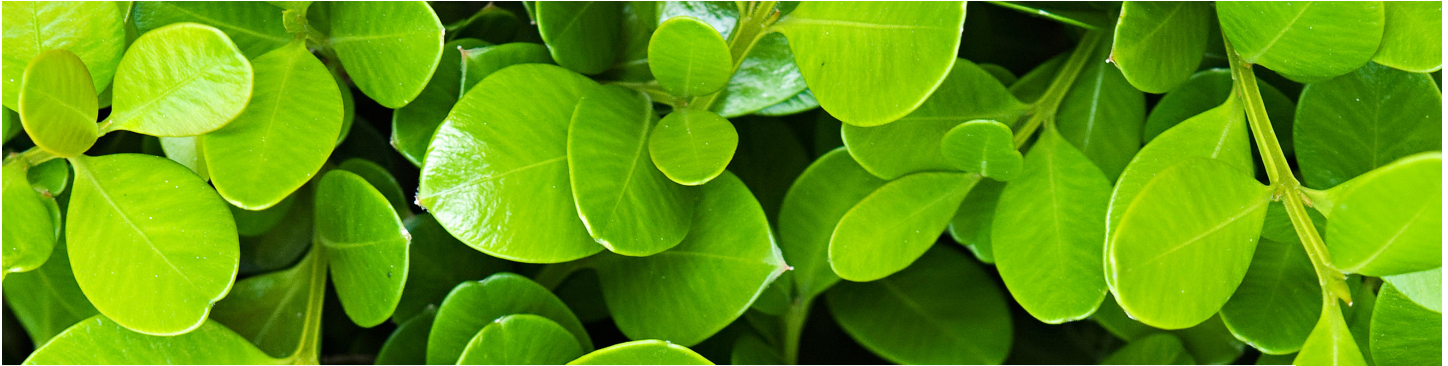




Horticultural
Research Institute

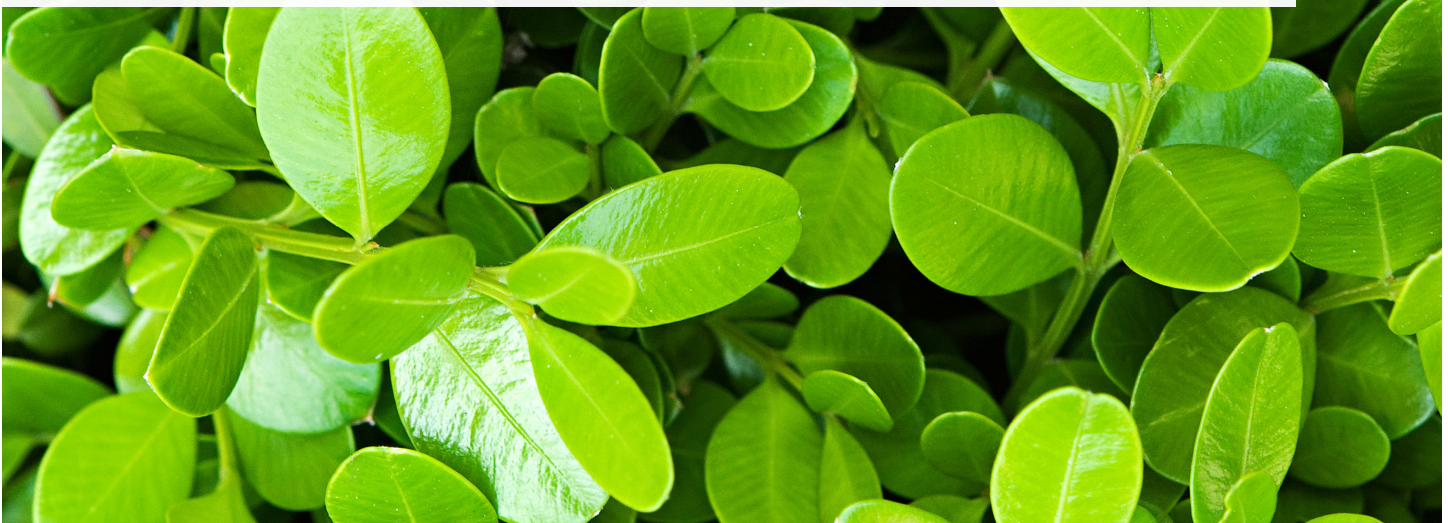


Best Management Practices

BOXWOOD HEALTH

Production and Landscape Management

Version 3.0



Endorsed by





Horticultural Research Institute

Best Management Practices

BOXWOOD HEALTH

Production and Landscape Management

Proudly Endorsed By



HORTICULTURAL RESEARCH INSTITUTE
2130 Stella Court | Columbus, OH 43215
p. 614-884-1155 | www.HRIResearch.org

