

Boxwood Blight FAQ's for Established Landscapes in Virginia

Please note that questions on this list came from Virginia growers. Answers, provided by Virginia researchers and Extension specialists, pertain to Virginia conditions. If you are from another state or geographic region, you may need to modify the answers for your local conditions.

THE PATHOGEN

1. What causes boxwood blight?
 - Boxwood blight is caused by the fungus *Calonectria pseudonaviculata*. This fungus has had several other names since it was first reported in the UK in 2000, but this is the most current Latin name of the fungus.

2. When is the fungus most active?
 - The Virginia Tech Plant Disease Clinic receives most boxwood samples that are positive for boxwood blight in either spring or fall. High temperatures of mid-summer in Virginia are not conducive to infection.
 - The boxwood blight pathogen is most active at temperatures between 64 to 77°F, but it can survive and grow outside that temperature range.
 - Rainfall events favor disease, but whether or not disease develops depends on the length of time the leaves remain wet. In research studies, leaf wetness periods of at least 48 hours were needed for the pathogen to produce significant numbers of spores. Once spores are present, infection can occur with as little as 5-8 hours of additional leaf wetness at favorable temperatures.
 - The bottom line: any time temperatures are moderately warm (in the 60 – 80°F range) and prolonged rainfall is predicted (e.g. several days in a row without prolonged dry interruptions), be on the lookout for boxwood blight.

3. What symptoms does the pathogen cause?
 - Early in disease development, the boxwood blight pathogen causes circular, tan leaf spots, often with a darker border.
 - Linear, black stem lesions appear on infected green stems; these lesions do not develop on woody stems.
 - Often the first symptom people notice is sudden and severe leaf drop. Plants may lose almost all of their lower leaves, with only a tuft of green leaves remaining at the top of the plant, but leaf drop may also appear in irregular patches on the plant.
 - When the pathogen is producing spores, white, star-shaped spore masses may be seen on infected plant tissue with magnification; however, the spore masses may not be present and they can be difficult to see even when they are present. (Note: orange spore masses are NOT the boxwood blight pathogen. (See DIAGNOSIS category of these FAQ's for information on look-alike problems.)
 - Roots are not affected.

4. Does the pathogen attack older or newer wood?
 - The fungus produces its spores on new wood, not on old wood. We do not know whether or not the infection extends down into the old wood, as there is no research-based information addressing this question; however, the black stem lesions are always found on green stems, not on stems that have formed bark.
 - The pathogen produces spores on stem lesions or on infected leaves.

HOST PLANTS

5. I know this disease is primarily associated with boxwood, but does it also affect some other plants? Is there another plant frequently planted with boxwood that would be a possible carrier of the disease?
 - The disease has been diagnosed on several plants in the family Buxaceae, including *Buxus* spp., *Pachysandra* spp., and *Sarcococca* spp. The disease has not been found to infect plants outside the Buxaceae family in nature, landscapes or nurseries, although some non-Buxaceae plants have been demonstrated to be susceptible to the boxwood blight pathogen under controlled laboratory conditions.
 - Boxwood is the primary carrier of boxwood blight in Virginia. Other plants in the boxwood plant family, such as species of pachysandra and sarcococca, are also susceptible, but instances of the disease on these plants are currently rare in Virginia (as of 2018).
6. Which types of boxwood are affected?
 - *Buxus sempervirens* ‘Suffruticosa’ (English boxwood), which is widely present in Virginia landscapes, is highly susceptible to boxwood blight. No species or cultivar of boxwood is known to be immune to the disease; however, species and cultivars of boxwood vary in their susceptibility, with some showing good resistance. Results of cultivar field trials done in North Carolina can be found on page 94 of this PDF file: <https://www.saundersbrothers.com/ccLib/attachments/pages/Boxwood+Guide+copy.pdf>

DISEASE SPREAD

7. How does boxwood blight spread?
 - In Virginia, most of the initial spread was by introduction of infected plants to landscapes that contained highly susceptible English and American boxwood. The disease spread from the introduced, infected plants to nearby susceptible boxwood.
 - Holiday decorations containing boxwood greenery may harbor the disease. Although the pathogen is typically not active in winter, if infected greenery is not disposed of

properly after the holidays, the pathogen could survive in compost or cull piles until conditions are favorable for spore production.

