

Research Final Report
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Title: Evaluation of fungicides for control of *Phytophthora syringae* and *Phytophthora citricola* in Oregon nurseries.

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Abstract

Phytophthora syringae is a significant disease of nursery crops causing stem cankers on trees and leaf blight and shoot dieback of *Rhododendron* during the dormant season. *Phytophthora citricola* is a pathogen in Oregon that causes leaf and shoot blight of *Rhododendron*, but it is active during the summer. This study tested the efficacy of several fungicides labeled for the control of *Phytophthora* diseases in nursery crops. The host plants (*Fraxinus americana* 'Autumn Purple', *Malus* 'Spring Snow', *Pyrus calleryana* 'Chanticleer', *Rhododendron* 'Nova Zembla', and *Zelkova serrata* 'Green Vase') were container-grown at the North Willamette Research & Extension Center, Aurora, Oregon. The treatments (Aliette, Fosphite, Magellan, Stature DM, Fenstar, Subdue MAXX) were applied as labeled as either a spray and or as a drench. During the fall (2004) all hosts which were challenged with *P. syringae* on 18 Nov. Similar treatments were repeated the following summer (2005) using only *Rhododendron* as a host and challenged on 16 Jun with *P. citricola*. The phosphorus generators Aliette, Fosphite, and Magellan provide the best overall control of both *Phytophthora* species. Of particular interest is the effectiveness of this fungicide group used as a drench. No phytotoxicity was observed with any of the treatments.

Research Objective

The goal of this project was to investigate fungicide efficacy on preventing *Phytophthora* disease on nursery grown *Malus*, *Fraxinus*, *Pyrus*, *Zelkova*, and *Rhododendron*.

Materials & Methods

Phytophthora syringae - Winter Study

A research block of container-grown trees and *Rhododendron* was established at the North Willamette Research and Extension Center, Aurora, Oregon. On March 4, 2004, a total of 600 one-year old bare-root trees were potted into #7 size containers using a Douglas-fir based substrate and grown under a retractable roof structure. The four tree cultivars used for this study were *Malus* 'Spring Snow', *Pyrus calleryana* 'Chanticleer', *Fraxinus americana* 'Autumn Purple', and *Zelkova serrata* 'Green Vase'. A total of 160 *Rhododendron* 'Nova Zembla' were selected from a crop of #1 size plants grown fungicide-free for at least 8 months prior to this trial. The plants were arranged into eight treatment groups.

Product	Application	Date (s)	Rates
Aliette	Spray	9/2/04, 10/7/04	5.0 lbs / 100 gal
Fosphite	Spray	9/9/04, 10/7/04	2 qts / 100 gal
Stature DM	Spray	11/4/04	12.8 oz / 100 gal
Fenstar	Spray	11/4/04	28 oz / 100 gal
Fosphite	Drench	9/9/04	12.7 oz / 100gal
Subdue MAXX	Drench	9/9/04	2.0 oz / 100 gal
Aliette	Drench	9/9/04	0.8 / lbs 100 gal
Untreated	None	None	None

All of the treated hosts were challenged with *Phytophthora syringae* on November 18, 2004. Each inoculation site was wounded with an irrigation punch and then sprayed with distilled water. A 0.5cm x 1.0cm mycelium agar piece was placed onto the wound, so that the top side of the agar contacted the stem and then wrapped tightly with parafilm to keep the site from drying out. *Rhododendron* leaves were inoculated using a similar technique. There was some difficulty in securing the parafilm around the leaf to ensure a tight fit. The plants were kept in a semi-controlled environment (retractable-roof greenhouse) for an incubation period of 50 days. Stem cankers were measured by length and recorded for analysis.

Phytophthora citricola - Summer Study

A total of 360 *Rhododendron* ‘Nova Zembla’ were selected from a crop of #1 size plants grown at the North Willamette Research & Extension Center. These plants were grown fungicide-free for at least 14 months prior to this trial. The plants were top-dressed with 12 grams Osmocote 18-6-12 on March 30. The *Rhododendrons* were grown under a retractable roof structure with overhead irrigation. Eight treatment blocks were established and the following treatments were applied.