© The Horticultural Research Institute, 2020
Version 3.0



contents

| | |
|--|---------------------------|
| <u>Introduction.....</u> | <u>4</u> |
| <u>Boxwood Blight Symptoms.....</u> | <u>5</u> |
| <u>(REVISED) Best Production Management Practices.....</u> | <u>6</u> |
| <u>(NEW) Best Landscape Management Practices.....</u> | <u>11</u> |

Also Included

[Print-and-Share Production Practices One Pager](#)

[Print-and-Share Landscape Practices One Pager](#)



Horticultural Research Institute

introduction

ABOUT BMPs

The following voluntary industry recommended **Best Management Practices for Boxwood Health** were designed to provide guidelines to help growers and landscape managers contend with the risk of boxwood blight (caused by *Calonectria pseudonaviculata*, previously called *Cylindrocladium pseudonaviculatum*) introductions and respond if the disease is confirmed on the nursery or landscape grounds.

These suggestions are based largely on best management practices (BMP's) promoted by the Connecticut Agricultural Experiment Station (CAES), the Oregon Department of Agriculture, and the Virginia Polytechnic Institute and State University and have received the support of the both the production and landscape management industries, the research community, and those in the regulatory community.

DEVELOPMENT & ENDORSEMENTS

The **Best Management Practices for Boxwood Health** were developed by the Horticultural Research Institute. They have been endorsed by AmericanHort, the National Plant Board, and the National Association of Landscape Professionals (NALP). These recommendations are strictly voluntary and are intended to provide guidance that is practical in terms of cost and benefit, relevant to multiple types of production and management, and takes into consideration the diversity of nursery and landscape sizes, their regional climatic conditions, and their production and management systems. All statements regarding plant material pertain only to *Buxus*, *Pachysandra*, and *Sarcococca* species and are not to be interpreted more broadly. Please be advised that holiday boxwood greenery and germplasm are also known as potential boxwood blight carriers.

HOW TO USE

Best Management Practices for Boxwood Health are presented and suggested for voluntary adoption by growers producing *Buxus* spp. and other boxwood blight host plants, as well as caretakers of *Buxus* spp. and other boxwood blight host plants in the landscape. They were developed by a working group convened by the HRI, the research affiliate of AmericanHort, with review and input from the National Plant Board (NPB). The NPB developed a model compliance agreement for growers either choosing to operate under a formal compliance agreement or required to after detection of boxwood blight at their place of production or management. Growers should be advised that if operating under a compliance agreement, key aspects of the BMP's, such as record-keeping, may become legally binding and subject to oversight by state plant regulatory personnel.

REVIEW TEAM

Marc Cubeta, North Carolina State University
Margery Daughtrey, Cornell University
Bruce Hellerick, BrightView Landscape Services
Chuan Hong, Virginia Polytechnic Institute and State University
Tom Hughes, Hughes Nursery and Landscaping
Dan Kenney, Ohio Department of Agriculture
Bob Mann, National Association of Landscape Professionals
Scott McAdam, McAdam Landscaping
Dana Rhodes, Pennsylvania Department of Agriculture
Scott Schirmer, Illinois Department of Agriculture
Anni Self, Tennessee Department of Agriculture
Nina Shishkoff, United States Department of Agriculture – Agricultural Research Service



Horticultural Research Institute

boxwood blight symptoms

Only leaves and stems are affected in field conditions. If in doubt, please contact a local plant diagnostic lab for help. Boxwood blight can be confused with *Volutella* infections and even some insect pest infestations.



FIRST SIGNS

First symptoms = light to dark brown, circular leaf spots with dark borders



FALLING FAST

Rapid defoliation, especially in the lower canopy



INFECTED STEMS

Infected stems have dark brown to black, elongated cankers.



 Horticultural Research Institute

Best Management Practices

BOXWOOD HEALTH

production practices

Individual nurseries are encouraged to review the recommended practices and apply some or all of them, depending on their specific circumstances.

SECTION A: Boxwood Blight Training

- a. Early detection is critical; train personnel to recognize and report disease symptoms.
- b. Train personnel in BMP's, including the biology and survival of the pathogen, sanitation strategies, and management options.
- c. Be aware that symptoms may be discreet and difficult to detect on some cultivars.
- d. Be aware that boxwood blight spores are sticky and can be transmitted from one block to another via contaminated spray hoses, clothing, shoes, tarps, vehicles, pruning tools, animals, etc.
- e. If a diseased plant is suspected, contact your state agricultural department or your local/ regional [National Plant Diagnostic Network](#)¹ laboratory to submit a sample for confirmation while restricting access to suspected blighted plants. When submitting a sample, collect plant material, about 8-10" in length, with both healthy and symptomatic material (such as leaf spots, stems with black streaks, defoliated stems). Place all plant material in a 1 gallon Ziploc bag. Samples

can be cut in half to fit in a bag if needed. Keep varieties and/or blocks in separate bags. Do not add moisture to the bag. Samples can be mailed but should be sent early in the week or via overnight delivery to avoid sitting over the weekend. Hand deliver to the lab, if possible.

