

Best Management Practices for Boxwood Blight

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Best Management Practices for Boxwood Blight in the Virginia Home Landscape

This Best Management Practice document is a set of guidelines for home growers of landscape boxwood to avoid introduction of the boxwood blight pathogen into a landscape or, if the disease is already present in a landscape, to manage the disease in the most effective manner and avoid spread of the disease to new locations.

What is Boxwood Blight?

Boxwood blight (also known as box blight), caused by the fungus *Calonectria pseudonaviculata*¹, is a serious fungal disease of boxwood that results in defoliation and decline of susceptible boxwood. In Virginia boxwood blight was first identified in a nursery location in Carroll County in 2011. By the fall of 2013 it was found in other commercial nursery/retail operations and landscapes in several counties in Virginia. Once introduced to a landscape, boxwood blight is very difficult and costly to control with fungicides. The major means of spread of this disease is by movement of contaminated plant material (e.g. container or field-grown boxwood, boxwood greenery used for holiday decoration), but boxwood blight spores can also be spread on pruning tools, clothing, equipment and anything that might have contacted infected plants. Home growers can best protect their boxwood by following the measures listed below to avoid introduction of the disease to their landscape.

Symptoms of Boxwood Blight

The most characteristic symptoms of boxwood blight on susceptible boxwood cultivars are brown leaf spots (Fig. 1) that lead to defoliation (Fig. 2 on page 2) and black streaking on boxwood stem tissue (Fig. 3 on page 3). Some cultivars of boxwood can harbor the boxwood blight pathogen, yet show no symptoms; these cultivars are considered partially resistant² (also referred to as “tolerant”) cultivars (Table 1 on page 2). Fungicides can also mask symptoms of the disease on susceptible cultivars.



Fig. 1. Leaf spots are typically circular and brown and develop a dark brown border (photo by M.A. Hansen).

¹ Synonyms: *Cylindrocladium pseudonaviculatum*, *Cylindrocladium buxicola*

² Currently there are no boxwood cultivars available that are immune to boxwood blight; however, cultivars possessing various levels of resistance to the disease have been identified and research is ongoing to rank cultivars according to their level of resistance or susceptibility.



Fig. 2. Defoliation on boxwood in the planter and the mature plants in the foreground (photo by A. Bordas, Virginia Cooperative Extension).

Table 1. Susceptibility of 23 commercial boxwood cultivars to boxwood blight

(Compiled from research by Ganci, Benson and Ivors, North Carolina State University, 2012. Refer to latest cultivar trial results at <http://plantpathology.ces.ncsu.edu/pp-ornamentals/>)

Highly susceptible	<i>B. sempervirens</i> 'Suffruticosa' <i>B. sinica</i> var. <i>insularis</i> 'Justin Brouwers'
Susceptible	<i>B. microphylla</i> var. <i>japonica</i> 'Morris Dwarf' <i>B. microphylla</i> var. <i>japonica</i> 'Morris Midget' <i>B. sempervirens</i> 'Jensen' <i>B. sempervirens</i> 'Marginata' <i>Buxus</i> X 'Glencoe' (Chicagoland Green) <i>B. sempervirens</i> 'American' <i>B. sempervirens</i> 'Elegantissima'
Moderately susceptible	<i>Buxus</i> X 'Green Mound' <i>Buxus</i> X 'Conroe' (Gordo) <i>B. microphylla</i> 'Green Pillow' <i>B. microphylla</i> 'Grace Hendrick Phillips' <i>B. microphylla</i> 'Jim Stauffer' <i>Buxus</i> X 'Green Mountain'
Moderately resistant	<i>B. microphylla</i> 'Winter Gem' <i>B. sempervirens</i> 'Dee Runk' <i>B. sempervirens</i> 'Fastigiata' <i>Buxus</i> 'Green Gem' <i>B. microphylla</i> 'John Baldwin'
Most resistant (recommended for new plantings)	<i>B. microphylla</i> 'Golden Dream' <i>B. harlandii</i> <i>B. sinica</i> var. <i>insularis</i> 'Nana' <i>B. microphylla</i> var. <i>japonica</i> 'Green Beauty'

Other plant hosts

Pachysandra terminalis (Japanese spurge), *Pachysandra procumbens* (Allegheny spurge) and *Sarcococca* species (sweetbox), which are in the same family (*Buxaceae*) as boxwood, are also susceptible to boxwood blight and infected plants of these species could introduce the disease to a landscape. Symptoms of the disease on *P. terminalis* are brown leaf spots. New host plants may be identified as researchers learn more about this disease, but hosts will likely be limited to members of the *Buxaceae* family.

