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GUIDELINES FOR REPORTING AND MANAGING BOXWOOD BLIGHT IN CONNECTICUT LANDSCAPES

Version 2.0**

The Connecticut Agricultural Experiment Station (CAES) has full state statutory regulatory authority for plant diseases, as stated in Sec. 22-84 and Sec 22-98 of the Connecticut General Statutes. Therefore, in Connecticut, regulatory actions for boxwood blight, caused by the fungus *Cylindrocladium pseudonaviculatum* (syn. *Calonectria pseudonaviculata*) are under the statutory authority of CAES. Official diagnosis of disease must be confirmed by CAES plant pathologists.

**These guidelines subject to revision upon the availability of new information.

I. GUIDELINES FOR REPORTING NEW INCIDENCES OF BOXWOOD BLIGHT

1. As soon as boxwood blight is suspected on boxwood and/or pachysandra, samples shall be brought or sent to the Plant Disease Information Office of CAES for identification and confirmation.
 - i. Website:
<http://www.ct.gov/caes/cwp/view.asp?a=3756&q=442802&caesNav=|>
 - ii. Phone: 203.974.8601, 203.974.8496, 203.974.8474 or toll-free in CT 877.855.2237.
2. When a positive confirmation is made, CAES plant inspectors will immediately be notified.
3. Property owners/managers will be contacted by CAES inspectors, who will work with these individuals to determine:
 - i. Source(s) of plant material; records will be requested to determine the source of the material and if trace-forward or trace-back studies will be appropriate;
 - ii. Best Management Practices and strategies for disposal of infected plants, cleanup of plant debris, and managing the health of any existing boxwood and/or pachysandra on the property (see II. on managing boxwood blight below).

II. MANAGING BOXWOOD BLIGHT IN THE LANDSCAPE

Recent information regarding the incidence of naturally occurring boxwood blight infections of pachysandra in the landscape have significantly changed possible approaches to managing this pathogen on properties where both hosts are present. Management guidelines based on the host plant affected are provided for boxwood, pachysandra, and the presence of both boxwood and pachysandra. Please bear in mind that published scientific studies on boxwood blight are relatively few and limited information on the management of this disease is available. These management practices are based on what is known about the biology, dispersal, and survival characteristics of this plant pathogen. The discovery of *C. pseudonaviculatum* in pachysandra is new.

A. PROPERTIES WITH BOXWOOD ONLY:

Once the disease has been confirmed by CAES, as follows are available options.

Boxwood Option 1. Total Removal

1. Remove all boxwood from property and double-bag for disposal in municipal trash. Alternative: plants can be buried on the property. If buried, at least 2 feet of soil should be placed over buried plants.
2. Plants should NOT be composted.
3. Replant with plants not in the Buxaceae (e.g., not boxwood, pachysandra, or sarcococca). Consult landscaper, landscape designer, or landscape architect for assistance with plant selection.
4. If a property owner elects to replant with a member of the Buxaceae (e.g., boxwood, pachysandra, or sarcococca), they need to be aware that there is a continual risk of re-infection from local or unidentified sources of the boxwood blight fungus.

Boxwood Option 2. Selective Removal

1. Remove all symptomatic boxwood plants and all adjacent, non-symptomatic boxwood within 10 feet of symptomatic plants on the property.
 - i. Double-bag plants for disposal in municipal trash. Alternative: plants can be buried on the property. If buried, at least 2 feet of soil should be placed over buried plants.
 - ii. Plants should NOT be composted.
2. Remove all organic matter and plant debris by vacuuming, sweeping, or raking for proper disposal (e.g., bagged for municipal trash, buried). This should NOT be composted.
3. On properties where leaf debris may have been incorporated into the soil, removal of 8-12 inches of surface soil* may be helpful to eliminate inoculum. (*This depth has not been validated with scientific research, but is based on what is known about how boxwood leaf debris can become incorporated into most soil types.) What has been scientifically documented is the longevity/survival of the boxwood blight fungus as mycelia and microsclerotia in leaves and leaf debris for at least 5-6 years.
4. Replanting with boxwood (or other plants in the Buxaceae) is not suggested, since the removal protocol cannot guarantee that all sources of the fungus have been eliminated from the vicinity.
5. Sanitize all tools and equipment after use.
 - i. Products for sanitizing: alcohols—ethyl and isopropyl, 60-85% (Lysol Spray), phenolics 0.4-5% (Pheno-cen), quaternary ammonium 0.5-1.5% (Consan

Triple Action 20, Physan 20, Green-Shield 20), and chlorine 100-1,000 ppm (10% Clorox, 10% household bleach).