- f. Resources to aid in training and identification can be found at:

[Virginia Cooperative Extension Boxwood Blight Task Force](#)²

[Connecticut Agricultural Experiment Station Boxwood Blight Plant Disease Information Office](#)³

SECTION B: Share BMPs adopted in production with customers.

Boxwood producers should be proactive and share the best management practices they adopt with their customers.

Section C: Mitigate Accidental Introduction of Boxwood Blight

- a. Consider growing only boxwood species and cultivars which are less susceptible than *Buxus sempervirens* 'Suffruticosa' and *Buxus sempervirens*. HRI's Boxwood Initiative currently supports validation of a standardized testing procedure to evaluate cultivar susceptibility and tolerance. Studies are in progress, and results will be released when available. Until then, please consult the [Tennessee State Extension guide](#)⁴.
- b. Propagate locally to avoid accidental introduction by incoming plant material whenever possible.
 - i. Avoid acquiring cuttings from high traffic and public areas, such as parks, parking lots, hedgerows along walkways, and cull piles.
 - ii. Inspect mother plants for signs and symptoms prior to taking cuttings.
 - iii. Avoid treating mother plants with fungicides in order that symptoms of disease will be evident, unless stock and site are known to be disease free.
 - iv. Place a physical barrier between containerized boxwood and the ground, such as a weed barrier cloth or gravel to facilitate leaf debris cleanup.

- c. When purchase is necessary.
 - i. Purchase only from reputable suppliers, ideally nurseries that are licensed and/or certified according to applicable phytosanitary laws and regulations.
 - ii. Trained nursery personnel should inspect plants and cuttings for signs and symptoms at the time of purchase.
 - iii. Separate plants obtained from different vendors.
 - iv. New buy-in's meant for production should be separated by a physical barrier or break (minimum 3 meters) from host plant nursery production stock for a minimum of 30 days.
 - v. Suspend the use of fungicides on new plants during the holding period.
 - vi. Re-inspect material regularly, based on environmental conditions conducive for disease development (warm, wet/humid, 60-80°F).
 - vii. Plants with suspicious symptoms of boxwood blight should be sent for diagnosis to your agricultural department or your local/regional National Plant Diagnostic Network¹ laboratory while restricting access to suspected blighted plants. When submitting a sample, collect plant material, about 8-10" in length, with both healthy and symptomatic material (such as leaf spots, stems with black streaks, defoliated stems). Place all plant material in a 1 gallon Ziploc bag. Samples can be cut in half to fit in a bag if needed. Keep varieties and/or blocks in separate bags. Do not add moisture to the bag. Samples can be mailed but should be sent early in the week or via overnight delivery to avoid sitting over the weekend. Hand deliver to the lab, if possible.
- d. Returned plants.
 - i. Avoid accepting returns on-site.
 - ii. No dead material should be accepted nor disposed of on site.
 - iii. Do not compost returned material.

Section D: Mitigate Local Spread of Boxwood Blight as if There Were an Accidental Introduction

- a. Follow standard in-field sanitation practices.
 - i. Employ smaller sized blocks and alternate with blocks of non-boxwood blight hosts.
 - ii. Crews should begin work with block or house with lowest likelihood of infection (lots from previous seasons) and finish with the blocks with highest risk (recent buy-ins).
 - iii. Individual pruning crews should work on a single house or block at a time.
 - iv. Clothing, equipment, and vehicles should be sanitized between blocks. Outer clothing of workers who conduct surveys and maintenance should either be disposable or laundered before entering another property. The use of disposable booties, coveralls, etc. are recommended. Conidia, a type of spore, are killed within seconds with 70% alcohol (either isopropyl or ethanol), and microsclerotia, a long-lived type of spore capable of persisting in soil from 5-6 years, are killed within four minutes. Other products, including concentrated Lysol, 10% bleach solution, hydrogen dioxide (Zero Tol®), hydrogen peroxide (OxiDate®), peroxyacetic acid (peracetic acid), and octanoic acid (caprylic acid) only kill conidia.
 - v. Pruning should be done when plants are dry or during low humidity periods, when possible.
 - vi. Do not over-prune plants.
 - vii. Remove debris from production area and dispose of properly, by placing in cull or compost piles.
- viii. Do not compost infected plant material.
- ix. Keep boxwood at least 3 meters from Pachysandra and Sarcococca.
- x. Insert a 3-meter barrier block (non-host plant such as Nandina or other non-host plant) between boxwood and Pachysandra or Sarcococca.
- b. Holding areas, delivery trucks, potting mixes and containers.
 - i. Locate the holding area on concrete, asphalt, or weed mat over gravel or plastic, if possible.
 - ii. Surfaces should be cleared of plant debris and standing water.
 - iii. Avoid bringing in plant diggers or large equipment that may have worked on sites where boxwood blight has been introduced.
 - iv. Clean and sanitize equipment as much as possible before it enters nursery property. Conidia, a type of spore, are killed within seconds with 70% alcohol (either isopropyl or ethanol), and microsclerotia, a long-lived type of spore capable of persisting in soil from 5-6 years, are killed within four minutes. Other products, including concentrated Lysol, 10% bleach solution, hydrogen dioxide (Zero Tol®), hydrogen peroxide (OxiDate®), peroxyacetic acid (peracetic acid), and octanoic acid (caprylic acid) only kill conidia.
 - v. Do not allow customer vehicles into the production areas of a nursery.
 - vi. Use new or sanitized pots and flats for boxwood production.
 - vii. Use new potting mixes and compost, free of boxwood debris.
 - viii. To avoid cross-contamination, clean pots and new potting mix should be stored in an area away from any cull piles or production beds and protected from drainage/irrigation water.
- c. Fungicides
 - i. Fungicides are only preventive for boxwood blight management.
 - ii. Fungicide applications can suppress symptom development and prevent further spread but do not cure the plant from infection.
 - iii. Repeated applications will be necessary, the number depending on the tolerance of