Avoiding introduction of boxwood blight to a landscape

Because the boxwood blight pathogen is not well adapted to long-distance spread by long-distance air currents, the most likely entry point for the disease in a home landscape is by accidental introduction of infected plant material and/or contaminated tools, equipment or other items. Home growers who have boxwood in the landscape should carefully adhere to the following recommendations to avoid inadvertent introduction of this devastating disease to their landscape:



Fig. 3. Dark streaks on stems (photo by M.A. Hansen).

- When purchasing boxwood plants for transplanting to a landscape, ask nursery personnel if their boxwood are from producers participating in the Boxwood Blight Cleanliness Program. Production nurseries participating in this program adhere to strict management practices that minimize the chance of introduction of this disease to their nurseries and are inspected by the Virginia Department of Agriculture and Consumer Services (VDACS) for the presence of boxwood blight. A link to information on the Boxwood Blight Cleanliness Program and other useful links can be found at the Virginia Boxwood Blight Task Force web site (<http://www.ext.vt.edu/topics/agriculture/commercial-horticulture/boxwood-blight/>).
- Prior to purchase, carefully inspect plants for symptoms of boxwood blight.
 - Be aware that partially resistant cultivars of boxwood (Table 1) could act as a “Trojan horse” in a landscape because partially resistant cultivars may harbor the boxwood blight pathogen, yet not show obvious symptoms.
 - Be aware that fungicide treatment can suppress symptom development.
- Monitor established boxwood and newly planted boxwood on a regular basis for any symptoms of boxwood blight.
- Be aware that boxwood greenery used for holiday decoration could harbor the boxwood blight pathogen.
 - To minimize risk of introducing the disease by this route, do not use boxwood greenery near landscape boxwood.
 - When disposing holiday greenery, double-bag it in sealed plastic bags and dispose of it in the landfill. Do not compost boxwood greenery.
- The boxwood blight fungus can be spread from one property to another via contaminated spray hoses, pruning tools, wheelbarrows, tarps, vehicles, clothing, shoes, or anything to which the sticky spores of the boxwood blight fungus might adhere. In fact, boxwood blight was reported to have spread from boxwood in one landscape to another landscape in North Carolina on a spray hose used to apply insecticides for boxwood leafminer control.

What to do if boxwood blight is suspected in a landscape

Virginia growers should submit suspect plant samples for diagnosis to the local Virginia Cooperative Extension (VCE) office (<http://www.ext.vt.edu/offices/>). VCE can send samples for confirmatory diagnosis to the Virginia Tech Plant Disease Clinic.

- Collect symptomatic boxwood samples (stems with black streaks, leaf spots, or defoliation) and double-bag in sealed plastic bags before transporting to your Extension office.
 - Plant samples should be accompanied by a completed plant diagnostic form (456-097), available at the county Extension office.
- Confirmatory diagnosis of this disease by a plant diagnostic lab is important because other problems on boxwood could be mistaken for boxwood blight. Additionally, to reduce spread of this serious disease, it is important for VCE to know where outbreaks of the disease occur and identify the source of any boxwood blight-diseased plant material.

What to do if boxwood blight is diagnosed in the landscape

Since boxwood blight cannot be effectively controlled once the infection begins, prompt removal of any diseased boxwood is recommended to help prevent spread of disease to healthy plants. Associated leaf debris should also be removed. **Be aware that removing diseased boxwood and leaf debris will not eradicate the boxwood blight pathogen from the location, since the pathogen produces long-lived survival structures that can persist in the soil for 5 to 6 years.** These survival structures can infect susceptible replacement boxwood planted in locations where the disease has been diagnosed. Therefore, replanting susceptible boxwood cultivars or members of the *Buxaceae* family in a location where infected boxwood has been removed is not advisable. Partially resistant boxwood cultivars (Table 1) could be used as replacement plants, but repeated fungicide applications will be necessary to protect any susceptible boxwood cultivars that remain in the landscape. Boxwood cultivars with a high level of resistance (termed “most resistant” in Table 1) will not require fungicide treatment.