6. FOR ALL REMAINING, NON-SYMPTOMATIC BOXWOOD ON PROPERTY:
 - i. Inspect for symptoms on a weekly basis for at least several months (preferably one year) after infected plants are removed.
 - ii. Any boxwood with suspicious symptoms should be sent to CAES for diagnosis and testing as previously described.
 - iii. Avoid overhead watering or working with plants when they are wet, since water is important for the spread and development of boxwood blight.
 - iv. Non-symptomatic plants can be sprayed with registered fungicides, at the discretion of the property owner.
 - a) Reports on fungicide efficacy from countries that have been dealing with this disease for many years are not encouraging, since fungicides have not been found to be particularly effective. However, they can be used in conjunction with other management strategies previously outlined, especially when weather is favorable for disease. When there is a risk of boxwood blight occurring, fungicide applications need to be used on a regular preventive schedule. Because of the tight nature of the boxwood canopy, thorough coverage with fungicides is difficult. However, all parts of the plant need to be covered, so any sprays should be applied until run-off. Because this is a new disease for the U.S., boxwood blight will not be on any fungicide labels. A number of products are registered for use in Connecticut—some are for professional use and others are for homeowner use. All are preventative and not curative. Contact the Experiment Station for more detailed or new information. Please note: research at CAES is ongoing to determine the most effective fungicides for CT and the U.S.
 - b) Examples (not all-inclusive) of products for CT homeowner use: the fungicides chlorothalonil and mancozeb are registered for use. Since these are protectant materials, they should be applied before symptoms are observed and repeated as necessary when conditions are favorable for disease development and spread.
 - c) Examples (not all-inclusive) of products for CT professional use: the fungicides azoxystrobin, boscalid + pyraclostrobin, chlorothalonil, fludioxonil, kresoxim-methyl, and mancozeb. These products differ significantly in their mode of action (e.g., some are more effective in inhibiting spore germination; others are more effective at inhibiting mycelial growth).
 - v. Monitor sanitation practices of anyone working with boxwood on property. All tools and equipment need to be sanitized frequently—between individual plants, beds, and plantings.
 - a) Readily available products for sanitizing: alcohols—ethyl and isopropyl, 60-85% (Lysol Spray), quaternary ammonium 0.5-1.5% (Consan Triple Action 20, Physan 20, Green-Shield 20), and chlorine 100-1,000 ppm (10% Clorox, 10% household bleach).

- vi. Monitor activities of pets, children, or toys in order to minimize the potential for movement and spread of the sticky fungal spores.
- 7. Keep accurate records.
 - i. Locations of symptomatic plants;
 - ii. Source and date of original plantings (if known);
 - iii. Locations of remaining boxwood plantings on the property;
 - iv. Mortality due to any cause;
 - v. All fungicide applications (date and rate of product).

B. PROPERTIES WITH PACHYSANDRA ONLY:

Once the disease has been confirmed by CAES, as follows are available options.

Pachysandra Option 1. Total Removal

1. Remove all pachysandra from property and double-bag for disposal in municipal trash. Alternative: plants can be buried on the property. If buried, at least 2 feet of soil should be placed over buried plants.
2. Plants should NOT be composted.
3. Replant with plants not in the Buxaceae (e.g., not boxwood, pachysandra, or sarcococca). Consult landscaper, landscape designer, or landscape architect for assistance with plant selection.
5. If a property owner elects to replant with a member of the Buxaceae (e.g., boxwood, pachysandra, or sarcococca), they need to be aware that there is a continual risk of re-infection from local or unidentified sources of the boxwood blight fungus.

Pachysandra Option 2. Selective Removal

1. Remove all symptomatic pachysandra plants and all adjacent, non-symptomatic pachysandra within 10 feet of symptomatic plants on the property.
 - i. Double-bag plants for disposal in municipal trash. Alternative: plants can be buried on the property. If buried, at least 2 feet of soil should be placed over buried plants.
 - ii. Plants should NOT be composted.
2. Remove all organic matter and plant debris by vacuuming, sweeping, or raking for proper disposal (e.g., bagged for municipal trash, buried). This should NOT be composted.
3. On properties where leaf debris may have been incorporated into the soil, removal of 8-12 inches of surface soil* may be helpful to eliminate inoculum. (*This depth has not been validated with scientific research, but is based on what is known about how boxwood leaf debris can become incorporated into most soil types.) What has been scientifically documented is the longevity/survival of the boxwood blight fungus as mycelia and microsclerotia in leaves and leaf debris for at least 5-6 years.
4. Replanting with pachysandra (or other plants in the Buxaceae) is not suggested, since the removal protocol cannot guarantee that all sources of the fungus have been eliminated from the vicinity.
5. Sanitize all tools and equipment after use.
 - i. Products for sanitizing: alcohols—ethyl and isopropyl, 60-85% (Lysol Spray), phenolics 0.4-5% (Pheno-cen), quaternary ammonium 0.5-1.5% (Consan Triple Action 20, Physan 20, Green-Shield 20), and chlorine 100-1,000 ppm (10% Clorox, 10% household bleach).