- Secondary spread has occurred by use of infested pruning tools or other landscape equipment, e.g. hoses, tarps, shovels, leaf blowers, etc., on healthy, susceptible boxwood.
 - Spores may be picked up on clothing of people working with infected plants, and infected leaf debris may be picked up on boots or shoes and thereby moved from infested to non-infested sites, although these means of spread are less efficient than transmission of the pathogen on pruning tools.
 - Boxwood blight is NOT easily spread by wind currents. The spores form in sticky masses that are not easily dislodged by wind.
 - Although the fungal spores are not easily spread by wind, infected leaves can be blown from one area to another, e.g. by wind or leaf blowers, and the pathogen can survive in the leaf debris, causing new infections when the infected leaves land near susceptible boxwood.
 - Animals, e.g. dogs, deer, skunks, birds, insects, spiders, etc., moving on or through infected plants may pick up spores on their bodies and transmit the disease from infected to uninfected plants.
 - Storm water may also spread the pathogen along its path.
8. If I haven't introduced new plants into my landscape and I don't prune my boxwood, how did my plants get infected?
- Although most new boxwood blight infections in Virginia have historically been introduced on infected plant material, the disease can also be spread by:
 - infested vehicles, equipment or tools (e.g. pruning shears, lawn mowers, leaf blowers, spray hoses, vehicles)
 - infected leaves blowing in from a nearby infested property
 - improper disposal of infected holiday greenery
 - spores or leaf debris picked up on clothing or shoes
 - animals that pick up the spores on their fur, feather or bodies
9. Can the pathogen infect plants in other yards or does it only infect plants that are close by?
- It is unlikely for the spores to be splashed very far, but the pathogen can be spread from one yard to another on infested pruning tools, on infected leaves that blow from one place to another (including leaves blowing from infected plants transported in an open pickup truck) or on animals, clothing or shoes.
10. How do I ensure that I am not buying infected plants from a nursery or retailer?
- We recommend purchasing boxwood plants produced in a nursery that participates in the Boxwood Blight Cleanliness Program, which is administered by the Virginia Department of Agriculture and Consumer Services (VDACS). Nurseries that participate in this program adhere to a strict set of guidelines that help prevent

boxwood blight from entering the nursery and agree to periodic inspections by VDACS.

- A list of production nurseries that have signed the Boxwood Blight Compliance Agreement and are in the Boxwood Blight Cleanliness Program can be found on the VDACS website: <http://www.vdacs.virginia.gov/plant-industry-services-boxwood-blight.shtml>.
- Retail nurseries do not participate in the Boxwood Blight Cleanliness Program and they may sell plants sourced from several different wholesale nurseries, but you can ask retailers if all of their plants come from production nurseries that are in the Boxwood Blight Cleanliness Program. If some of their plants come from out of state or if the retailer does not know the source of the plants, be cautious about buying boxwood from them.
- Whenever you buy boxwood plants, inspect them carefully for telltale signs of boxwood blight and do not purchase any suspicious-looking plants, especially when purchasing from a business that is not in the Boxwood Blight Cleanliness Program. Heavy discounts on boxwood plants are usually an indication that you should NOT buy the plant material being sold!
- Note that fungicides may suppress symptom development on infected boxwood, and infected plants may not show symptoms if they have recently been treated with a fungicide. It is a good idea to monitor even healthy-looking new boxwood plants for several weeks before transplanting.
- Although it is possible for boxwood to be infected with the boxwood blight pathogen without showing noticeable symptoms, using the precautions above will help you to avoid purchasing infected plants in most cases.

11. If my local community offers composted leaf litter for pickup, should I worry about infected boxwood leaves being in the leaf litter?

- Without knowing what is placed in the local leaf compost, we cannot recommend using leaf litter from a community compost pile in a landscape with susceptible boxwood.
- We know the pathogen can survive for long periods in infected leaves. Unless a community has a way to exclude boxwood, we do not recommend using community leaf mulch near boxwood plants.
- Never compost plant material that has been diagnosed with boxwood blight!

12. My neighbor had boxwood blight diagnosed on his property. He removed the infected plants and placed them on the curb for brush removal. Is it OK to place unbagged, infected boxwood plants on the roadside for brush removal?

- Unbagged, infected boxwood plants should NEVER be placed on the roadside for brush removal. Infected leaves can blow from unbagged plants to susceptible plants in neighboring landscapes.

- Transporting loose plant material in an open pickup truck can also spread the disease: infected leaves may blow out of the truck and land near susceptible plants.
- We recommend double-bagging any plants that have been diagnosed with boxwood blight and placing them in the trash to go to the landfill.
- Other methods of removing infested plant material include burning on site, if allowed, or burying at least two feet deep.

