

Evaluation of products for charcoal rot management in annual strawberry, 2019-2020.

To evaluate products for the control of charcoal rot disease of strawberry, a replicated field trial was carried out over the Florida winter growing season. The trial was initiated on 8 Oct 2019 by transplanting bare-root, green-top plants from California into plastic-mulched, raised beds. The beds were 32 in. wide at the base on 4-ft centers. Telone II (150 lb/A) was applied at bed formation to control nematodes. Transplants were irrigated by overhead sprinklers during the day for 10 days to facilitate establishment, then irrigated and fertilized through a central drip tape in each bed. Treatments were arranged in a randomized complete block design with four blocks in adjacent beds. Plots were 10 ft long and contained 20 plants in two staggered rows with 12-in. spacing within and between rows. Products were applied two to five times between 22 Oct and 17 Dec through dedicated drip tapes in 4,350 gal water/A (4 gal/plot followed by a 1-gal/plot flush with clean water). Two tapes were installed per plot, one close to each plant row. Each tape was 11-ft long with 10 emitters on 12-in. spacing. A single Rhyme application was injected into the soil with an EZ-Ject soil injector, delivering approximately 1 fl.oz. to individual plants. Injections were placed between the plant and the central drip tape, approximately 1 in. from the crown and 1 ½ in. deep. *M. phaseolina* inoculum was grown in darkness at 30° C for 14 d on sterile V-8 juice-impregnated toothpicks on corn meal agar plates. On 24 Oct (2 d after the initial application), two toothpicks with different isolates were placed on opposite sides of each plant approximately 0.5 in. from the crown and pressed vertically into the soil. A non-treated control was included in the experimental design, as well as a control inoculated with standard infested toothpicks. To suppress fruit diseases in the experimental area, Captan 80WDG was applied weekly by a tractor-mounted hydraulic sprayer (200 psi, 100 gal/A). Plots were harvested nine times from 5 Dec 2019 to 9 Jan 2020 to determine yield of marketable fruit. Healthy fruit weighing more than 1/3 oz each were considered marketable. Disease incidence was evaluated six times at 2-wk intervals from 5 Nov 19 (28 days after planting) to 14 Jan 20 (98 DAP) by counting the number of dead and diseased plants/plot. Diseased plants were still partially green but had one or more permanently wilted or dead crowns. Disease incidences were calculated by dividing the combined number of dead and diseased plants/plot by the initial number of plants/plot and expressed as proportions or percentages. Disease incidences expressed as proportions were used to determine values for area under the disease progress curve (AUDPC). Data were analyzed by ANOVA using the GLM procedure in SAS. Multiple mean comparisons were by Fischer's protected LSD ($\alpha = 0.05$).

Warm temperatures are conducive to infection and symptom development by thermophilic pathogens such as *M. phaseolina*. During the critical 2-wk period after inoculation, daily average air and soil temperatures were 77.0 and 80.4°F, respectively. Temperatures were lower during the next 2 weeks (65.5 and 74.5°F) and seasonably cool temperatures prevailed for the remainder of the trial. Disease incidence increased slowly at first. Of the 960 plants in this experiment, none were diseased 28 days after planting (DAP) on 5 Nov, and only 49 on 19 Nov (42 DAP). However, 490 plants were either dead or diseased at the end of the trial on 14 Jan (98 DAP). At that time, disease incidence (DI) in the inoculated control was 67.5% compared to 1.3% in the non-inoculated control. This indicates a successful inoculation in which *M. phaseolina* presumably accounts for most, if not all diseased plants in the trial. Topsin and Velum Prime suppressed disease development, as indicated by AUDPC values and percent DI at the end of the trial. Disease incidences in most other treatments ranged from 55 to 60%, which were not significantly different from the inoculated control. However, DI was 70% in one Rhyme treatment, whose first application was delivered by low volume soil injection, rather than conventional chemigation. This development suggests that the first application may be critically important for disease control. Overall yields were low since they represent only early season production. Even with this constraint, differences were detected. Topsin and Velum Prime increased yield, which has been shown in previous trials. The higher rate of pyraziflumid also increased yield. This relatively new SDHI fungicide has been highly effective against strawberry powdery mildew. Phytotoxicity symptoms were not observed in this trial.

| Treatment (product and rate/A) ^z | Application timing (DAP) | | | | | Yield (lb/A) | Disease parameters ^y | |
|--|--------------------------|----|----|----|----|-----------------|---------------------------------|--------------------|
| | 14 | 28 | 42 | 56 | 70 | | AUDPC | DI (%) |
| Control, non-inoculated | | | | | | 1889 a | 0.037 a | 1.3 a ^x |
| Velum Prime 6.5 fl oz | x | | x | | | 1545 ab | 1.275 b | 41.3 b |
| Topsin 4.5FL 20 fl oz | x | | x | | x | 1385 bc | 1.363 b | 42.5 bc |
| pyraziflumid 20SC 3.1 fl oz ^w | x | x | x | x | | 1551 ab | 1.562 bc | 51.3 bcd |
| Integral Pro 12.5 fl oz | x | x | x | x | x | 1154 bcd | 1.688 bc | 55.0 b-e |
| pyraziflumid 20SC 2.3 fl oz ^w | x | x | x | x | | 1192 bcd | 1.750 bc | 55.0 b-e |
| Serifel 10WP 8 oz | x | x | x | x | x | 1187 bcd | 1.638 bc | 56.3 b-e |
| Merivon 4.0 fl oz + Integral Pro 12.5 fl oz | x | x | x | x | x | 1061 cd | 1.813 bc | 56.3 b-e |
| Rhyme 7 fl oz | x | x | x | x | | 1298 bcd | 1.750 bc | 57.5 b-e |
| Rhyme 7 fl oz | x | | x | | x | 987 cd | 1.936 bc | 59.5 cde |
| Rhyme 7 fl oz ^v | x | x | x | x | | 1194 bcd | 2.088 c | 70.0 e |
| Control, inoculated | | | | | | 878 d | 2.175 c | 67.5 de |

^z Broadcast rates (as shown on the label) are given. However, drip treatments were considered banded applications and adjusted accordingly. In the experimental field, the beds covered 67% of the total surface area.

^y AUDPC = area under the disease progress curve (based on proportions). DI = disease incidence observed 98 days after planting (DAP), corresponding to the end of the early harvest period.

^x Values followed by the same letter are not significantly different ($\alpha = 0.05$) by Fisher's Protected LSD test.

^w Pyraziflumid is the active ingredient of a product under development; no trade name is available.

^v First application made with an EZ-Ject soil injector rather than the drip treatments used for all other applications in this trial.