

Evaluation of fungicides for strawberry powdery mildew management under greenhouse conditions in San Luis Obispo, CA, summer 2024.

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Podosphaera aphanis, causal agent of strawberry powdery mildew, is a foliar pathogen that infects flowers, fruit, leaves, and petioles. The disease can result in declining plant health, deformed fruit, and yield loss. This report evaluates the efficacy of fungicides for the control of powdery mildew under greenhouse conditions in San Luis Obispo, California in summer of 2024. Disease incidence and severity were evaluated for all treatments and controls. Results of this study will inform strawberry growers in developing effective fungicide programs for managing powdery mildew.

Keywords: Luna Sensation, Miravis Prime, Quintec, Pristine, Tesaris, Ensoil, Microthiol Disperss

The trial was conducted in a greenhouse at the Cal Poly Crops Unit in San Luis Obispo, CA. In preparation, bareroot 'Monterey' transplants were planted outdoors on raised nursery benches on 26 Jun 2024 in plastic nursery 1 gal trade pots (Greenhouse Megastore, Sacramento, CA) containing a soilless mixture called CB 1294 (Sun Gro Horticulture, Nipomo, CA), with 10 g of Osmocote Plus (Scotts, Marysville, OH) added to the surface of each pot 14 days after planting (10 Jul). Plants were inoculated on 22 Jul (26 days after planting) by moving them from the outdoor nursery benches and placing them in the greenhouse where powdery mildew-infected strawberry plants were present with high levels of sporulation. No symptoms of the disease were detected on plants on the day they were transferred to the greenhouse. Treatments were replicated four times with each replicate consisting of 4 plants (1 plant/pot) in a 3 ft × 3 ft area, arranged in a randomized complete block design on greenhouse benches. Plants were irrigated automatically for 2 min, 3 times per week using an arrow dripper (1 L/hr) (Netafim USA, Fresno, CA). The greenhouse temperature control system was set to heat at 55°F and cool at 75°F. Products in the trial were: OR-536, OR-097A, OR-488, OR-009E, Ensoil, Mevalone, SA-0130310, SA-0650004, Tesaris, Miravis Prime, Quintec, and Pristine. Two standards were included in the trial: Luna Sensation (conventional standard) and Microthiol Disperss (organic standard). One untreated control and one water treatment control were also included. Treatments containing Ensoil received a drench treatment at planting on 26 Jun, followed by three foliar applications prior to inoculation on 3, 10, and 17 Jul. Following inoculation, fungicide applications were made at approximately 7-day intervals: 23, 31 Jul and 6, 14, and 21 Aug. Weekly leaf counts, disease incidence, and severity evaluations were made visually, one day prior to each fungicide application and one week after the final application (22 Jul to 28 Aug). Disease severity was based on the percent of the upper and lower leaf surfaces covered by visible mycelial growth of each fully emerged trifoliate leaf. Disease incidence was assessed as the percent of trifoliate leaves with at least one powdery mildew lesion. Treatments were applied using a compressed CO₂ handheld backpack sprayer at 35 psi with a single flat fan nozzle (DG8002VS yellow) (TeeJet Technologies, Clovis, CA) angled down at 90-degrees and calibrated to deliver 100 gal/A. No yield data was collected due to very low fruit production during the trial. Stolons (runners), and fully ripe fruit were removed from plants once per week. Data were subjected to analysis of variance (ANOVA) and Fisher's LSD mean separation was calculated using ARM version 2024.2.