GEOGRAPHIC DISTRIBUTION OF BOXWOOD BLIGHT

13. I don't remember hearing about boxwood blight until recently. When did boxwood blight first become a problem in Virginia?
- The disease was found for the first time in Virginia in a boxwood nursery in Carroll County in the fall of 2011.
14. How did the disease get into the United States?
- No one knows how the disease entered the United States.
 - The disease was first described in the United Kingdom and New Zealand in the mid 1990's and by 2002, it had been diagnosed in other parts of Europe.
 - The disease was diagnosed in the United States for the first time in 2011 simultaneously in two different states: Connecticut and North Carolina. By 2018, 26 other states had reported interceptions of infected plant materials or boxwood blight outbreaks.
15. Is the disease all over the state of Virginia now or is it localized in certain places?
- Since 2011, the disease has spread to many parts of Virginia. As of 2018, it has been found in 37 counties and independent cities in Virginia. The disease has been confirmed in all counties in Northern Virginia, as well as all counties surrounding Richmond, VA.
 - Currently, in Virginia counties where the disease occurs, it occurs on isolated properties or neighborhoods and is not widespread on all boxwood in the county. This is probably due to the fact that the spores of the fungus are not easily wind-borne. However, spores are easily splashed from plant to plant, so properties or neighborhoods with large plantings of adjacent, susceptible boxwood are more prone to disease spread once the pathogen is introduced to a property.
16. Do you expect incidences of boxwood blight in Virginia to increase?
- Yes. Initially (2011-2016), most introductions occurred only when the pathogen was introduced to new locations on infected plants, so the number of new cases increased slowly.

- Following accidental sales of infected boxwood (which were sourced from the West Coast) by a major national retailer in Virginia in 2016, we saw many more cases of boxwood blight, especially in central Virginia.
- As a result of the increased number of infected plants that have been introduced to Virginia landscapes since 2016, we are now seeing secondary spread via pruning tools, animals and other means.
- English boxwood and most other susceptible cultivars of boxwood are being phased out at production nurseries in Virginia. Over time, as new resistant cultivars become available and as people plant more resistant cultivars of boxwood, we may begin to see a decrease in the number of new cases.

DISEASE CONTROL

General

17. If only a few of my boxwood plants are symptomatic, can I save the others? If so, how?

- Whether you can save remaining boxwood really depends on the severity of the disease and the cultivar of boxwood you want to save. If you want to save susceptible boxwood plants that are not showing symptoms at a site where some of the plants have already been diagnosed with boxwood blight, it would be best to thoroughly remove all the symptomatic plants, including all leaf debris, as well as any highly susceptible plants that are close to the infected plants. Any remaining susceptible boxwood should be mulched to cover any remaining leaf debris and treated with a protectant fungicide on a regular basis, according to product label directions, when environmental conditions favor disease or favorable conditions are forecast.
- In general, the disease, once introduced, spreads rapidly in English boxwood, and trying to save remaining English boxwood would not be practical. Disease tends to spread more slowly in American boxwood, so it is more likely that protecting remaining, uninfected American boxwood with fungicides after removing infected plants would be possible.
- Some people with large American boxwood plants have chosen to prune out symptomatic branches on infected plants rather than remove whole plants. We do not know at this time what the long-term prognosis is for American boxwood plants that have been selectively pruned for disease control. It is possible that American boxwood would be able to produce enough new growth that plants will appear to recover over time; however, the fungus would still be present and it would be necessary to protect new growth with a fungicide when environmental conditions favor boxwood blight. This approach should not be used for English boxwood, which would not be likely to recover.
- Be aware that any remaining leaf debris can harbor survival structures of the pathogen for 5 to 6 years. These survival structures can produce spores and infect

susceptible replacement boxwood planted in locations where the disease has been diagnosed. Therefore, replanting susceptible boxwood or members of the *Buxaceae* family in a location where infected boxwood has been removed is not advisable. It may be possible to replant with resistant boxwood, especially if any remaining leaf debris is covered with mulch.

18. Are there organic controls for the disease?

- No, unfortunately, there are no organic controls. Currently recommended fungicides are listed on the [Virginia Boxwood Blight Task Force](#) website on the Fungicide tab.

19. If my boxwood has been diagnosed with boxwood blight, do I need to hire a professional to remediate?

- Whether you hire a professional to remediate boxwood blight is a personal choice. It is certainly possible to remediate boxwood blight yourself, especially if only a few plants are affected or if the affected plants are small, but if you are trying to protect remaining boxwood that are of high value to your landscape, it may be worthwhile to hire a knowledgeable professional. In either case, removing all affected plant material carefully and immediately is your best bet for preventing spread.
- The most difficult parts of remediation are: (1) to avoid the spread of dead leaves as plants are being removed, (2) to remove leaf debris as thoroughly as possible, and (3) to double-bag (or wrap in plastic) large plants. It may be difficult to effectively remove leaf debris and large, infected plants without the proper equipment.
- There are knowledgeable landscape professionals in Virginia who offer remediation services that minimize the risk of spreading the disease during plant removal. Such services may be worth the investment for a high-value landscape.