After removal of diseased plants and debris, different management approaches should be considered, depending on the particular landscape situation. The two different scenarios outlined below illustrate two recommended, but different, management approaches:

Scenario 1

A landscape contains highly valued boxwood that are susceptible to boxwood blight, symptoms of boxwood blight were observed in the planting, and the disease was confirmed by a plant diagnostic lab (e.g. the VCE Plant Disease Clinic).

Immediate Actions Recommended

1. Remove diseased boxwood and leaf litter promptly. Remove leaf litter from soil surface by vacuuming, raking, or sweeping. If leaf debris has been incorporated into the soil, removing soil to a depth of 8" to 12" may help eliminate fungal inoculum of the pathogen. Diseased boxwood, leaf debris, and soil should be bagged and removed to the landfill OR buried 2' deep in soil away from boxwood plantings. **Do not compost boxwood debris or plant material.**
2. Because the fungal spores can stick to tools, equipment, etc., sanitize all tools, equipment, tarps, shoes, gloves, etc., used after removing plants to prevent spread of fungal inoculum to healthy boxwood (Table 3).
3. Promptly begin a preventative fungicide spray program on any susceptible boxwood in the landscape to prevent further disease outbreaks.
4. Be aware that pets, children, and other animals can also potentially move the sticky spores of this fungus to new locations.

Long-term Actions Recommended

1. Repeat fungicide applications (7- to 14-day intervals, according to product label) to susceptible boxwood throughout the growing season for the life of the boxwood plants.
 - a. If temperatures warm after the growing season has ended, additional fungicide application may be warranted. Warm temperatures plus leaf wetness are very favorable for boxwood blight

infection and spread, so any time temperatures are over 60°F and rainfall is expected, a preventative fungicide spray program should be in place.

2. Monitor boxwood weekly during the growing season for symptoms of boxwood blight. Remove any symptomatic plants/debris/soil as outlined above.
3. Boxwood debris should never be composted. Bag and dispose of in the landfill OR bury 2' deep in a location away from boxwood plantings.
4. When working in boxwood plantings, minimize the chance of spreading boxwood blight inoculum that could be present on shoes, gloves, clothing, equipment and tools by sanitizing between plants/plantings (Table 3).
5. Implement the suggested cultural practices in the section below: "Cultural Practices Recommended to Minimize Chance of Boxwood Blight."

Scenario 2

A landscape contains boxwood plants that developed symptoms of boxwood blight and the disease was confirmed by a plant diagnostic lab (e.g. Plant Disease Clinic); however, the boxwood in this landscape are not highly valued specimens. In this situation the simplest approach would be to replace boxwood blight-susceptible boxwood with boxwood cultivars that possess a high level of resistance (termed "most resistant" in Table 1) purchased from a nursery in the Boxwood Blight Cleanliness Program (Table 1). This will allow the grower to enjoy the beauty of boxwood plantings without the significant burden of repeated fungicide sprays to susceptible boxwood over the lifetime of the planting.

1. All susceptible boxwood should be removed, including the roots. Infested plant debris should be removed by raking, sweeping, or vacuuming, then bagged and taken to the landfill. Alternatively, debris can be buried 2' deep in soil away from landscape plantings. Do not compost diseased plant material. Be aware that removing diseased boxwood and leaf debris will not eradicate the boxwood blight fungal pathogen from the location, since the pathogen produces long-lived survival structures that can persist in the soil for 5 to 6 years.

2. If boxwood leaf debris has been incorporated into the soil, removing soil to a depth of 8” to 12” may help eliminate survival structures of the pathogen. Dispose of soil and leaf litter as recommended above for diseased plant material. Do not compost.
3. Sanitize all tools, equipment, tarps, shoes, gloves, clothing, etc., used when removing plants to prevent spread of fungal inoculum that can cause infection on healthy boxwood (Table 3).
4. Replant with boxwood cultivars that possess a high level of resistance (termed “most resistant” in Table 1) purchased from nursery producers who are in the Boxwood Blight Cleanliness Program.
3. Fungicides labeled for use by home growers are protectant fungicides and must be used preventatively.
4. An effective preventative fungicide spray program will require repeated applications (at 7- to 14-day intervals, depending on product label and environmental conditions) of fungicides throughout the growing season.
5. **Post-growing season: Warm temperatures with leaf wetness results in high boxwood blight disease pressure**, so if temperatures are over 60°F and a rain event is expected, a preventative fungicide spray should be in place post-season as well.
6. Thorough fungicide coverage of boxwood foliage is difficult, yet necessary for protection from the disease.

