

Evaluation of conventional and biorational fungicides to control *Phytophthora* crown rot in annual strawberry, 2016-2017.

The experiment was conducted in plastic-mulched beds fumigated with Telone C-35 at 300 lb/A when the beds were formed. The beds were 32-in. wide at the base on 4-ft centers. Each bed accommodated two staggered rows of strawberry plants 12 in. apart with plants spaced 12-in. apart within rows. Treatments were arranged in a randomized complete block design with four blocks in adjacent beds. Plots consisted of 20 plants in 9 ft of bed separated by 3- to 4-ft gaps between plots. Bare-root transplants from Canada were inoculated by dipping roots in suspensions of 5×10^3 zoospores/ml of *P. cactorum* on 13 Oct, held overnight at room temperature, and planted the next morning. Inoculated controls and non-inoculated controls dipped in water were included in the experimental design. Actinovate and Prestop treatments were initiated by briefly dipping the plants in suspensions of product before planting. After transplant, beds were irrigated by overhead sprinklers during the day for 10 days to facilitate plant establishment. When overhead water was withdrawn on 24 Oct, and before other treatments had been applied, plant mortality was already occurring. The experiment was re-initiated on 28 Oct by removing the tops of all plants in the trial and planting non-inoculated runner plants from the same nursery source in the original planting holes. Plant dips in Actinovate and Prestop were repeated at replanting. The overhead irrigation cycle was also repeated, after which plants were fertigated through a central drip tape in each bed. Experimental applications were made 2, 4, 5, 6, and 8 weeks after replanting (WARP) as foliar sprays or soil applications through drip tapes. The number and types of applications were treatment specific and indicated in the table below. Drip applications were made in 0.4 gal water per foot of bed (4,630 gal/A) through 11 foot-long drip tapes with 12-in. emitter spacing. Two drip tapes were installed per plot, one next to each plant row. Foliar sprays (60 psi and 100 gal/A) were made with a CO₂ back-pack sprayer equipped with two TeeJet® hollow-cone nozzles spaced 12 in. apart on the wand. Plots were evaluated for disease at 2-wk intervals from 28 Nov (4 WARP) to 18 Feb (16 WARP). Plants that were dead, partially killed, or severely stunted were considered diseased. Percent disease incidences are presented for 10 and 16 WARP. Fruit were harvested twice weekly from 5 Jan to 13 Feb (12 harvests) to obtain the yield of healthy fruit weighing more than 10 g each. Data were analyzed by two way ANOVA using the GLM procedure in SAS (SAS Institute, Cary, NC).

Plant mortality from *Phytophthora* crown rot typically occurs in Nov and early Dec, and decreases markedly with the onset of cold weather. This season, mild temperatures persisted throughout the winter and plants continued to develop symptoms at relatively constant rates. Some plants died partially or completely, while others were noticeably stunted. Non-inoculated plants also developed symptoms, indicating that some transplants were naturally infected. In this trial, yield data may best reflect treatment effects on overall plant health and vigor. A21723, Ridomil Gold, A20941, TKO, SiTKO, and Prophyt significantly increased yield, whereas Prophyt + Agsil, Ranman, Kphite, Actinovate, and Prestop did not. Because the last set of treatments was applied 8 WARP, disease observations at 10 WARP should also reflect treatment effects. At 10 WARP, most treatments that increased yield also reduced disease incidence. Actinovate (*Streptomyces lydicus*) and Prestop (*Clonostachrys catenulatum*) also suppressed disease, but without a concomitant increase in yield. By 16 WARP, disease incidence was remarkably similar among many treatments. However, the suppressive effects of A21723 at 23.7 fl oz/A and the commercial standard Ridomil Gold seemed to persist the longest. The increase in disease incidence after applications had ended (i.e., between 10 and 16 WARP), was relatively high for Actinovate and Prestop, despite both controlling disease at 10 WAP, indicating that treatment effects for these two biological products may not persist. A comparison of TKO to SiTKO and Prophyt to Prophyt + Agsil suggests that supplementing phosphorous acid-based products with potassium silicate did not improve disease control. Symptoms of phytotoxicity were not observed in this trial.

Product and rate/A	Application type and timing ^z	Yield (lb/A)	Disease incidence (%) ^y		
			10 WARP	16 WARP	Δ DI ^x
A21723 23.7 fl oz	2d,5d,8d	8872 ab	1.3 a	12.0 a ^w	10.7
Ridomil Gold SL 16 fl oz	2d,5d,8d	9259 a	2.6 ab	13.1 ab	10.5
A20941 9.6 fl oz	2d,5d,8d	7905 b-e	8.0 a-d	23.9 abc	15.9
TKO Phosphite 65.4 fl oz	2s,4s,6s,8s	8720 abc	8.7 a-d	25.5 abc	16.8
Prophyt 2 qt + Agsil 21 1.4 gal	2, 4, 6, 8 ^v	7480 c-f	13.2 bcd	25.9 abc	12.7
SiTKO 2 qt	2s,4s,6s,8s	7727 b-e	19.3 de	26.1 abc	6.8
A21723 6.84 fl oz	2s,5s, 8s	7709 b-e	14.3 bcd	26.1 abc	11.8
Ranman 400SC 12 fl oz	2d,5d,8d	6804 ef	19.1 de	26.5 abc	7.4
Prophyt 2 qt	2s,4s,6s,8s	8519 a-d	12.7 a-d	28.1 abc	15.4
Control (non-inoculated)	na	7306 def	19.0 de	28.6 bc	9.6
Kphite 7LP 2 qt	2s,4s,6s,8s	7369 def	17.7 cde	28.8 bc	11.1
Actinovate AG 0.12 oz/gal	plant dip ^u				
Actinovate AG 6 oz	2d,5d,8c	7136 ef	6.0 abc	29.3 bc	23.3
Prestop 0.067 oz/gal	plant dip ^u				
Prestop 19.2 oz	2d,5d,8c	7020 ef	11.4 a-d	40.2 cd	28.8
Control (inoculated)	na	6347 f	28.9 e	49.5 d	20.6

^zNumbers indicate weeks after replanting on 28 Oct. “d” = drip application; “s” = foliar spray application.

Drip application rates were calculated as banded applications made to the beds only, which occupied approximately 67% of an acre.

^yIncidence of dead and severely stunted plants 10 and 16 weeks after replanting (WARP); final treatments were applied 8 WARP.

^xΔ DI = change in disease incidence between 10 and 16 WAP.

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

^vIn the Prophyt/Agsil treatment, Prophyt was applied as a foliar spray and Agsil through the drip tapes.

^uActinovate and Prestop treatments were initiated by dipping transplants at planting.