UPDATES & DISCLAIMER

Updates to the recommendations are made on an ongoing basis and as new information regarding boxwood blight and its management comes to light.

Reference within this document to any specific commercial or noncommercial products by trade name or active ingredient does not constitute or imply an endorsement or recommendation by AmericanHort and HRI. Please consult product labels for the most current use rates and guidelines.

cultivars present and weather conditions from year to year.

- iv. Thorough coverage is difficult given the compact growing habit of boxwood. Spray to run-off. Spray fungicides on both front and back of leaves and stems.
 - v. Fungicides that have federally labeled for boxwood blight management include, but are not limited to:
 1. Chlorothalonil (Daconil®, others)
 2. Chlorothalonil + thiophanate methyl, (Spectro®, others)
 3. Cyprodinil + fludioxonil (Palladium®)
 4. Fludioxonil, (Spirato®)
 5. Fluxapyroxad + pyraclostrobin (Orkestra®)
 6. Propiconazole (Banner Maxx®, others)
 7. Tebuconazole (Torque®, others)
 - vi. Always consult product labels for most up to date rates, spray intervals, and site recommendations, as well as local restrictions.
- d. Water management – water is an important part of disease dispersal.
- i. Avoid overhead watering when possible.
 - ii. Water plants in the morning hours unless weather conditions require additional watering.
 - iii. Direct runoff water from holding areas and compost and cull piles away from production areas.
 - iv. Prevent the accumulation of pooling water in growing blocks.
 - v. Space plants to allow for air circulation.

Section E: Scouting and Evaluating On-Site Boxwood, Pachysandra, and Sarcococca Material

- a. On-site host plant material from previous seasons should be inspected by trained nursery personnel for signs and symptoms of boxwood blight on a regular basis, frequency to be based on environmental conditions conducive for disease development (warm, wet/humid, 60-80°F).
- b. Restrict access to and do not sell boxwood with suspicious symptoms until they have been inspected and cleared.

Section F: Boxwood Blight Pathogen Eradication and Containment

- If a boxwood sample from the nursery has been confirmed as having boxwood blight by a laboratory
- a. Be aware that boxwood blight spores are sticky and can be transmitted from one property or block to another via contaminated spray hoses, clothing, shoes, tarps, vehicles, pruning tools, animals, etc.
 - b. Do not compost infected plant material.
 - c. All infected plants and plant debris should be burned, buried a minimum of 2 ft. below the surface, or disposed of in an approved landfill or incinerator.
 - d. Cover or double bag diseased plants before transport.
 - e. Do not move during rain events.
 - f. If plants are too big to bag, then burn or bury them on-site (so that the top of the debris is at least ten inches below the soil surface) or transport in a covered trailer for disposal. Clean trailer with a disinfectant after use. Conidia, a type of spore, are killed within seconds with 70% alcohol (either isopropyl or ethanol), and microsclerotia, a long-lived type of spore capable of persisting in soil from 5-6 years, are killed within four minutes. Other products, including concentrated Lysol, 10% bleach solution, hydrogen dioxide (Zero Tol®), hydrogen peroxide

RESOURCES & LINKS

¹National Plant Diagnostic Network: <https://www.npdn.org/home>

²Virginia Cooperative Extension Boxwood Blight Task Force: <https://ext.vt.edu/agriculture/commercial-horticulture/boxwood-blight.html>

³Connecticut Agricultural Experiment Station Boxwood Blight Plant Disease Information Office: <https://portal.ct.gov/CAES/PDIO/Boxwood-Blight/Boxwood-Blight>