Cultural Practices for Disease Control

20. Is it a problem to use a leaf blower around boxwood plants that have boxwood blight?

- It is definitely NOT a good idea to use a leaf blower near any boxwood plants that have been diagnosed with boxwood blight. The pathogen can remain viable for at least 5 years as survival structures called microsclerotia in dead leaves. The fungus can germinate from the microsclerotia, form spores and cause new infections under the right conditions. Therefore, using a leaf blower would be a good way to SPREAD the disease, simply by moving infected leaves from infected plants to healthy, susceptible plants.
- Spores of the pathogen could also contaminate the leaf blower itself. Although spores do not remain viable as long as microsclerotia do, there would be a period of time – likely several hours to several days -- during which the leaf blower could spread spores to healthy plants.

- Lawnmowers can also be contaminated with infected leaves if they are used near boxwood plants that have been diagnosed with boxwood blight. They could spread the disease during mowing.
- Care should be taken to sanitize any equipment that has been used near infected boxwood. Recommended sanitizers are listed on the [Virginia Boxwood Blight Task Force](#) website.

21. If I cover infected leaves with soil or mulch after the infected plants have been removed, will this prevent the fungus from infecting new boxwood planted in the same area?

- Research field studies have shown that covering infected leaves with soil or mulch helps to reduce new infections on susceptible boxwood planted where infected plants have been removed. Covering leaf debris with soil or mulch prevents splash dispersal of the pathogen from leaf debris on the soil surface to the lower leaves of new transplants.
- In research studies, a 2- to 4-inch layer effectively prevented splash dispersal of spores to lower leaves, but probably any depth of mulch or soil will do, as long as boxwood leaf debris is completely covered. We generally recommend no more than a 2-inch depth of mulch in order to discourage voles. Voles are small rodents that tunnel through mulch and may feed on bark of woody plants below the surface of the mulch.
- It is important to remember that it is still possible for animals to dig through any soil or mulch that has been placed around plants and bring infected leaves to the surface, and the disease could still be introduced from outside the planting by various means.
- If you do apply mulch for boxwood blight control, NEVER pile the mulch against the base of the trunk or main stem of a tree or shrub – this causes moisture to build up on the bark and may predispose the bark to decay.

22. If I plant something that is not in the Buxaceae family in an area where boxwood blight was diagnosed, do I have to worry about boxwood blight recurring?

- We do not have a clear answer to this question at this time. Several non-Buxaceae plants have been demonstrated to be susceptible to the boxwood blight pathogen under controlled laboratory conditions, but so far none of these plant species has been found to be infected with the boxwood blight pathogen in nature or in the landscape or nursery. Based on what we know right now, it is much less likely that boxwood blight will develop on transplants that are not in the Buxaceae family.
- Even if you do not intend to replant boxwood in a previously infested area, it is still a good idea to remove any infected boxwood debris as thoroughly as possible to minimize the risk of the disease spreading to neighboring properties.

23. How can I avoid introducing the disease to a landscape on holiday greenery?
- The boxwood blight pathogen may be present on holiday greenery that contains boxwood. Inspect greenery carefully for symptoms of boxwood blight (leaf spots, black, linear stem lesions) and avoid purchasing any questionable greenery.
 - Be sure to bag and then discard holiday greenery in the trash and not in the yard waste or compost pile after the holidays. Although the pathogen is not active at normal winter temperatures, it may produce spores on infected greenery in the spring and could spread from cull or compost piles if it remains in the landscape.
 - The safest approach is to choose holiday greenery that does not contain boxwood.
24. Is the recommendation to remove infected plants from an infested site still the best plan?
- Yes, this is the best way to remove the inoculum from the site and to minimize the chance of infection of nearby healthy boxwood.
25. What are some options for replacement plants for boxwood?
- When considering alternatives to boxwood blight-susceptible boxwood, be sure to consider the form, function and adaptation of the plant to the site, i.e. with respect to sun and wind exposure, drainage, etc., in order to promote healthy plant growth from the outset.
 - Few plants fill the landscape niche that boxwood does (i.e. slow-growing, broadleaf, evergreen shrub), so planting boxwood species or cultivars with resistance to boxwood blight is a good approach. However, some possibilities for other plants include:
 - dwarf forms of Norway spruce
 - boxleaf euonymous
 - mounded forms of Arborvitae
 - barberry, cv. 'William Penn'
 - Consult the VCE fact sheet *Problem-Free Shrubs for Virginia Landscapes* for additional ideas.
(http://pubs.ext.vt.edu/content/dam/pubs_ext_vt_edu/450/450-236/450-236_pdf.pdf)
26. When I remove infected boxwood, do I need to remove ALL of the roots as well as the stems?
- No, the boxwood blight pathogen is not known to infect roots, and remaining root systems are not known to pose a threat. It is not necessary to remove the roots of infected plants as long as the plants are cut to the ground and all leaf debris is removed.

