

Evaluation of products for powdery mildew control in annual strawberry, 2018-2019.

On 8 Oct 2018, bare-root, green-top plants from Canada were transplanted into plots on plastic-mulched, raised beds in a high plastic tunnel. The beds were 28-in. wide on 4-ft centers and were fumigated with Telone C-35 (300 lb/A) at bed formation. Individual plots were 10 ft long and contained 14 plants in two staggered rows 12-in. apart with 15-in. in-row plant spacing. Treatments were arranged in a randomized complete block design with four blocks in adjacent beds. After planting, plants were overhead irrigated during the day for 10 d to facilitate establishment and then irrigated and fertilized through a central drip tape. Treatments were applied four times at 2-wk intervals (30 Nov, 14 Dec, 28 Dec, and 11 Jan). Foliar applications were made with a CO₂ backpack sprayer calibrated to deliver 100 gal/A at 60 psi through two TeeJet disc-core hollow-cone nozzles spaced 12 in. apart on the boom. Drip applications were made through dedicated drip tapes with 10 emitters at 12-in. spacing. Tapes were placed next to each row of plants (two tapes/plot). Drip applications were made in 0.4 gal water per linear bed foot (4350 gal/A), and for dosage calculations, were considered banded applications to beds occupying 67% of the field area. Foliar colonization by *P. aphanis* was evaluated by removing a center leaflet from each of 10 plants/plot on 5 Jan and evaluating 10 microscopic fields/leaflet at 25X for the presence or absence of mycelial growth. For uniformity, leaflets were obtained from leaves tagged during early petiole elongation on 27 Dec, one day before the third set of treatments was applied. The number of positive fields/leaflet was averaged for all 10 leaflets/plot and expressed as a percentage representing foliar mycelial coverage. Fruit were harvested once or twice weekly from 10 Dec to 28 Jan (12 harvests). Healthy fruit weighting more than 10 g each were counted and weighed to determine yield. Unmarketable fruit were also enumerated. Fruit with visible powdery mildew growth on more than 25% of the achenes were considered unmarketable and not included in yield data. Fruit disease incidence was based on these fruit and expressed as a percentage of all fruit harvested. Data were analyzed by ANOVA using the Proc GLM procedure in SAS (SAS Institute, Cary, NC). Multiple means comparisons were conducted by Fisher's protected LSD test ($\alpha = 0.05$).

Powdery mildew development in Oct and early Nov was suppressed by overhead irrigation and high temperatures. By mid-Nov, a few curled leaves showing powdery mildew growth on the abaxial surface were observed. Thereafter, foliar symptoms increased rapidly and were followed by powdery mildew development on the fruit. Yields for the 7-wk harvest period were unusually low, explained in part by high numbers of fruit rejected due to powdery mildew growth on the achenes. Over the 7-wk harvest period, fruit disease incidence (DI) reached 76.4% in the control, but was greatly reduced by several rates of pyraziflumid and Exp22. Prolivo + Suffa, Gatten 8 fl oz + Kinetic, and Rhyme alternated with Quintec moderately reduced fruit DI to 30 to 42%, whereas most other treatments provided minimal or no control. Due to the prevalence of fruit rejection caused by powdery mildew, yield data closely correlated with powdery mildew control on the fruit. The highest yields were associated with various rates of pyraziflumid and Exp22. Microscopic assessment of mycelial foliar coverage showed significant differences among treatments. Various rates of Exp 22 and pyraziflumid markedly reduced foliar coverage from 97.8 % in the control to a range of 4.0 to 14.4%, and appeared to show a dose rate response. Gatten moderately reduced mycelial foliar coverage, with the lowest coverage (45.2%) provided by the high rate (8 fl oz) combined with the non-ionic wetting agent Kinetic. Drip applications of Rhyme alternated with Quintec foliar sprays also reduced mycelial coverage, but only to 82.6%. No other product or program significantly reduced powdery mildew development on the leaves. Although temperatures in the high tunnel were often warmer than outside, phytotoxicity symptoms were not observed in this trial.