⁴Tennessee State Extension resource on boxwood blight for guidance as to cultivar resistance/susceptibility: <http://www.tnstate.edu/extension/documents/Boxwood%20Blight%20Factsheet.pdf>

- (OxiDate®), peroxyacetic acid (peracetic acid), and octanoic acid (caprylic acid) only kill conidia.
- g. Remove all fallen leaf and plant debris from areas where pathogen is detected.
- h. Disinfect or bury pots (so that the top of the debris is at least ten inches below the soil surface). Do not reuse in boxwood production.
- i. Clothing, equipment, and vehicles used during the disposal of diseased plants should be sanitized before reentering production areas. Outer clothing of workers who conduct disposal should either be disposable or laundered before returning to the nursery. The use of disposable booties, coveralls, etc. are recommended. Conidia, a type of spore, are killed within seconds with 70% alcohol (either isopropyl or ethanol), and microsclerotia, a long-lived type of spore capable of persisting in soil from 5-6 years, are killed within four minutes. Other products, including concentrated Lysol, 10% bleach solution, hydrogen dioxide (Zero Tol®), hydrogen peroxide (OxiDate®), peroxyacetic acid (peracetic acid), and octanoic acid (caprylic acid) only kill conidia.
- h. Location of any and all burial pits. Burial of infected debris does not kill the pathogen quickly but immobilizes it while it dies slowly. Therefore, it is important to avoid replanting Buxus in these areas.
- i. Inspection records.
- j. Personnel training.
- k. Weather records, if available.

Section G: Record Keeping

Accurate and detailed records for the following activities should be maintained a minimum of 12 months for traceability, if possible.

- a. Plants moving off-site.
 - i. Quantity
 - ii. Destination
- b. Plants brought on-site.
 - i. Quantity
 - ii. Source
- c. Plant propagation techniques.
- d. Location of receiving and holding areas.
- e. Mortality due to any boxwood blight-suspicious cause(s).
- f. Diagnostic records.
- g. Fungicide treatments.
 - i. Product name
 - ii. Rate used.
 - iii. Date of application.

BOXWOOD HEALTH

landscape practices

Individual landscape management companies are encouraged to review the recommended practices and apply some or all of them, depending on their specific circumstances.

SECTION A: Boxwood Blight Training

- a. Early detection is critical; educate personnel to recognize the disease symptoms and know what to do if symptoms are observed.
- b. Train personnel in BMP's, including the biology and survival of the pathogen, sanitation strategies, and management options.
- c. Be aware that symptoms may be discreet and difficult to detect on some cultivars.
- d. Be aware that boxwood blight spores are sticky and can be transmitted from one property to another via contaminated spray hoses, clothing, shoes, tarps, vehicles, pruning tools, animals, etc.
- e. If a diseased plant is suspected, contact your state agricultural department or your local/ regional [National Plant Diagnostic Network](#)¹ laboratory to submit a sample for confirmation while restricting access to suspected blighted plants. When submitting a sample, collect plant material, about 8-10" in length, with both healthy and symptomatic material (such as leaf spots,

stems with black streaks, defoliated stems). Place all plant material in a 1 gallon Ziploc bag. Samples can be cut in half to fit in a bag if needed. Keep varieties and/or blocks in separate bags. Do not add moisture to the bag. Samples can be mailed but should be sent early in the week or via overnight delivery to avoid sitting over the weekend. Hand deliver to the lab, if possible.

- f. Resources to aid in training and identification can be found at:

[Virginia Cooperative Extension Boxwood Blight Task Force](#)²

[Connecticut Agricultural Experiment Station Boxwood Blight Plant Disease Information Office](#)³

SECTION B: Share BMPs adopted by landscape management company with parties and customers being serviced.

Landscape managers should be proactive and share the best management practices they adopt with their customers.

SECTION C: Mitigate introduction to a landscape. It is much easier to prevent boxwood blight introduction than control it or remediate.

- a. Well established boxwood gardens and plantings
- Avoid bringing any host plant material to the property
 - Use nonhost groundcovers and companion plants

- Purchase plant material only from reputable suppliers, ideally nurseries that are licensed and/or certified according to applicable phytosanitary law and applications.
 - Maintenance should be done by designated staff with site-specific set of tools
 - Boxwood management is ideally done independently of other tasks. Schedule boxwood maintenance as either the first or last task of the job and/or as the first or last stop of the day and practice strict sanitation protocols.
 - Practice sanitation measures and advocate these to others working on the same property
 - Scout regularly
- b. New boxwood gardens and plantings
- Purchase only from reputable suppliers, ideally nurseries that are licensed and/or certified according to applicable phytosanitary laws and regulations.
 - Install boxwood species and cultivars which are less susceptible than *Buxus sempervirens* 'Suffruticosa' and *Buxus sempervirens*. HRI's Boxwood Initiative currently supports validation of a standardized testing procedure to evaluate cultivar susceptibility and tolerance. Studies are in progress, and results will be released when available. Until then, please consult the [Tennessee State Extension guide](#)⁴.
 - Request history of fungicide applications from the producer/nursery, including fungicide name(s), application rate(s), and date(s) applied.
 - Plants should be inspected for symptoms of boxwood blight at the time of purchase.
 - Hold plants for at least four weeks before planting to ensure that they are disease free prior to planting, especially if there are already established boxwoods on the property.
 - Avoid co-mingling of plant material if obtained from different vendors/nurseries.
 - Choose a holding area with a surface that can be easily cleaned of plant debris.
 - Remove all plant debris on a regular basis by vacuuming, sweeping, or raking and properly dispose of it. Do not compost.