27. How should fallen leaves be handled when remediating boxwood blight?

- Removing boxwood leaves from an infested site is difficult. Boxwood leaves are too small for raking to be a practical alternative. A shop-vac or landscape vacuum can be used to vacuum up the infected leaves, but the equipment itself then becomes contaminated and should not be used around any plants other than infected boxwood.
- If burning is allowed in the affected area, a blow torch or flame-weeder can be used to burn off leaf debris from the soil surface.
- After removal/remediation, it is a good idea to cover the area with soil or mulch to bury any remaining infected leaves, especially if plants in the boxwood family will be replanted in this area.

28. If I prune my boxwood back to the base, can I get rid of the disease?

- It is possible that you could get rid of the disease by pruning your boxwood back to the base, but there are several problems with this approach:
 - Any green shoots that remain on the woody stems may be infected, and any new green shoots that form on woody stems after pruning will be prone to new infections. It would be advisable to apply mulch to the soil around the base of any plants that are pruned in this way and to monitor regrowth for symptoms of the disease.
 - If you prune the plants all the way to the base, the stumps may not produce any regrowth.
 - Even if regrowth occurs, it will take the plants a long time to reach full size again. Many boxwood species and cultivars are very slow growing.

Fungicides

29. Are fungicides really effective against this disease?

- The only fungicides known to provide effective control are preventative fungicides. They will not cure the plant of the disease. These products would need to be applied prior to infection and would need to be in place whenever weather conditions are conducive for disease in order to prevent infection. Thus, many applications may be needed in order for fungicide protection to be effective. Once the disease is present, it is very difficult to control with fungicides or any other means.
- The only fungicide active ingredient currently registered and recommended for homeowner use in the United States is chlorothalonil, which has good efficacy for preventing boxwood blight. Additional products are available for commercial applicators. In general, these fungicides are very effective at preventing the disease, but they are not effective once the disease is present. Therefore, removal of

infected boxwood from sites diagnosed with the disease is the preferred means of remediation.

- Currently registered fungicides for boxwood blight control are listed on the [Virginia Boxwood Blight Task Force](#) website on the Fungicide tab.

30. Will boxwood recover from the disease if sanitation and fungicides are used?

- Without knowing the cultivar of boxwood or the sanitizer or fungicide in question, it is difficult to answer this question in a meaningful way.
- There are currently no fungicides that will cure plants of boxwood blight; however, there are preventative fungicides that will protect uninfected boxwood.
- Infected plants may put out new growth; however, the fungus remains on/in the plant whether or not the plant has been treated with a fungicide, and any new growth will be susceptible to infection under favorable disease conditions. It is very difficult to manage boxwood blight on susceptible boxwood that are already infected.
- Repeated infection and leaf drop will weaken highly susceptible plants and cause them to decline further over time even if the plants put out regrowth.

31. If I want to protect my boxwood with fungicide, how many sprays per season should I apply? When should I start/stop spraying?

- Currently registered fungicides for boxwood blight control are only effective when used preventatively, so the fungicide would have to be present on the plant every time weather favorable for the disease is predicted. Most preventative fungicides will protect for 7-10 days following application, as long as they are not washed off by rain soon after application.
- The number of sprays needed will vary, depending on weather conditions, but regular applications, primarily in spring and fall, would be necessary for most areas in Virginia.
- Start spraying, according to fungicide label instructions, in spring when daytime temperatures reach 60°F and prolonged (2 days or more) rain is predicted. You can stop spraying when daytime temperatures are regularly above 80°F in summer and begin sprays again in fall when temperatures drop below 80°F and prolonged rain is predicted.
- You can stop spraying in winter when temperatures regularly stay below 60°F, but pay attention to forecasts for prolonged periods of mild winter weather when fungicides might need to be in place.
- If you want more precise information on when weather conditions are favorable for boxwood blight, you can either download the Boxwood Blight app for Android or iPhone, or log onto the uspest.org website and navigate to the Online IPM Pest and Plant Disease Models and Forecasting (uspest.org/wea/). On the website, click on the “Quick Start” tab, choose “nursery” and enter your zip code. This will lead you to a table showing the risk of boxwood blight development on susceptible cultivars of boxwood. However, please be aware that the forecasting model used for these apps

is under development and, in its current form, will tend to over-predict the risk of boxwood blight.