Products and rates/A	Application type	Application timing ^z	Yield (lb/A)	Diseased fruit (%) ^y	Foliar coverage (%) ^x
Exp22 10.0 fl oz + Induce 16 fl oz	spray	1,2,3,4	2193 a	15.2 a	4.0 a ^w
Exp22 8.0 fl oz + Induce 16 fl oz	spray	1,2,3,4	2270 a	18.9 a	6.6 ab
pyraziflumid 3.08 fl oz + Kinetic 12 fl oz	spray	1,2,3,4	1829 ab	21.6 a	8.8 ab
pyraziflumid 2.31 fl oz + Kinetic 12 fl oz	spray	1,2,3,4	2314 a	26.0 ab	9.3 ab
pyraziflumid 1.54 fl oz + Kinetic 12 fl oz	spray	1,2,3,4	2182 a	30.2 abc	14.4 b
Gatten 8.0 fl oz + Kinetic 12 fl oz	spray	1,2,3,4	1679 abc	38.1 bcd	45.2 c
Gatten 6.0 fl oz + Kinetic 12 fl oz	spray	1,2,3,4	1115 c-g	52.0 d-g	74.0 d
Rhyme 7.0 fl oz alternate	spray	1,3			
Quintec 6.0 fl oz	spray	2,4	1432 bcd	42.0 cde	82.6 de
Gatten 6.0 fl oz	spray	1,2,3,4	934 d-g	61.9 f-i	85.4 ef
Quintec 6.0 fl oz alternate	spray	1,3			
Rhyme 7.0 fl oz	drip	2,4	727 efg	62.1 f-i	90.0 efg
Quintec 6.0 fl oz alternate	spray	1,3			
Torino 3.4 fl oz	spray	2,4	719 efg	57.0 e-h	91.8 fg
Prolivo 300SC 4.0 fl oz	spray	1,2,3,4	549 fg	68.8 hi	92.0 fg
Rhyme 7.0 fl oz	spray	1,4			
Quintec 6.0 fl oz	spray	2			
Torino 3.4 fl oz	spray	3	1274 b-e	46.6 def	94.0 fg
Prolivo 300SC 4.0 fl oz + Suffa 0.67 gal	spray	1,2,3,4	1234 b-f	30.3 abc	96.0 g
Regev (=SAU 20) 6.0 fl oz	spray	1,2,3,4	710 efg	69.2 hi	96.5 g
Prolivo 300SC 4.0 fl oz + Microthiol Disperss 5 lb	spray	1,2,3,4	1334 b-e	47.8 def	96.9 g
SAU 20 8.0 fl oz	spray	1,2,3,4	950 d-g	56.5 e-h	97.1 g
Rhyme 7.0 fl oz	drip ^v	1, 3			
Velum Prime 6.5 fl oz	drip	2			
Quintec 6.0 fl oz	spray	4	738 d-g	62.0 f-i	97.4 g
Prolivo 300SC 5.0 fl oz	spray	1,2,3,4	888 d-g	64.0 ghi	97.8 g
Rhyme 7.0 fl oz alternate	drip	1,3			
Quintec 6.0 fl oz	spray	2,4	957 d-g	54.9 e-h	98.1 g
Control			418 g	76.4 i	97.8 g

^z Number in a sequence of four bi-weekly applications starting 30 Nov, 2018 and ending 11 Jan, 2019.

^y Percent of total harvested fruit with conspicuous powdery mildew (PM) growth on more than 25% of the achenes.

^x Percent of leaf area covered with powdery mildew based on microscopic observations at 25x.

^w Means in a column followed by the same letter are not significantly different by Fisher's Protected LSD test ($\alpha = 0.05$).

^v Drip application volumes were 0.4 gal water per bed foot; rates were calculated as banded applications to beds only which occupied 0.67% of an acre.