STRAWBERRY (*Fragaria* x *ananassa* 'Strawberry Festival')
Charcoal rot; *Macrophomina phaseolina*

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Evaluation of products for charcoal rot management in annual strawberry, 2016-2017.

Biological fungicides Prestop, QRD 0001.109, and Serenade ASO; and synthetic fungicides Fontelis, Kenja, Rhyme, Topsin, and Velum Prime were tested for charcoal rot control in annual strawberry. On 10 Oct, 2016, bare root, green top plants from Canada were transplanted into plastic-mulched raised beds fumigated with Telone II (150 lb/A) to control nematodes. The beds were 28 in. wide on 4-ft centers. Plots were 9.5 ft long and contained 20 plants in two staggered rows with 12-in. spacing between rows and plants within rows. Treatments were arranged in a randomized complete block design with four blocks in adjacent beds. Transplants were irrigated by overhead sprinkler during the day for 10 days to facilitate establishment, then irrigated and fertilized through a central drip tape in each bed. *M. phaseolina* inoculum was grown on sterile toothpicks impregnated with V-8 juice in corn meal agar plates for 2 wk at 29º C. On 21 Oct (11 d after planting), two toothpicks, each with a different isolate, were placed on opposite sides of the plants 0.5 in. from the crown and pressed vertically into the soil. One control was inoculated with toothpicks; a second control was not inoculated to assess native inoculum in the soil. Treatments were applied as plant dips, chemigation, and/or foliar sprays. Biological treatments were initiated by dipping plants in suspensions of product for 5 min prior to planting. Chemigation treatments were applied in 4,360 gal water/A (0.4 gal/bed ft) through two dedicated drip tapes/plot. Each tape was placed close to a plant row and was 11 ft long with 12-in. emitter spacing. Two Rhyme treatments received foliar applications only, applied with a CO_2-powered sprayer through a wand fitted with two TeeJet hollow cone nozzles spaced 12 in. apart (60 psi., 100 gal/A). Chemigation and foliar treatments were applied 2, 5, and 9 weeks after planting on 24 Oct, 14 Nov, and 14 Dec, respectively. To suppress fruit diseases in the experimental area, Captan 80WP was applied weekly by a tractor-mounted hydraulic sprayer (200 psi, 100 gal/A). Plots were harvested 8 times from 16 Dec to 12 Jan to determine yields of healthy ripe fruit weighing more than 10 g each. Disease incidence was evaluated by recording the number of dead and diseased plants/plot at 2-wk intervals from 7 Nov to 16 Jan. Diseased plants were still partially green, but had one or more permanently wilted or dead crowns. Disease incidence on 2 Jan was expressed as a percentage of dead and diseased plants/plot. Values for area under the disease progress curve (AUDPC) were based on proportions of dead and diseased plants recorded during the evaluation period. Data were analyzed by ANOVA using Proc GLM in SAS.

Warm temperatures during the experimental period contributed to rapid disease progress. Dead and diseased plants were noted only 6 weeks after planting (WAP) on 21 Nov. By 2 Jan (12 WAP), disease incidence (DI) in the inoculated control reached 41%. DI in the non-inoculated control was 6.3% indicating relatively low levels of natural inoculum. DI in the Prestop treatment (10.1%) was similar to the non-inoculated control. Charcoal rot was also suppressed by eight other treatments (DI ranging from 20.0 to 28.7%), but not by the high rate of Kenja, nor by Rhyme applied as a foliar spray. However, chemigation applications of Rhyme and the low rate of Kenja did suppress disease. According to AUDPC, only Prestop, the low rate of Kenja, Topsin + Serenade, and Velum Prime reduced disease development throughout the evaluation period ending 16 Jan (14 DAP). Of these treatments, Prestop, Topsin + Serenade, and Velum Prime, as well as Rhyme applied by chemigation, produced significantly higher yields than the inoculated control. This restricted group of treatments may well suppress charcoal rot during an average growing season with more normal temperatures. The biological fungicide Prestop (*Gliocladium catenulatum*) was particularly effective in this trial. No signs of phytotoxicity were observed.

Treatments (Products and rates/A)[z]	Application type/timing[y] At planting	2, 5, 9 WAP	Yield (lb/A)	AUDPC[x]	DI (%)[w] (12 WAP)
Control (non-inoculated)			7,469 a	0.26 a	6.3 a[v]
Prestop WG 0.067 oz/gal	plant dip				
Prestop WG 1.2 lb[w]	---	chemigation	7,504 a	0.35 ab	10.1 ab
Kenja 400SC 13.5 fl oz		chemigation	6,502 a-e	0.83 bc	20.0 bc
Serenade ASO 0.64 fl oz/gal	plant dip				
Topsin 4.5FL 20 fl oz + Serenade ASO 2 qt	---	chemigation	7,112 abc	0.82 bc	22.7 cd
Velum Prime 6.4 fl oz		chemigation	7,356 ab	0.86 cd	22.7 cd
QRD 0001.109 0.18 fl oz/gal	plant dip				
Topsin 4.5FL 20 fl oz + QRD 0001.109 17.75 fl oz	---	chemigation	6,401 a-e	1.10 c-f	27.5 cde
Rhyme 7 fl oz		chemigation	6,799 abc	0.91 cde	27.5 cde
QRD 0001.109 0.36 fl oz/gal	plant dip				
Topsin 4.5FL 20 fl oz + QRD 0001.109 35.5 fl oz	---	chemigation	6,113 c-f	1.05 c-f	27.9 c-f
Topsin 4.5FL 20 fl oz		chemigation	6,466 a-e	0.99 c-f	27.9 c-f
Fontelis 1.67SC 17 fl oz		chemigation	6,717 a-d	1.01 c-f	28.7 c-f
Kenja 400SC 15.5 fl oz		chemigation	6,059 c-f	1.35 def	36.5 efg
Rhyme 5 fl oz		foliar spray	5,371 ef	1.45 fg	40.0 fgh
Rhyme 7 fl oz		foliar spray	5,147 f	1.86 g	51.9 h
Control (inoculated)[u]			5,115 def	1.35 ef	41.3 gh

[z] Rates for chemigation treatments are calculated on a banded or treated acre basis. In this field, the beds covered 67% of the total surface area.
[y] Plant dip treatments were applied at planting on 10 Oct; chemigation and spray treatments were made 2, 5, and 9 weeks after planting (WAP).
[x] Area under the disease progress curve (AUDPC) is based on the proportions of diseased plants monitored at 2-wk intervals from 4 to 14 WAP.
[w] DI (disease incidence) = percentage of diseased and dead plants 12 weeks after planting.
[v] Values followed by the same letter are not significantly different ($\alpha = 0.05$) by Fisher's Protected LSD test.
[u] Because all treated plots were inoculated, comparisons should be made to the inoculated control at the bottom of the table.