GROWERTALKS

Pest Management

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Bridging the Gap Between Research & Practice

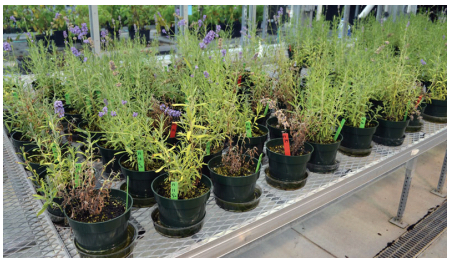
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American Society for Horticultural Science

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As the U.S. market for lavender production continues to increase, Phytophthora root and crown rot (PRCR) has become one of the most significant disease threats to the lavender industry today—both in the greenhouse and field. While the European lavender markets have been heavily geared toward essential oil production, this booming industry in the United States relies heavily on agritourism, including U-pick events and facility rentals, making the aesthetics of the fields that much more important.

PRCR was first reported in a Maryland nursery in 1991 on English lavender (*Lavandula angustifolia*) plants and since then the disease has also been found to occur in Spain, Italy, Greece and Bulgaria. Although multiple species of Phytophthora (oomycete pathogens that are fungus-like microorganisms) have been found to cause PRCR on several species of lavender, the originally isolated pathogen, *Phytophthora nicotianae*, continues to be the most common cause of PRCR on lavender today. Of the species of lavender grown commercially, English lavender appears to be more susceptible than hybrid lavender (i.e., lavandin) and other lavender species.



Lavender plants infected with *P. nicotianae* initially show characteristic symptoms of wilting and gray discoloration, and then, as the disease progresses, plants eventually develop root rot and may die. Many times, symptoms are brought on by excessive soil moisture, which produces a conducive environment for the pathogen and a stressful environment for the plants. It's not uncommon for entire sections of a field to begin expressing symptoms simultaneously when environmental conditions favor disease development.

English lavender Hidcote plants growing in a greenhouse after being treated with various fungicides and then inoculated with *Phytophthora nicotianae*. Plants in different treatments were placed randomly on the bench. The

container mix in pots was kept wet by placing saucers under each pot; this promoted infection and disease development.

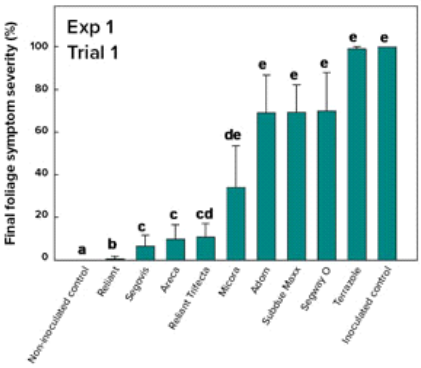
Because this is an emerging problem on an emerging specialty crop, there haven't been many studies on disease management. Based on the principles of plant disease management, the ideal situation would be to exclude the pathogen from lavender farms and fields; however, that's not always possible. Unfortunately, there are no curative products to eradicate Phytophthora pathogens from infected plants. Therefore, the two best options for a grower with a PRCR problem are to avoid environmental conditions that favor disease development and use plant protection products—for example, apply fungicides.

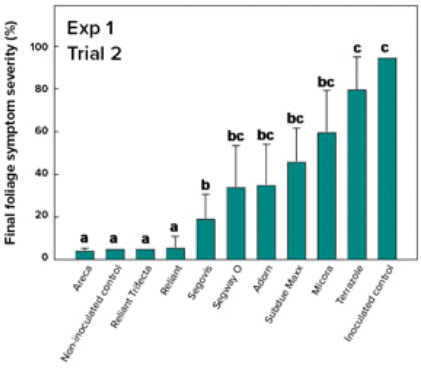
One of our goals at a land grant university is to work with industry partners to evaluate fungicides for efficacy at managing specific diseases affecting ornamental plants and then to relay our results to growers, so they can make informed disease management decisions. Our objective with this study was to evaluate registered and commercially available fungicides for efficacy at managing PRCR on lavender plants in the greenhouse. Results from this study could be used to identify fungicides that show the most promise for evaluation in field trials.