Treatment	Application	Date (s)	Rates
Aliette	Spray	6/3/05, 6/29/05	5.0 lbs / 100 gal
Magellan	Spray	6/3/05, 6/14/05, 6/29/05	64 oz / 100 gal
Stature DM	Spray	6/3/05, 6/14/05, 6/29/05	12.8 oz / 100 gal
Fenstar	Spray	6/3/05, 6/14/05, 6/29/05	28 oz / 100 gal
Aliette	Drench	6/3/05	0.8 / lbs 100 gal
Magellan	Drench	6/3/05	12.0 fl oz /100 gal
Subdue MAXX	Drench	6/3/05	2.0 oz / 100 gal
Untreated	None	None	None

On June 16, a sample set of seven plants per treatment were stem and leaf inoculated with *P. citricola*. A similar procedure was used to inoculate the *Rhododendron* stems as was used in the earlier study. The leaf inoculations were performed using a newly developed technique. Using a push pin, a wound was made near mid vein and the wound misted with de-ionized water. A small, white plastic cap filled with moist cotton was used to hold the inoculum directly over the wound and keep moisture in. The cap was held in place on the leaf by using a metal hair clip (5cm in length and 1cm wide). The clip was bent slightly to ensure an even pressure on the cap and good contact with the leaf. The caps were kept in place for five days then removed. The plants were kept in a semi-controlled environment (retractable-roof greenhouse) and overhead irrigated twice each day for an incubation period of 12 days. Stem cankers and leaf spot development were measured by length and recorded for analysis.

Results & Discussion

Phytophthora syringae - Winter Study

Overall, the fungicide Aliette applied either as a foliar spray or container drench provided the best control of *P. syringae* canker development for all five hosts. Of particular interest is the effectiveness of the phosphorus acid generators applied as a drench. The efficacy of the Fosphite drench treatment was similar to the Aliette treatments and was more effective than being applied as a foliar spray. While Stature DM and Subdue MAXX provided good control of canker development on *Zelkova*, they did not provide control on the other tree cultivars or *Rhododendron*. The new fungicide Fenstar performed poorly under the conditions of this study. As with previous studies, the flowering crab apple trees appear to be less responsive to the fungicide treatments than the flowering pear trees. There were no significant reduction in *Rhododendron* leaf spot size between the treatments. No *P. syringae* canker disease developed on any of the test plants unless they were inoculated. In addition, no phytotoxicity was observed with any of the fungicides evaluated.

Treatment	Type	<i>Phytophthora syringae</i> Stem Canker Length - cm				
		Flowering Pear	Flowering Crab Apple	White Ash	Zelkova	Rhododendron
Aliette	Spray	0.5 a ^z	2.2 a	1.0 a	1.7 abc	1.2 ab
Aliette	Drench	0.8 a	2.4 a	2.4 abc	2.2 abc	0.2 a
Fosphite	Drench	0.8 a	2.9 a	1.9 ab	2.5 bc	0.1 a
Fosphite	Spray	2.9 b	6.6 b	3.3 bcd	3.6 cd	1.7 bc
Stature DM	Spray	3.3 bc	6.4 b	3.5 cd	0.5 a	2.4 c
Subdue MAXX	Drench	4.6 cd	9.1 c	3.9 d	1.2 ab	2.1 bc
Fenstar	Spray	5.7 d	9.2 c	4.8 d	4.5 d	2.7 c
Untreated	None	6.0 d	9.5 c	4.1 d	4.7 d	2.3 bc

^z Column numbers followed by the same letter are not significantly different at P = 0.01 as determined by Tukey's multiple range test (NCSS, 2004).

Phytophthora citricola - Summer Study

Under the conditions of this study, the fungicides that provide the best overall control of foliar disease caused by *Phytophthora citricola* were Aliette and Magellan applied either as a drench or spray. The Stature DM, Fenstar, and Subdue MAXX treatments were not effective in preventing large stem cankers from developing. Stature DM was the only treatment that significantly reduce leaf spot size, but inoculated leaves did not develop very large disease spots, possible due to their advanced maturity. No disease incidence was observed on any of the uninoculated plants. No phytotoxicity was observed with any of the fungicide treatments.

Treatment	Application	<i>Phytophthora citricola</i>	
		Canker Length - cm	Leaf Spot Diameter - cm
Aliette	Drench	1.4 a ^z	0.7 ab
Magellan	Drench	2.1 a	0.7 ab
Aliette	Spray	2.3 a	0.7 ab
Magellan	Spray	3.9 a	0.8 ab
Stature DM	Spray	9.4 b	0.4 a
Fenstar	Spray	11.8 bc	1.1 ab
Subdue MAXX	Drench	11.8 bc	1.7 b
Untreated	None	12.8 c	1.5 b

^z Column numbers followed by the same letter are not significantly different at P = 0.01 as determined by Tukey's multiple range test (NCSS, 2004).