Fungicide management of boxwood blight in the home landscape

Important considerations for home growers when deciding whether to implement a preventative fungicide management program for boxwood in the home landscape are:

1. Fungicides cannot eradicate the disease from infected plants.
2. Once boxwood blight is present in the landscape, it is very difficult to control. Fungicide applications that are begun after the disease is already present do not provide acceptable disease control, according to the latest research results from North Carolina State University.

Currently, effective fungicide options for home growers are limited; however, professional applicators in the home landscape have more product options. Future research may lead to development of effective control of boxwood blight for home growers with fewer fungicide applications. For a list of specific fungicides labeled for control of boxwood blight in the landscape for use by non-professional applicators, refer to Table 2.

Cultural Practices Recommended to Minimize Chance of Boxwood Blight

- Purchase boxwood from nursery producers in the Boxwood Blight Cleanliness Program.

Table 2. Products containing the active ingredient chlorothalonil have been shown to be very effective in management of the boxwood blight pathogen, if used preventatively.

Active ingredient	Brand name and manufacturer
chlorothalonil	- Broad Spectrum Landscape & Garden Fungicide (Ferti-lome) - Vegetable, Flower, Fruit and Ornamental Fungicide (Hi-Yield) - Fung-onil (Bonide) - Ortho Max Garden Disease Control or Ortho Disease B Gon (Scotts)

Note: Read and follow label directions for all products. Commercial products are named in this publication for informational purposes only. The authors do not endorse these products and do not intend discrimination against other products that also may be suitable.

- Minimize leaf wetness and promote good air-circulation in boxwood plantings to minimize disease pressure. Examples include:
 - Choose cultivars that have a more open-growth habit (e.g. *Buxus microphylla* cultivars as opposed to *B. sempervirens* ‘Suffruticosa’).
 - Avoid overhead irrigation.
 - Ensure good air circulation in plantings by providing adequate spacing between plants. In general, growers may want to avoid close spacing of boxwood and, therefore, hedges.
- Mulch boxwood plantings to reduce the spread of boxwood blight inoculum to foliage by splashing water.
- Avoid working in boxwood plantings when the foliage is wet and fungal inoculum is more likely to be spread.
- Practice good sanitation practices to avoid moving infested soil or plant material to landscape locations where boxwood are located.
 - Sanitize pruning tools and other tools/equipment/ clothing/tarps between boxwood plantings and also between other members of the *Buxaceae* family.
 - Bag and dispose of all boxwood debris (including holiday greenery) in the landfill or bury 2’ deep in soil away from boxwood plantings.
 - Be aware that allowing boxwood tippers onto your property to collect greenery may increase the risk

of introduction of boxwood blight if the tippers visit multiple boxwood plantings and do not follow good sanitation practices.

- If you hire landscape professionals to spray or otherwise maintain landscape boxwood, discuss your concern about boxwood blight with them to learn about management practices they may have in place to avoid movement of boxwood blight from one client’s landscape to another. Then you can decide if their approach is acceptable to you.

Recordkeeping

Keep accurate records of boxwood cultivar names and locations on your property and where and when plants were purchased (or otherwise obtained). Keep records on location(s) of any diseased boxwood that are removed. Keep records of fungicide applications, including product information and date of application.

New Landscape Plantings

Purchase boxwood from nursery producers in the Boxwood Blight Cleanliness Program. When considering new boxwood plantings in the home landscape, consider installing boxwood blight cultivars that possess a high level of resistance (termed “most resistant” in Table 1), which have the glossy green, evergreen foliage and growth habits valued by many Virginia home gardeners. The boxwood blight pathogen can live and produce spores on these partially resistant cultivars, but cultivars with a high level of resistance, even if infected, will thrive and do not show noticeable symptoms of the disease.

Table 3. Sanitizers for equipment/tools.

Follow label directions and precautions on all labeled products. Surfaces must be free of soil and other organic matter for sanitizers to be effective. The highest label rate is recommended. For best efficacy, at least 5-minute contact time with sanitizing agent is recommended for tools; for pots or other surfaces, at least 10 minutes. These products are corrosive, so oil tools after treatment.

Active ingredient	Brand Names
o-Benzyl-p-chlorophenol (1.25 oz/gallon)	Lysol Concentrate Disinfectant
sodium hypochlorite (1 part bleach: 9 parts water)	Clorox, other brands of household bleach (must be prepared fresh)

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