Petunia (*Petunia×hybrida*)
Phytophthora root and crown rot: *Phytophthora nicotianae*

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Evaluation of the curative efficacy of fungicides in managing *Phytophthora* root and crown rot of petunia, 2023.

Disease-free petunia (*Petunia×hybrida,* PAS3189, Easy Wave® Pink) plants, growing in 15.2-cm pots filled with bark-based potting media (Pacific Organics CC55-screened pine bark), were sourced from a local nursery. Plants were placed outdoors on a gravel pad at the Hampton Roads Agricultural Research and Extension Center until use. Plants were watered once or twice a day for 8 minutes each depending on the weather conditions. A total of eight treatments were used: each treatment had four replicate pocket trays with each having two pots/plants (a total of 64 plants with 8 plants per treatment). The treatments were arranged in a randomized complete block design. The pocket trays were set 80 cm apart within each block and 90 cm apart among blocks. *Phytophthora nicotianae* isolate 47J5, originally recovered from petunia in Virginia Beach in 2010, was used to inoculate the petunia plants on June 15, 2023. The inoculum was prepared using the rice grain method. To inoculate each plant, four 5-cm deep holes were made vertically into the potting media of each pot using a wooden rod (18 x 0.8 cm), approximately 2 to 4 cm from the crown of each plant. One fully-colonized rice grain was inserted into each hole in block 1, two grains in each hole in blocks 2 and 3, and three grains in each hole in block 4, excluding the non-treated, non-inoculated controls. Immediately after inoculation, pots from each pocket tray were placed in a flat tray filled with water for approximately 12 hours to facilitate host infection. After one week of inoculation, fungicides were applied as a soil drench treatment on June 22, 2023. Due to precipitation in the days leading up to the treatment, the potting media was wet. Prior to drenching, the holding capacity of the potting media in each pot was measured, which allowed for an additional 3 fl oz of liquid – half of what was prescribed in the protocol. Subsequently, 3 fl oz of each fungicide at doubled concentration was drenched to each pot to ensure that petunia plants of individual treatments received the correct amount of product listed in the protocol while minimizing fungicide leachate. With additional precipitation forecasted, the petunia plants were moved into a greenhouse using the same layout as prior to the drench treatment. The plants remained in the greenhouse until the termination of the trial. For aerial parts, disease severity was first assessed on June 19, 2023 followed by two additional assessments at weekly intervals. Disease severity was assessed on a 0–5 scale (0 = healthy plants, 1 = 1–20% infection and no signs of crown rot, 2 = 21–40% infection and up to 3.0-cm diameter of crown rot, 3 = 41–60% infection and 3.1- to 6.0-cm crown rot, 4 = 61–80% infection and 6.1- to 9.0-cm crown rot, and 5 = >80% infection and >9.0-cm crown rot). For root rot, the whole root system was assessed on a 1–5 scale (1 = healthy roots, 2 = 1–25% damage, 3 = 26–50% damage, 4 = 51–75% damage, and 5 = 76–100% damage) on July 6. Disease ratings were converted into mid-points, and the effect of different treatments on disease severity was analyzed using one-way analysis of variance (ANOVA) followed by Tukey's HSD post hoc test in the R programming language. The normality of residuals was assessed using `qqPlot()` function of the car package. Only the final disease assessment data was considered in the analysis.

For aerial parts, the disease was not observed in non-treated, non-inoculated treatments; however, severe crown rot symptoms developed on inoculated petunias within a few days of inoculation regardless of fungicide treatment. Although the highest disease severity was observed on plants which did not receive any fungicide treatment**,** there was no statistical difference in disease severity between non-treated, inoculated petunias and treated, inoculated petunias. Similar trends were observed in the first two assessments (data not shown). Phytotoxicity was not observed on plants from any of treated plants. For roots, the plants of nontreated, non-inoculated treatment had a statistically better root quality than those of all other treatments.

In conclusion, none of the fungicides or concentrations applied 7-day post-inoculation was effective at managing petunia root and crown rot under this trial setting, i.e., weather conditions, inoculum levels and interval between inoculation and drench treatment. Further investigations are warranted to explore the potential curative efficacy of these treatments by examining shorter application intervals under varying weather conditions and inoculum levels.

Treatment and rate /100 gal	Disease severity ratings	
	Shoots*	Roots*
A17578 [A] 32 fl oz	2.3 a	2.3 a
A17578 [A] 8 fl oz	2.2 a	2.2 a
A20597 [B] 3.2 fl oz	2.2 a	2.2 a
A18590 [A] 3 fl oz	2.1 a	2.1 a
A17578 [A] 16 fl oz	2.1 a	2.1 a
A9619 [C] 1 fl oz	1.9 a	1.9 a
Non-treated, inoculated control	2.4 a	2.4 a
Non-treated, non-inoculated control	0 b	0 b

* Values are the means of four replicates in each treatment; those followed by the same letters within a column are not different at $P =< 0.05$.