PHYTOPHTHORA
SOLUTIONS GUIDE
Products and Tips for Successful Control

*Phytophthora* organisms are a group of soil-borne pathogens, often referred to as water-molds. Dispersal of this pathogen can occur through contaminated groundwater, streams and irrigation water, use of infested potting media and soils, as well as contaminated plant material. Plants grown in saturated soil conditions due to overwatering and areas prone to flooding are at risk for infection.

There are numerous *Phytophthora* spp. that can affect a wide range of herbaceous and woody ornamental plants in the nursery and landscape. They are responsible for causing root and stem rots, cankers, as well as foliar blights.

The effect of *Phytophthora* spp. diseases can be devastating. In vegetable crops, *Phytophthora infestans* was responsible for the European famine in the mid-1800s. More recently, the sudden decline of oaks (AKA Sudden Oak Death), *Rhododendron* spp. and other woody species across many parts of the U.S. is caused by *Phytophthora ramorum*. Knowing the conditions that are conducive to infections and the susceptible plant species, coupled with good scouting and a preventive rotation of effective fungicides, can help you to avoid losses from *Phytophthora* diseases.
Woody Ornamentals

- Azalea
- Boxwood
- Camellia
- Citrus
- Ilex
- Juniper
- Kalmia
- Honeysuckle
- Lilac
- Magnolia
- Oaks
- Pieris
- Rhododendron
- Viburnum

Disease Symptoms

Recognizing the early signs of *Phytophthora* spp. infections is critical for stopping the spread of the pathogen across production areas. Symptoms to look for include:

**Stem Rot and Cankers**
- Irregularly shaped, water-soaked lesions often develop on the main stem near the soil line
- Dark brown, greasy lesions/cankers can develop on stems and petioles in the upper canopy
- Foliage on affected stems will be wilted and discolored as the disease progresses
- Internal tissue of affected stems will be discolored above and below the stem lesion
- Oozing cankers can form on the trunk and branches of woody plants

**Root and Crown Rot**
- Plants will have slow growth, smaller than normal foliage and are often stunted
- Affected roots can’t absorb water resulting in leaves turning yellow, becoming rolled/wilted and dropping from the plant
- One or more branches will show signs of wilt, eventually turn brown and necrotic
- The plant will collapse when the infection encompasses the entire lower stem
- White, fluffy mycelial growth may be seen at the affected site under high humidity
- Roots of affected plants will be dark brown-black and have a musty odor
- Symptoms may develop over a period of several weeks to months as the pathogen destroys the roots and works its way into the stems

**Foliar Spots and Leaf Blights**
- Lesions begin at the margin of the leaf and move inward, creating brown, zonate lesions that are irregular or elliptical in shape
- The margin of the lesion may have a dark border and appear water-soaked when held up to the light
- When wet, humid conditions prevail, lesions expand giving the tissue a blighted appearance
- Foliar blights can move into the stem causing shoot blights
Environmental Conditions
Temperature preferences vary among the *Phytophthora* species. While many prefer warm-to-high temperature conditions (70 – 90°F), others like *Phytophthora ramorum* thrive in cool-to-moderate temperatures (36 – 79°F, 68°F optimum). Infections occur with prolonged periods of foliar or soil wetness. The pathogen can overwinter in soil or in plant debris as oospores or chlamydospores, which germinate in the spring creating new infections. Motile zoospores are released under saturated soil conditions and enter the plant through wounds. The presence of water on leaves and high humidity are favorable conditions for foliar infections.

Cultural and Management Tips

- Use clean soil media for containerized production (*do not re-use old planting media without proper steaming or pasteurization*)
- Provide a clean, dry growing environment
- Avoid overhead watering, if possible, by using drip or micro-irrigation
- Avoid overwatering and monitor weather conditions for rain events
- Irrigate early in the day to reduce how long leaves and soil are wet
- Provide good plant spacing and horizontal air flow
- Elevate plants off the ground to avoid water spread, particularly in areas prone to flooding
- Immediately remove and dispose of infected plants
- Sanitize between crops
- In greenhouse production, keep humidity low by heating and venting as needed

Preventive treatments with effective fungicides are the best defense against *Phytophthora* diseases. For outdoor production areas, monitor weather conditions closely. If there is going to be a significant rain event causing saturated soil conditions for an extended period, make sure the plants are protected.