6. FOR ALL REMAINING, NON-SYMPTOMATIC PACHYSANDRA ON PROPERTY:
 - i. Inspect for symptoms on a weekly basis for at least several months (preferably one year) after infected plants are removed.
 - ii. Any pachysandra with suspicious symptoms should be sent to CAES for diagnosis and testing as previously described.
 - iii. Avoid overhead watering or working with plants when they are wet, since water is important for the spread and development of boxwood blight.
 - iv. Non-symptomatic plants can be sprayed with registered fungicides, at the discretion of the property owner.
 - a) Reports on fungicide efficacy from countries that have been dealing with this disease for many years are not encouraging, since fungicides have not been found to be particularly effective. However, they can be used in conjunction with other management strategies previously outlined, especially when weather is favorable for disease. When there is a risk of boxwood blight occurring, fungicide applications need to be used on a regular preventive schedule. Because of the growth habit of pachysandra, thorough coverage with fungicides is difficult. However, all parts of the plant need to be covered, so any sprays should be applied until run-off. Because this is a new disease for the U.S., boxwood blight will not be on any fungicide labels. A number of products are registered for use in Connecticut—some are for professional use and others are for homeowner use. All are preventative and not curative. Contact the Experiment Station for more detailed or new information. Please note: research at CAES is ongoing to determine the most effective fungicides for CT and the U.S.
 - b) Examples (not all-inclusive) of products for CT homeowner use: the fungicides chlorothalonil and mancozeb are registered for use. Since these are protectant materials, they should be applied before symptoms are observed and repeated as necessary when conditions are favorable for disease development and spread.
 - c) Examples (not all-inclusive) of products for CT professional use: the fungicides boscalid + pyraclostrobin, chlorothalonil, fludioxonil, and mancozeb. These products differ significantly in their mode of action (e.g., some are more effective in inhibiting spore germination; others are more effective at inhibiting mycelial growth).
 - v. Monitor sanitation practices of anyone working with pachysandra on property. All tools and equipment need to be sanitized frequently—between beds and plantings.
 - a) Readily available products for sanitizing: alcohols—ethyl and isopropyl, 60-85% (Lysol Spray), quaternary ammonium 0.5-1.5% (Consan Triple Action 20, Physan 20, Green-Shield 20), and chlorine 100-1,000 ppm (10% Clorox, 10% household bleach).
 - vi. Monitor activities of pets, children, or toys in order to minimize the potential for movement and spread of the sticky fungal spores.

7. Keep accurate records.
 - i. Locations of symptomatic pachysandra plants;
 - ii. Source and date of original plantings (if known);
 - iii. Locations of remaining pachysandra plantings on the property;
 - iv. Mortality due to any cause;
 - v. All fungicide applications (date and rate of product).

C. PROPERTIES WITH BOTH BOXWOOD AND PACHYSANDRA:

When both hosts are present on a property that is diagnosed with boxwood blight, it will be very difficult to effectively control or manage this disease and keep both of the hosts in the landscape. Once the fungus is present, regardless of the host, the known biology of this pathogen suggests that it will likely persist and serve as a continual source of inoculum for that property and for any neighboring properties with boxwood or pachysandra. It is not known if this fungus can be successfully eradicated once it is present in the landscape.

Boxwood and Pachysandra Option 1 Total Removal

1. Remove all boxwood and pachysandra from property and double-bag for disposal in municipal trash. Alternative: plants can be buried on the property. If buried, at least 2 feet of soil should be placed over buried plants.
2. Plants should NOT be composted.
3. Replant with plants not in the Buxaceae (e.g., not boxwood, pachysandra, or sarcococca). Consult landscaper, landscape designer, or landscape architect for assistance with plant selection.
4. Since host plants will no longer be present on the property, boxwood blight should no longer be an issue.

Boxwood and Pachysandra Option 2 Removal of Boxwood

1. Remove all boxwood (symptomatic and non-symptomatic) from property and double-bag for disposal in municipal trash. Alternative: plants can be buried on the property. If buried, at least 2 feet of soil should be placed over buried plants.
2. Plants should NOT be composted.
3. Replant with suitable plants not in the Buxaceae (e.g., not boxwood or sarcococca). Consult landscaper, landscape designer, or landscape architect for assistance with plant selection.
4. For all pachysandra on property, follow protocol previously outlined in section titled “**Pachysandra Option 2. Selective Removal.**”

Boxwood and Pachysandra Option 3 Removal of Pachysandra

1. Remove all pachysandra (symptomatic and non-symptomatic) from property and double-bag for disposal in municipal trash. Alternative: plants can be buried on the property. If buried, at least 2 feet of soil should be placed over buried plants.
2. Plants should NOT be composted.
3. Replant with suitable plants not in the Buxaceae (e.g., not pachysandra or sarcococca). Consult landscaper, landscape designer, or landscape architect for assistance with plant selection.

4. For all boxwood on property, follow protocol previously outlined in section titled **“Boxwood Option 2. Selective Removal.”**

D. OTHER HELPFUL INFORMATION:

As new science-based information becomes available, it will be posted on the Boxwood Blight page of the Experiment Station’s website:

<http://www.ct.gov/caes/cwp/view.asp?a=3756&q=500388&caesNav=|>

Additional guidelines and information on boxwood blight can be found at that location.

12 October 2012 (revised)