32. Are there curative fungicide treatments that show promise?

- Fungicides currently recommended for boxwood blight control are not curative, but only preventative. They will slow disease progression on infected boxwood, but they will not eliminate the fungus from the plant.
- When fungicides are washed off or no longer applied, and if fungal spores or microsclerotia are present, disease can occur again.
- Some systemic fungicides, such as propiconazole, have showed significant activity against the boxwood blight pathogen in laboratory experiments, but it is not yet known whether any of these fungicides might have curative activity in the field. Experiments are ongoing. We will update these FAQ's as new results are obtained.

33. If boxwood blight has been diagnosed in my yard and I choose to spray fungicides, do I need to spray my pachysandra and sweet box as well? If so, should I spray with the same product as for the boxwood?

- It is important to understand that fungicide use is unlikely to be effective at protecting plants from disease unless all infected plant debris is removed before application begins.
- Once you have removed all infected plant debris, it would be a good idea to spray the pachysandra and sweet box if you don't remove these plants, especially if they are located near susceptible boxwood.
- Recommended fungicide products for boxwood blight control are listed on the [Virginia Boxwood Blight Task Force](#) website on the Fungicide tab. As long as the fungicide is registered for general ornamental use or has pachysandra and sweet box (sarcococca) specifically listed on the label, it may also be used for treating these plant species.

34. Which fungicides or combinations of fungicides are the most effective at preventing healthy boxwood plants from becoming infected?

- The most effective fungicide, according to current research field trial data as of 2018, is chlorothalonil. This fungicide is registered under various trade names for landscape use in the United States (look for the active ingredient, chlorothalonil, on the label).
- Fungicides containing the active ingredient, fludioxonil, which are registered for use by commercial applicators, have also shown good to excellent preventative control in field trials.
- Use of a combination product, consisting of a protectant or locally systemic fungicide plus a systemic fungicide, was more effective at controlling boxwood blight in field trials than use of a systemic fungicide alone; however, these products are only available for professional applicators. Combination products that have shown

good to excellent control in research trials conducted in the United States include the following active ingredient combinations:

- trifloxystrobin + triadimefon
- chlorothalonil + thiophanate methyl
- propiconazole + chlorothalonil

35. What is the recommended fungicide rotation scheme?

- The main fungicide currently recommended for homeowner use in the United States, chlorothalonil, is a multi-site toxin, which has a low risk of resistance development, so repeat applications are allowed.
- Most fungicides other than chlorothalonil that are effective for boxwood blight control are site-specific toxins, which have a higher risk of resistance development and therefore have restrictions regarding how many times per season they should be applied.
- Always follow resistance management instructions listed on the fungicide label, including the maximum number of times a fungicide should be used in one season.
- In general, using fungicides with the same mode of action (i.e. same FRAC code) poses a higher risk of resistance development in the pathogen. Pay attention to the FRAC code on the fungicide label and rotate fungicides at risk of resistance with fungicides that have different FRAC codes (different modes of action). In particular, fungicides with FRAC code 11 are at considerable risk of resistance development and should not be overused.

36. Is Green Cure (potassium bicarbonate) effective for box blight control?

- Green Cure is not labeled for boxwood blight control and we do not have information on its efficacy or lack thereof.
- Currently registered fungicide products and their efficacy against boxwood blight are listed on the [Virginia Boxwood Blight Task Force](#) website.

37. Will spraying infected plants with fungicide before removal help prevent the spread of the disease?

- Many landscapers who offer boxwood blight remediation services do this as a precautionary measure. There is some research-based information that suggests that chlorothalonil suppresses sporulation and germination of spores to some degree, so it seems reasonable that this practice would help prevent spread of the disease as infected plants are being removed from a property. However, the most important way to prevent spread of the disease during removal is to double-bag or shrink-wrap the plants to prevent leaf drop. If plants are bagged before removal, spraying plants with a fungicide should not be necessary.

38. Would spraying fungicide with a mist sprayer actually be more likely to spread the disease than to control it?

- There is no current research-based information on this topic. While it is possible to move spores or infected leaves with a force sprayer, it is also important to get good coverage with the fungicide, and a little extra force may help to distribute the fungicide to the interior leaves in the canopy. As long as you are not spraying during or shortly after a wet period, chances are probably minimal that you will spread the disease while spraying fungicide. However, if you are concerned about this, you can always use a wand sprayer rather than one with a force blower.

39. Are there fungicides that will inactivate microsclerotia?

- Microsclerotia are fungal survival structures that can survive for five years or more in infected leaves. Although no fungicides are registered for inactivation of microsclerotia, several sanitizers are effective at killing or preventing growth of the boxwood blight pathogen from leaf debris containing microsclerotia. Laboratory studies have shown that the fungus will not grow from infected leaf debris treated with either 70% (or higher) ethanol or Lysol Disinfectant Brand III.
- The most important way to prevent survival of microsclerotia is thorough removal of infected leaves.
- Burning leaf debris with a blow torch and soil fumigation are also practices that inactivate microsclerotia. However, soil fumigation is not available for homeowner use and burning may not be allowed in some locations.