UPDATES & DISCLAIMER

Updates to the recommendations are made on an ongoing basis and as new information regarding boxwood blight and its management comes to light.

Reference within this document to any specific commercial or noncommercial products by trade name or active ingredient does not constitute or imply an endorsement or recommendation by AmericanHort and HRI. Please consult product labels for the most current use rates and guidelines.

4. Do not use fungicides on new plants during the holding period.
 - vi. Do not use or dispose of boxwood greenery near boxwoods in the landscape.
 1. When disposing holiday greenery, double bag it in sealed plastic bags and dispose of it in the landfill or bury it so that the top of the debris is at least ten inches below the soil surface.
 2. Do not compost.
 - vii. Minimize exposure of ‘temporary/seasonal’ boxwoods (e.g. in planters, pots, etc.) to, and contact with, infected areas/plants within the landscape. If relocation or disposal is required, handle these plants as if they are infected.
 - viii. Be aware that boxwood blight spores are sticky and can be transmitted from one property to another via contaminated spray hoses, clothing, shoes, tarps, vehicles, pruning tools, animals, etc.
 - ix. Advocate sanitation and hygiene practices to the property and business owners.
 - x. If a diseased plant is suspected, contact your state agricultural department or your local/regional National Plant Diagnostic Network¹ laboratory while restricting access to suspected blighted plants. When submitting a sample, collect plant material, about 8-10” in length, with both healthy and symptomatic material (such as leaf spots, stems with black streaks, defoliated stems). Place all plant material in a 1 gallon Ziploc bag. Samples can be cut in half to fit in a bag if needed. Keep varieties and/or blocks in separate bags. Do not add moisture to the bag. Samples can be mailed but should be sent early in the week or via overnight delivery to avoid sitting over the weekend. Hand deliver to the lab, if possible.
- applicable laws) or incinerator, promptly burned, or buried a minimum of ten inches below the surface. Do not compost.
 - ii. Remove all adjacent, non-symptomatic boxwood, Pachysandra, and Sarcococca plants within ten feet of symptomatic plants.
 - iii. Cover or bag diseased plants before transport.
 - iv. Do not move during rain events.
 - v. If plants are too big to bag, then burn or bury them on-site or transport in a covered trailer for disposal. Carefully remove leaves and clean the trailer with a disinfectant, such as a quaternary ammonia-based product (Green Shield® or Physan 20®) or ethanol, after use.
 - vi. Remove all fallen leaf and plant debris from areas where pathogen is detected.
 - vii. Do not compost infected plant material.
 - viii. If the diseased plant is in a container, the container must be treated. Disinfest (sanitize) or bury pots and containers quickly and effectively disinfest tools and contaminated impervious surfaces. Conidia, a type of spore, are killed within seconds, and microsclerotia, a long-lived type of spore capable of persisting in soil from 5-6 years, are killed within four minutes. Other products, including concentrated Lysol, 10% bleach solution, hydrogen dioxide (Zero Tol®), hydrogen peroxide (OxiDate®), peroxyacetic acid (peracetic acid), and octanoic acid (caprylic acid) only kill conidia.

SECTION D: Mitigate spread in the event of a confirmed infection.

- a. Contain the disease and protect remaining healthy-looking boxwood on the property
 - i. All infected plants and plant debris should be double bagged in sealed plastic bags and disposed of in an approved landfill (per

RESOURCES & LINKS

¹National Plant Diagnostic Network: <https://www.npdn.org/home>

²Virginia Cooperative Extension Boxwood Blight Task Force: <https://ext.vt.edu/agriculture/commercial-horticulture/boxwood-blight.html>

³Connecticut Agricultural Experiment Station Boxwood Blight Plant Disease Information Office: <https://portal.ct.gov/CAES/PDIO/Boxwood-Blight/Boxwood-Blight>

⁴Tennessee State Extension resource on boxwood blight for guidance as to cultivar resistance/susceptibility: <http://www.tnstate.edu/extension/documents/Boxwood%20Blight%20Factsheet.pdf>