<table>
<thead>
<tr>
<th>Fungicide</th>
<th>FRAC Groups</th>
<th>Rate (Per 100 Gal)</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mural® fungicide</td>
<td>7 + 11</td>
<td>2-3 oz. drench</td>
<td>4-7 oz. foliar</td>
</tr>
<tr>
<td>Segovis® fungicide</td>
<td>49</td>
<td>0.6-3.2 fl. oz. (Drench or foliar spray)</td>
<td>Systemic and translaminar</td>
</tr>
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<td>Micora® fungicide</td>
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<td>4-8 fl. oz. (Drench or foliar spray)</td>
<td>Translaminar</td>
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<td>1-2 fl. oz. (Drench or foliar spray)</td>
<td>Systemic and translaminar</td>
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<tr>
<td>Pathogen</td>
<td>Temperature Range</td>
<td>Injury &amp; Common Plant Hosts</td>
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<tr>
<td>Phytophthora cactorum</td>
<td>36 – 89°F (77°F optimum)</td>
<td>Root &amp; crown rot on broad range of herbaceous &amp; woody ornamentals</td>
<td></td>
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<tr>
<td>Phytophthora cinnamomi</td>
<td>41 – 93°F (75-82°F optimum)</td>
<td>Root rot &amp; cankers on broad range of woody ornamentals</td>
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</tr>
<tr>
<td>Phytophthora citricola</td>
<td>37 – 89°F (77-82°F optimum)</td>
<td>Root rot &amp; trunk canker on citrus, <em>Rhododendron spp.</em>, other woody species</td>
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<tr>
<td>Phytophthora cryptogea</td>
<td>34 – 91°F (71-77°F optimum)</td>
<td>Root &amp; crown rot of gerbera, pansy and other herbaceous plants</td>
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<tr>
<td>Phytophthora drechsleri</td>
<td>41 – &gt;95°F (82-88°F optimum)</td>
<td>Root and crown rot of poinsettia, calibrachoa and other herbaceous plants</td>
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<tr>
<td>Phytophthora nicotianae/parasitica</td>
<td>43 – 98°F (80-89°F optimum)</td>
<td>Root &amp; crown rot on broad range of herbaceous plants</td>
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<tr>
<td>Phytophthora palmivora</td>
<td>51 – 95°F (80-86°F optimum)</td>
<td>Root rot and foliar blight on palms &amp; foliage plants</td>
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<tr>
<td>Phytophthora ramorum</td>
<td>35 – 79°F (68°F optimum)</td>
<td>Twig &amp; foliar blight on <em>Quercus spp.</em>, <em>Rhododendron spp.</em>, camellia, other woody species</td>
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<td>Phytophthora syringae</td>
<td>40 – 73°F (59-68°F optimum)</td>
<td>Stem canker on crab apple, lilac and <em>rosa spp.</em></td>
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<td>Phytophthora tropicalis</td>
<td>70 – 90°F (75-82°F optimum)</td>
<td>Leaf blight &amp; stem canker on foliage &amp; herbaceous plants</td>
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</tbody>
</table>

**Susceptible Crops**

*Phytophthora spp.* can infect a wide range of ornamental crops under the right conditions. Carefully scout the following plants that are prone to infection:

**Herbaceous Plants**

- Begonia
- Calibrachoa
- Foliage plants (including Dieffenbachia, Pothos, Spathiphyllum, English Ivy and more)
- Gerbera
- Gloxinia

- Lavender
- Liriope
- Pansy
- Petunia
- Poinsettia
- Snapdragon
- Vinca
- Violet
**Phytophthora nicotianae** Control on Petunia

2016 – Vero Beach Research Center

**CONTROL OF PHYTOPHTHORA CROWN ROT** *(Phytophthora Cryptogea)* on Gerbera

<table>
<thead>
<tr>
<th>Disease Severity</th>
<th>9</th>
<th>8</th>
<th>7</th>
<th>6</th>
<th>5</th>
<th>4</th>
<th>3</th>
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<td>Segovis 1 fl. oz.</td>
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<td>Adorn* 4 fl. oz.</td>
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2015 – Hand, The Ohio State University
WAI = Weeks After Inoculation
Rates per 100 gal

**CONTROL OF PHYTOPHTHORA ROOT ROT** *(Phytophthora Cinnamomi)* on Dogwood

<table>
<thead>
<tr>
<th>% Root Rot Severity</th>
<th>80</th>
<th>70</th>
<th>60</th>
<th>50</th>
<th>40</th>
<th>30</th>
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<td>Mural 3 fl. oz.</td>
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<td>Subdue Maxx 2 fl. oz.</td>
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2017 – F. Gurel & Timmons, Tennessee State University
Rates per 100 gal

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Your Comprehensive **Phytophthora spp.** Solution

A preventive fungicide is essential for successfully controlling *Phytophthora spp.* since often, it is too late to control once it is found. Incorporating effective fungicides and appropriate cultural practices can help reduce the threat of *Phytophthora spp.* in greenhouses and nurseries.

To learn more, visit [GreenCastOnline.com/Solutions](http://GreenCastOnline.com/Solutions)

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