40. Do fungicide sprays shut down the progression of twig cankers?

- Different fungicides have different modes of action, but the fungicides that are effective for boxwood blight control are preventative fungicides. This means they will not cure a plant of the infection; they will only prevent new infections or inhibit the growth of the fungus that is already present. They will not kill the boxwood blight fungus on the plant.
- Thus, no fungicide currently registered for boxwood blight control will “shut down” a twig canker; it will simply slow the progression of the disease or prevent new infections.

Sanitation

41. What should I use (chemicals, washes, Clorox wipes, microwaves) to sanitize my tools and clothes?

- Sanitizing wipes are not effective for sanitizing tools or clothing.
- Tools must be exposed to a sanitizer for the recommended length of time in order for the sanitizer to be effective at killing the fungus on the tool. Refer to the Sanitizer tab on the [Virginia Boxwood Blight Task Force](#) website for further detail.
- Although there is no research-based information on the effects of microwaving, this method cannot be used for metal tools and it would not be a practical means of sanitizing clothing.

- Clothing used around infected boxwood should be washed in hot water immediately after use, as the fungal spores are sensitive to heat. Drying clothing in a heated dryer is also helpful.
- Some professionals use disposable Tyvek suits, gloves, and booties in order to minimize the risk of picking up fungal spores on their clothing.
- Soil and leaf debris should always be washed off of boots or shoes that have been worn around infected plants. Wash footwear at the infested site, then dip or spray with a solution of 70% (or higher) ethanol.
- Soil and leaf debris should always be washed off tools and equipment prior to sanitizing them for maximum efficacy of the sanitizer.
- A number of different sanitizers have shown efficacy for sanitizing tools or equipment in research trials. It is important that they be used at the recommended concentration and exposure time in order for them to be effective. Effective sanitizers that are available at many department or grocery stores are listed below. Refer to the Sanitizers tab on the [Virginia Boxwood Blight Task Force](#) website for additional options and further detail.
 - 70% (or higher) ethanol (Dip tools 5 min or spray and allow to air dry.)
 - Lysol Disinfectant Brand III (Dip tools 5 min or spray and allow to air dry.)
 - Bleach (1:9 dilution of 5.25% sodium hypochlorite or 1:14 dilution of 8.25% sodium hypochlorite) (5 min exposure for dipped tools; 10-15 min exposure for equipment surfaces)

42. Are some disinfectants better than others?

- 70% ethanol and Lysol Disinfectant Brand III consistently killed the pathogen when applied to either spores alone or to infected leaf debris in research trials. Bleach consistently killed the spores of the pathogen on the tool, but was not 100% effective at killing the pathogen on leaf debris.
- Ethanol and Lysol Disinfectant Brand III are non-corrosive when applied to metal and may be preferable for sanitizing tools; however, bleach may still be the most practical and affordable option for sanitizing floors, benches or containers.

43. Does the presence or absence of plant debris and soil on the equipment affect the length of time the fungus can remain viable on contaminated equipment?

- Yes. The fungus can remain viable for a long time in infected plant debris left on equipment, as well as in soil containing infected plant debris. Infected leaves may contain overwintering structures called microsclerotia, which have been shown to survive for up to 5 years in infected leaves.
- Soil and plant debris should always be washed off equipment and tools on-site as soon as possible after use on infected boxwood or plants suspected to have boxwood blight.

Resistance

44. Are some varieties of boxwood more resistant to boxwood blight than others?
- Yes. A number of boxwood cultivars performed very well in field trials in North Carolina (conducted by NCSU and Saunders Brothers Nursery) in which plants were inoculated with the boxwood blight pathogen. Some cultivars were tested repeatedly over a period of 5-6 years. A table summarizing the cumulative results of these trials can be found in the 5th edition of the Saunders Brothers' "Boxwood Guide" (p. 94) (https://www.saundersbrothers.com/_ccLib/attachments/pages/Boxwood+Guide+copy.pdf).
 - Cultivars that consistently showed high levels of resistance, not only to boxwood blight, but also to leafminers include:
 - *Buxus harlandii*
 - *Buxus harlandii* 'Richard'
 - *Buxus microphylla* 'Golden Dream'
 - *Buxus sempervirens* 'Fastigiata'
 - *Buxus sinica* var. *insularis* 'Franklin's Gem'
 - *Buxus sinica* var. *insularis* 'Nana'
 - *Buxus sinica* var. *insularis* 'Winter Gem'
 - *Buxus sinica* var. *insularis* 'Wintergreen'
 - A line of new cultivars, developed by Saunders Brothers Nursery under the general name "NewGen", is expected to become commercially available in 2020. These cultivars also show moderate to strong resistance to both boxwood blight and leafminers.
 - It is important to remember that resistant cultivars are not IMMUNE to the disease and it is possible for resistant plants to be infected even though the symptoms are not noticeable. Some people refer to this as "partial resistance" or "tolerance".
 - Also remember that if an infected, resistant cultivar is planted near susceptible boxwood, the disease can easily spread from the introduced resistant plant to the susceptible boxwood.