SECTION E: Management practices in the landscape

- ix. Clothing, equipment, and vehicles used during the disposal of diseased plants should be sanitized before entering other properties; outer clothing of workers who conduct disposal should either be disposable or laundered before entering another property. The use of disposable booties, coveralls, etc. are recommended.
 - x. If other boxwood remains on the property, initiate a preventive fungicide spray program and do not use overhead irrigation. See [Section E, Fungicides](#) below for a list of fungicides.
 - xi. Monitor for disease development on a regular basis, once a week for several months after removal.
 - xii. Continue preventive fungicide spray program
- b. Replanting
- i. Removal of diseased boxwood and all associated leaf debris will not eradicate boxwood blight from the location. The pathogen produces long-lived survival structures, microsclerotia, that can persist in the soil for 5-6 years.
 - ii. Tolerant boxwood cultivars may be planted in a site where disease was detected on other boxwood earlier, but may require repeated fungicide applications in subsequent years, depending on the level of resistance and weather conditions.
 - iii. Mulch a new boxwood planting immediately following replanting to prevent pathogen reinfection.
 - iv. Sanitize tools, equipment, shoes, gloves, and clothing between plantings. The use of disposable booties, coveralls, etc. are recommended. 70 % alcohol, either isopropyl or ethanol, is an inexpensive product to quickly and effectively disinfest tools and contaminated impervious surfaces. Conidia, a type of spore, are killed within seconds, and microsclerotia, a long-lived type of spore capable of persisting in soil from 5-6 years, are killed within four minutes. Other products, including concentrated Lysol, 10% bleach solution, hydrogen dioxide (Zero Tol®), hydrogen peroxide (OxiDate®), peroxyacetic acid (peracetic acid), and octanoic acid (caprylic acid) only kill conidia.
- a. Cultural practices
- i. Choose cultivars with a more open-growth habit, as opposed to those with a dense canopy, to increase airflow and minimize leaf wetness. HRI's Boxwood Initiative currently supports validation of a standardized testing procedure to evaluate cultivar susceptibility and tolerance. Studies are in progress, and results will be released. Until then, please consult the Tennessee State Extension guide⁴ cited below.
 - ii. Shearing boxwoods is not recommended. Pruning strategies that promote airflow and quick drying (e.g. thinning the canopy, separating, etc.) are ideal. If shearing is occurring, increase scouting practices and consider employing a preventive fungicide program. See [Section E, Fungicides](#) below for a list of fungicides.
 - iii. Shaping boxwood with a peaked form is recommended to improve air flow rather than flat surfaces.
 - iv. Avoid overhead irrigation.
 - v. Provide adequate spacing between plants and avoid close spacing such as that associated with most hedges.
 - vi. Remove lower branches and leaves by pruning.
 - vii. Mulch boxwood plantings.
 - viii. Avoid working in boxwood plantings when foliage is wet to reduce potential spread of spores.
 - ix. Plant boxwood in open air area, if possible.
 - x. Elevate surrounding tree branches to improve air movement.
- b. Sanitation
- i. Sanitize tools, equipment, shoes, gloves, and clothing between plantings. 70 % alcohol, either isopropyl or ethanol, is an inexpensive product to quickly and effectively disinfest tools and contaminated impervious surfaces. Conidia, a type of spore, are killed within seconds, and microsclerotia, a long-lived type of spore capable of persisting in soil from 5-6 years, are killed within four minutes. Other products, including concentrated Lysol, 10%

SECTION F: Record Keeping. Accurate and detailed records for the following activities should be maintained a minimum of 12 months for traceability, if possible.

- bleach solution, hydrogen dioxide (Zero Tol®), hydrogen peroxide (OxiDate®), peroxyacetic acid (peracetic acid), and octanoic acid (caprylic acid) only kill conidia.
- ii. All infected plants and plant debris should be double bagged in sealed plastic bags and disposed of in an approved landfill (per applicable laws) or incinerator, promptly burned, or buried a minimum of ten inches below the surface.
- iii. Work in plantings with suspected infection last, after completing work in known healthy plantings.
- c. Fungicides
 - i. Fungicides are only preventive for boxwood blight management.
 - ii. Fungicide applications can suppress symptom development and prevent further spread but do not cure the plant from infection.
 - iii. Repeated applications will be necessary, the number depending on the tolerance of cultivars present and weather conditions from year to year.
 - iv. Thorough coverage is difficult given the compact growing habit of boxwood. Spray to run-off. Spray fungicides on both front and back of leaves and stems.
 - v. Fungicides that have federally labeled for boxwood blight management include, but are not limited to:
 - 1. Chlorothalonil (Daconil®, others)
 - 2. Chlorothalonil + thiophanate methyl, (Spectro®, others)
 - 3. Cyprodinil + fludioxonil (Palladium®)
 - 4. Fludioxonil, (Spirato®)
 - 5. Fluxapyroxad + pyraclostrobin (Orkestra®)
 - 6. Propiconazole (Banner Maxx®, others)
 - 7. Tebuconazole (Torque®, others)
 - vi. Always consult product labels for most up to date rates, spray intervals, and site recommendations, as well as local restrictions.
- a. Cultivar names and locations by property.
- b. Where and when plants were purchased.
- c. Location of any diseased boxwood, even if removed.
- d. Fungicide treatments
 - i. Product name
 - ii. Rate used
 - iii. Date of application
 - 1. Location of any and all burial pits. Burial of infected debris does not kill the pathogen quickly but immobilizes it while it dies slowly. Therefore, it is important to avoid replanting Buxus in these areas.



