performed similarly for the 'Camminore noir' (Table 3). For 'Camminore noir', downy mildew was significantly delayed in development by comparison to 07370-84, even in the untreated control plots. The high input regimen provided the least amount of fruit rot, as measured by incidence and severity. This was true without regard to variety (Tables 4 and 5). 'Camminore noir' may be less susceptible to diseases than 07370-84, but practically, a full spray program will be required for both. Though the low input program provided good downy mildew control in 'Camminore noir', it required a full program for rot management. For 07370-84, a high input regimen worked best for downy mildew and rots. Both of these varieties are 94% *Vitis vinifera* in their parentage. The limited hybridization with native grape species, though conferring resistance to Pierce's disease, does not allow for use of more economical spray programs. No phytotoxicity was observed on either variety.

Table 1. Treatment programs by fungicide and date.

	Fungicide input regimens			
Treatment and amount/A	High	Moderate	Low	Untreated
Untreated	---	---	---	---
Abound 10 fl oz	ADEFH	---	---	---
Captan 4L 1.5 qts	DEFGH	DEFGH	DEFGH	---
Elevate 1 lb	G	G	G	---
Endura 8 oz	BE	B	B	---
Malathion 3 pt	H	H	H	---
Manzate Prostick 3 lb	ABC	ABC	ABC	---
Mustang Max 4 oz	G	G	G	---
Oxidate 1:100	GH	GH	GH	---
Prophyt 4 pt	ACEFG	ACEFG	---	---
Rally 3 oz	CDG	---	---	---
Ridomil Gold MZ 2.5 lb	D	D	---	---
Rovral 2 pt	H	H	H	---
Switch 14 oz	F	F	F	---
Vangard 10 oz	C	C	C	---
Zampro 14 oz	B	B	---	---

*Treatment dates: A = 27 Apr (prebloom) B = 8 May (bloom 1) C = 21 May (bloom 2), D = 17 Jun (cover), E = 6 Jul (cover), F = 15 Jul (veraison), G = 30 Jul (veraison).

Table 2. Downy mildew incidence and severity on white grape hybrid 07370-84.

Treatment and amount/A	Application timing *	Downy mildew leaf incidence		Downy mildew leaf severity	
		28 Jul**	11 Aug **	28 Jul **	11 Aug **
Untreated	---	99.0 a	95.0 a	46.3 a	55.7 a
Low input	ABCDEFG	36.0 b	44.0 b	3.6 b	7.8 b
Moderate input	ABCDEFG	14.0 bc	12.0 c	0.3 b	1.1 b
High input	ABCDEFG	8.0 c	6.0 c	0.2 b	0.4 b

*Treatment dates: A = 27 April (prebloom) B = 8 May (bloom 1) C = 21 May (bloom 2), D = 17 Jun (cover), E = 6 Jul (cover), F = 15 Jul (veraison), and G = 30 Jul (veraison).
** Downy mildew incidence (% infected leaves) and severity (% of leaf covered by downy mildew) were calculated from 20 leaves per treated plant. Means following the same letter are not significantly different from one another when using Tukey's HSD ($P \leq 0.05$).

Table 3. Downy mildew incidence and severity on 'Camminare noir'.

Treatment and amount/A	Application timing *	Downy mildew leaf incidence	Downy mildew leaf severity
		11 Aug **	11 Aug **
Untreated	---	100.0 a	27.1 a
Low input	ABCDEFG	18.0 b	0.8 b
Moderate input	ABCDEFG	14.0 b	0.6 b
High input	ABCDEFG	33.0 b	1.2 b

*Treatment dates: A = 27 April (prebloom) B = 8 May (bloom 1) C = 21 May (bloom 2), D = 17 Jun (cover), E = 6 Jul (cover), F = 15 Jul (veraison), and G = 30 Jul (veraison).
** Downy mildew incidence (% infected leaves) and severity (% of leaf covered by downy mildew) were calculated from 20 leaves per treated plant. Means following the same letter are not significantly different from one another when using Tukey's HSD ($P \leq 0.05$).

Table 4. Fruit rot incidence and severity on white grape hybrid 07370-84.

Treatment and amount/A	Application timing *	Fruit rot incidence			Fruit rot severity		
		28 Jul**	11 Aug **	2 Sep **	28 Jul **	11 Aug **	2 Sep **
Untreated	---	86.0 a	100.0 a	100.0 a	13.6 a	58.3 a	96.4 a
Low input	ABCDEFG	36.0 b	86.0 ab	100.0 a	2.7 b	14.2 b	81.4 ab
Moderate input	ABCDEFG	18.0 c	78.0 b	100.0 a	1.3 b	8.4 b	75.2 b
High input	ABCDEFG	18.0 c	48.0 c	100.0 a	1.0 b	4.0 b	35.8 c

*Treatment dates: A = 27 April (prebloom) B = 8 May (bloom 1) C = 21 May (bloom 2), D = 17 Jun (cover), E = 6 Jul (cover), F = 15 Jul (veraison), and G = 30 Jul (veraison).
** Fruit rot incidence (% infected fruit) and severity (% of fruit cluster with rot) were calculated from 10 clusters per treated plant. Means following the same letter are not significantly different from one another when using Tukey's HSD ($P \leq 0.05$).

Table 5. Fruit rot incidence and severity on 'Camminare noir'.

Treatment and amount/A	Application timing *	Fruit rot incidence			Fruit rot severity		
		28 Jul**	11 Aug **	2 Sep **	28 Jul**	11 Aug **	2 Sep **
Untreated	---	48.0 a	100.0 a	100.0 a	3.9 a	32.9 a	92.1 a
Low input	ABCDEFG	30.0 ab	96.0 a	100.0 a	3.7 a	16.4 b	66.9 b
Moderate input	ABCDEFG	26.0 ab	98.0 a	100.0 a	2.0 a	16.1 b	65.0 b
High input	ABCDEFG	12.0 b	94.0 a	100.0 a	1.1 a	14.3 b	41.4 c

*Treatment dates: A = 27 April (prebloom) B = 8 May (bloom 1) C = 21 May (bloom 2), D = 17 Jun (cover), E = 6 Jul (cover), F = 15 Jul (veraison), and G = 30 Jul (veraison).
** Fruit rot incidence (% infected fruit) and severity (% of fruit cluster with rot) were calculated from 10 clusters per treated plant. Means following the same letter are not significantly different from one another when using Tukey's HSD ($P \leq 0.05$).