DISEASE DIAGNOSIS

45. How do I get a definitive answer as to whether my plants have boxwood blight?
- Plant samples with symptoms of boxwood blight can be submitted to your local [Virginia Cooperative Extension](https://ext.vt.edu/offices.html) office (<https://ext.vt.edu/offices.html>). If the sample requires laboratory diagnosis, it will be forwarded to the Virginia Tech Plant Disease Clinic.

- Collect 4-5 symptomatic boxwood twigs (stems with black streaks, leaf spots, or defoliation) and double-bag in sealed plastic bags before transporting to your local Extension office. Try to include at least some twigs that still have some green leaves on them.
 - Plant samples should be accompanied by a completed plant diagnostic form (#456-097), available at your local county Extension office.
 - You will receive the results from your Extension agent after the diagnosis is complete. It may take up to 10 days for a complete laboratory analysis.
46. If a sample is being sent to the lab for analysis, how much of the plant and what parts are needed for diagnosis?
- Collect at least 4-5 symptomatic boxwood twig samples (stems with black streaks, leaf spots, or defoliation), including some twigs that still have some green leaves.
 - Samples should be collected as soon as possible after symptoms are first noticed.
 - Do not send twigs that have been dead for a long time, as these twigs may have been invaded by secondary decay organisms that reduce the chance of an accurate diagnosis.
 - Symptoms of dieback on boxwood can also be caused by root disease. Root samples are not needed for diagnosis of boxwood blight, but they are needed for diagnosis of root disease if root disease is suspected. Samples submitted for diagnosis of root disease should include a large handful of fibrous roots in at least one pint of soil, taken from the root zone of affected plants.
47. What are the key diagnostic methods used to verify that the plant has boxwood blight?
- Boxwood blight cannot definitively be diagnosed from visual observation of symptoms alone. Leaf spots are not diagnostic for boxwood blight; however, linear black streaks on stems are only rarely caused by other pathogens (e.g. *Volutella* or *Colletotrichum*). Sudden, severe leaf drop is often an indication that a plant has boxwood blight.
 - In the laboratory, twig samples are examined for production of the characteristic spores of the boxwood blight fungus *Calonectria pseudonaviculata*. If spores are not being produced on the sample when it is received, the sample is placed in a humidity chamber for up to 7 days and monitored for spore production. Note that if plants were sprayed with a fungicide within a few days prior to sample submission, spore production may be delayed and a false negative diagnosis could result, so be sure to make note of any recent fungicide applications on the submission form.
48. How do you tell the difference between boxwood blight and other problems that cause similar-looking symptoms? Are there any distinguishing symptoms of boxwood blight?

- Leaf spots caused by the boxwood blight pathogen are not unique and could be confused with leaf spots caused by other fungi or by the boxwood leafminer, an insect pest.
- Black, linear cankers on green stems are usually indicative of boxwood blight, although some other fungi occasionally cause blackening on stems (e.g. *Volutella*, *Colletotrichum* or other fungi).
- Sudden, severe defoliation is usually indicative of boxwood blight. Leaf drop that occurs more gradually may be caused by other factors.
- In general, plants that have dieback with dead leaves remaining attached to stems probably do NOT have boxwood blight. Such plants may be have a root problem, *Volutella* blight, or *Colletotrichum* dieback.
- Images of boxwood blight symptoms can be found at the [Image Gallery](#) link on the Virginia Boxwood Blight Task Force website.
- A comparison of boxwood blight symptoms to other problems on boxwood can be found at the [Look-Alike Problems](#) link on the Virginia Boxwood Blight Task Force website.

49. How can I find more detailed information on boxwood blight in Virginia?

- Refer to information on the [Virginia Boxwood Blight Task Force](#) website, which includes detailed best management practices for landscapes and nurseries, as well as lists of sanitizers, resistant cultivars and fungicides, and this list of frequently asked questions. An image gallery, showing symptoms of the disease, as well as links to videos and webinars on boxwood blight, are also available on the website.