Horticultural Research Institute

HORTICULTURAL RESEARCH INSTITUTE
2130 Stella Court | Columbus, OH 43215
p. 614-884-1155 | www.HRIResearch.org



Horticultural Research Institute

Boxwood Blight BMPs *for landscape*

CAUSAL AGENT

Calonectria pseudonaviculata

HOST PLANTS

Buxus species, *Pachysandra*, *Sarcococca*. 100% resistance has not been documented in any variety.

HOW DISEASE SPREADS

- Infected plant material and plant debris
- Contaminated tools, clothing, tires, hoses
- Rain splash and wind-driven rain
- Contaminated animals, including dogs, deer, squirrels, others

For a complete list of recommended best management practices for managing boxwood blight in the landscape, consult HRI's Best Management Practices for Boxwood Health at www.HRIresearch.org.

SPOT THE SYMPTOMS

Only leaves and stems are affected in field conditions. If in doubt, please contact a local plant diagnostic lab for help. Boxwood blight can be confused with *Volutella* infections and even some insect pest infestations.

First symptoms = light to dark brown, circular leaf spots with dark borders



Rapid defoliation, especially in the lower canopy



Infected stems have dark brown to black, elongated cankers.



TOP 10 BEST MANAGEMENT PRACTICES FOR BOXWOOD HEALTH IN THE LANDSCAPE

| | | | | |
|---|---|---|---|--|
| Train personnel for disease scouting and biology, sanitation, and management | Purchase plant material from reputable suppliers who adhere to a boxwood blight compliance agreement. | When installing new boxwood, select varieties tested and known to be more tolerant and less susceptible of boxwood blight. | Mulch boxwood plantings. | Sanitize tools, equipment, shoes, clothing between plantings. 70% alcohol and other products are recommended sanitizers. |
| Shearing boxwoods is not recommended. Pruning to encourage air flow is ideal. Avoid flat surfaces. Remove lower branches that touch the ground. | Avoid working in boxwood plantings when foliage is wet. | All infected plant material should be double bagged and disposed of in an approved landfill, burned, or buried at least 10" below the soil surface. | Do not compost infected plant material. | Fungicides are preventive only and will not cure an infected plant. |



Horticultural Research Institute

Boxwood Blight BMPs *for production*

CAUSAL AGENT

Calonectria pseudonavicularata

HOST PLANTS

Buxus species, *Pachysandra*, *Sarcococca*. 100% resistance has not been documented in any variety.

HOW DISEASE SPREADS

- Infected plant material and plant debris
- Contaminated tools, clothing, tires, hoses
- Rain splash and wind-driven rain
- Contaminated animals, including dogs, deer, squirrels, others

For a complete list of recommended best management practices for managing boxwood blight in the landscape, consult HRI's Best Management Practices for Boxwood Health at www.HRIresearch.org.

SPOT THE SYMPTOMS

Only leaves and stems are affected in field conditions. If in doubt, please contact a local plant diagnostic lab for help. Boxwood blight can be confused with *Volutella* infections and even some insect pest infestations.

First symptoms = light to dark brown, circular leaf spots with dark borders



Rapid defoliation, especially in the lower canopy



Infected stems have dark brown to black, elongated cankers.



TOP 10 BEST MANAGEMENT PRACTICES FOR BOXWOOD HEALTH IN PRODUCTION

| | | | | |
|---|--|---|--|--|
| Train personnel for disease scouting and biology, sanitation, and management. Symptoms, especially early infections, may be discreet and difficult to detect. | Propagate locally to avoid introduction by infected material. When purchase is necessary, purchase from reputable producers and separate new introductions from existing blocks. | Consider growing only varieties tested and known to be more tolerant and less susceptible to boxwood blight. | Employ smaller sized blocks and alternate with blocks of nonhost plants. | Sanitize tools, equipment, shoes, clothing between plantings. 70% alcohol and other products are recommended sanitizers. |
| Avoid overhead irrigation. | Avoid working in boxwood plantings when foliage is wet. | All infected plant material should be double bagged and disposed of in an approved landfill, burned, or buried at least 10" below the soil surface. | Do not compost infected plant material. | Fungicides are preventive only and will not cure an infected plant. |