The first visual symptoms of infection were detected on 31 Jul, 9 days after exposing plants to the disease in the greenhouse. There were no significant differences among treatments for powdery mildew incidence or severity before the first fungicide application (data not shown). The powdery mildew incidence and severity evaluation on 20 Aug, 30 days after inoculation, offered the most treatment separation. Overall, powdery mildew pressure was high as demonstrated by the non-treated control (Supplementary Table S1), which can be attributed to the favorable conditions in the greenhouse environment. All fungicide treatments, including the water control, significantly reduced powdery mildew incidence and severity when compared to the non-treated control in the 20 Aug evaluation (Supplementary Table S1). Luna Sensation was the most effective treatment in reducing powdery mildew severity (0.0%). Both the Luna Sensation treatment and the treatment rotation of Miravis Prime, Quintec, and Pristine were the most effective in reducing powdery mildew incidence (1.0%). Phytotoxicity was not observed in any of the treatments.

Supplementary Table S1. Evaluation of fungicide efficacy for reduction of powdery mildew incidence and severity.

Treatment (amount/A)	Application sequence ^z	Powdery mildew (%) on 20 Aug ^y				AUDPC ^w			
		Incidence ^{x v}		Severity		Incidence		Severity	
Non-treated control		39.7	a	6.7	a	829.5	a	168.3	a
Water control (100 gal)	EFGHI	33.6	a	4.7	b	620.8	b	78.1	bc
Luna Sensation 57.2 SC (7.6 fl oz)	EFGHI	1.0	f	0.0	g	16.3	i	0.8	h
Miravis Prime 34.2 SC (12.8 fl oz)	EH								
Quintec 22.58 SC (6 fl oz)	FI								
Pristine 38 DF (18.5 fl oz)	G	1.0	f	0.1	g	24.2	i	1.2	h
Tesaris 26.55 SC (9.1 fl oz)	EFGHI	1.2	f	0.1	g	43.4	i	2.6	h
OR-536 (4 lb)	EFGHI	2.4	f	0.1	g	116.9	hi	8.3	gh
SA-0130310 (10.5 fl oz)	EFGHI	6.1	ef	0.4	fg	197.7	gh	14.7	gh
Mevalone 16.05 WC (55 fl oz)	EFGHI	12.5	de	1.1	efg	292.3	fg	28.6	fg
OR-536 (4 lb)	EFGHI								
OR-097A (32 fl oz)	EFGHI	13.9	cd	1.4	d-g	341.4	ef	37.7	ef
Ensoil (Drench) (1.47 fl oz) ^u	A								
Ensoil (16.9 fl oz)	BCDEFGHI								
Microthiol Disperss 80 DF (5 lb)	EFGHI	19.0	bcd	2.0	c-f	482.5	cd	57.6	cde
SA-0650004 (28 fl oz)	EFGHI	19.4	bcd	2.0	cde	410.3	def	47.9	def
Microthiol Disperss 80 DF (5 lb)	EFGHI	20.0	bc	2.1	cde	459.4	de	56.6	cde
OR-488 (50 fl oz)	EFGHI								
OR-009E (32 fl oz)	EFGHI	20.0	bc	2.7	cd	420.3	de	47.8	def
Ensoil (Drench) (1.47 fl oz) ^u	A								
Ensoil (16.9 fl oz)	BCDEFGHI	23.3	b	3.2	bc	602.1	bc	89.3	b
OR-488 (50 fl oz)	EFGHI								
OR-097A (32 fl oz)	EFGHI	25.0	b	3.1	bc	531.8	bcd	64.9	cd
LSD P=0.05		7.41		1.58		126.09		21.59	

^z Application sequence: A=26 Jun, B=3 Jul, C=10 Jul, D=17 Jul, E=23 Jul, F=31 Jul, G=6 Aug, H=14 Aug, I=21 Aug.

^y This disease assessment was made 6 days after product application.

^x Treatments that do not share a letter are significantly different according to Fisher’s LSD mean separation test ($\alpha=0.05$) calculated using ARM version 2024.2 (Gylling Data Management, Brookings, SD).

^w Area Under the Disease Progress Curve was calculated for disease incidence at 7 weekly ratings using ARM version 2024.2.

^v Except for the non-treated and water control, treatments are ordered by powdery mildew incidence on 20 Aug.

^u Drench applications were mixed with 100 ml of water and applied to the surface of each pot.