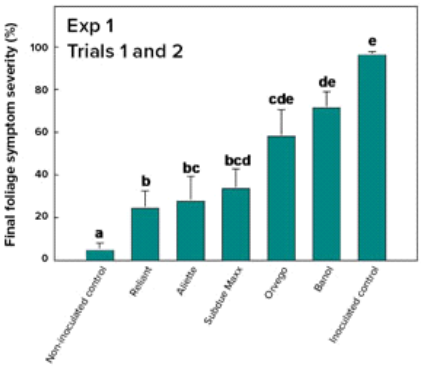
Study & results

Our study consisted of two separate experiments, each with two replicate trials and a variety of fungicides containing different active ingredients. The experiments were conducted during the summers of 2018 and 2019. We needed separate experiments to evaluate all the fungicides that were available.

Individual trials ran for approximately 40 days and used Hidcote English lavender plants. Plants were inoculated with a mixture of three P. nicotianae isolates—each recovered from a diseased Hidcote plant from a different state. We tested a total of 12 fungicides—nine in the first experiment and five in the second experiment. Two fungicides, Reliant and Subdue Maxx, were used in both experiments as standards. Only one product, Reliant Trifecta, wasn't commercially available because it was an experimental granular formulation of Reliant, which is a liquid fungicide. All other fungicides were labeled for managing Phytophthora diseases on ornamental plants or herbs. The 12 products included nine different chemical groups from the Fungicide Resistance Action Committee (FRAC).







Fungicides were applied four days prior to inoculation, with 11 products applied as soil drenches and Reliant Trifecta spread on the soil surface. There were also two control treatments in each trial that used plants not treated with fungicides. In one treatment, plants were inoculated with the pathogen and in the other treatment plants were not inoculated. Throughout the trials, the container mix in all pots was kept wet to encourage infection and disease development.

The effect of 12 fungicides on the severity of symptoms that developed on the foliage of lavender plants affected by Phytophthora root and crown rot in a greenhouse. Fungicides were evaluated in two experiments with two replicate trials conducted for each experiment. Data for the trials in Experiment 1 were analyzed separately, whereas data for the trials in Experiment 2 were combined for analysis.

Results from our experiments were very promising, with several fungicides providing significant protection of the inoculated plants. Efficacy was determined by recording weekly foliage symptom severity and then calculating area under disease progress curves (AUDPCs) and by weighing plant mass at the end of each trial. Foliage symptom severity and AUDPC provided very clear results, but only symptom severity data are reported here.

In the first experiment, analysis of data in the two trials was carried out separately due to differences between the trials, so results for each trial are reported separately. Despite these differences, the phosphonate products (Areca, Reliant and Reliant Trifecta) and Segovis, which contains the active ingredient oxathiapiprolin, were most effective at managing PRCR. The other fungicides in this experiment (Micora, Adorn, Subdue Maxx, Segway O and Terrazole) did not provide significant disease management when compared to the inoculated control treatment.

In the second experiment, the two trials produced similar results, so data from these trials were combined for analysis and reporting. Again, the phosphonate products (Reliant and Aliette) provided the best protection. However, unlike in the first trial, Subdue Maxx also provided significant protection when compared to the inoculated control plants, but Orvego and Banol were not effective in either trial.

Across all four trials, plants died from infection as early as 28 days after inoculation and up to 100% of inoculated control plants died in some trials, demonstrating just how quickly young English lavender plants can succumb to PRCR when not protected with fungicides or when treated with ineffective products. Despite the heavy disease pressure in our greenhouse experiments, phosphonate fungicides (Reliant, Reliant Trifecta, Areca and Aliette) consistently protected plants against PRCR. Consequently, this group of fungicides shows much promise for managing PRCR on lavender plants.

Based on our results, some growers have used phosphonate fungicides on lavender plants in the field and reported positive results. Segovis, with its novel mode of action, also provided good protection in the first experiment, but its use is restricted to greenhouses, nurseries and landscapes. Subdue Maxx, with the active ingredient mefenoxam,

historically has been a very effective product at managing Phytophthora diseases on ornamental plants, but it produced inconsistent results in our study, performing differently in the two experiments.

Fungicide resistance has been reported for P. nicotianae, but the isolates used in this study were tested and not resistant, therefore, this wasn't the problem. Obviously, additional studies with Subdue Maxx on lavender are needed. The other six fungicides used in our study didn't provide adequate protection of inoculated lavender plants under the experimental conditions in the greenhouse.

This study was conducted at Clemson University in collaboration with the U.S. Lavender Growers Association and industry partners. Our results have been reported to growers and the public by talking directly with individuals, presenting extension talks and workshops, and publishing a paper in the journal HortScience. Additionally, this project provided an effective training tool for a graduate student, thus helping to shape the next generation of plant health professionals serving the horticulture industry. **GT**

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