CAES
The Connecticut Agricultural Experiment Station
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BEST MANAGEMENT PRACTICES FOR BOXWOOD BLIGHT FOR CONNECTICUT

- PRODUCTION AND RETAIL NURSERIES -

Version 4.0**

**These are subject to revision based on the availability of new information (revised February, 2023).

IF BOXWOOD BLIGHT HAS BEEN CONFIRMED:

A. ELIMINATION OF THE PATHOGEN

1. The following protocol will be initiated for boxwood blocks that have tested positive:
    i. All infected plants will be buried or incinerated with oversight by state plant inspectors as soon as disease is detected.
        a) Efforts should be made to prevent plant debris from contaminating the nursery on route to disposal (e.g., cover trailer loads of infected plants with plastic sheets).
        b) At least 2 feet of soil should be placed over buried plants. Burial sites and staging areas around these sites should be capped with at least an additional 2 inches of clean soil.
        c) Pots can be buried with infected plants or stacked for decontamination and disinfestation.

a. All organic matter and plant debris should be properly disposed.
b. The most effective product for sanitizing is 70% alcohol (Isopropyl or ethanol). Conidia are killed on contact when wet and microsclerotia are killed with expose (continuously wet) within 4 minutes. Other products (at label rates) kill conidia only and include: phenolics (e.g., Lysol concentrate); 1:10 dilution of household bleach (10% Clorox); hydrogen dioxide (e.g., ZeroTol, Oxidate); and hydrogen peroxide, peroxyacetic acid, and octanoic acid (e.g., X-3). Personal protective equipment may be necessary when handling some sanitizers.
c. Products for sanitizing boots, shoes, and clothing in the field include alcohols or over-the-counter sprays (e.g., Lysol disinfectant spray).

ii. Apparently healthy ("non-symptomatic") plants will be held on a rolling 3-month schedule to ensure that only apparently healthy, pathogen-free boxwood are shipped.
    a) The 3-month schedule is based on the date of the most recent positive detection. If/when new positives are detected, the clock starts again for another 3 months.
iii. Plants within large houses should be divided into manageable-sized groups to minimize the number of plants that need to be destroyed if positives are detected. Small group blocks should be separated by a minimum of 4-6 feet.
    a) When disease is detected in a group or small block, all plants in the group will be removed for burial or incineration.
    b) Symptomatic plants should not be moved to another part of the nursery unless they are being moved specifically for disposal. This eliminates contamination of additional sites.
    c) This will automatically set the holding clock back to 3 months.
iv. Plants will be inspected on a weekly basis (or more frequently, if new infections are detected).
v. Plants will not be sprayed with fungicides during the 3-month holding period.
    a) Because no fungicide sprays should be applied, routine practices such as canopy pruning should be suspended during this period.
    b) Efforts should also be made to minimize handling of the crop (e.g., for spacing).
vi. All plant debris should be removed on a regular basis by vacuuming, sweeping, or raking. Debris should be bagged for incineration or burial. At least 2 feet of soil should be placed over buried plants. Burial sites and staging areas around these sites should be capped with at least an additional 2 inches of clean soil.
vii. Plants can only be shipped after they are examined by CAES inspectors and are given an apparently healthy status.
viii. Locate new boxwood blocks in areas where boxwood (and boxwood blight) have not previously been grown. These areas should be located as far as possible from the infected blocks.

IF BOXWOOD BLIGHT HAS NOT BEEN DETECTED OR CONFIRMED OR AFTER ELIMINATION OF DISEASED PLANTS:

B. EXCLUSION OF THE PATHOGEN

1. Start with pathogen-free material by propagating from healthy stock plants on-site or purchasing from reputable suppliers or nurseries that are licensed and/or certified according to all applicable phytosanitary laws and regulations.
    i. Avoid purchasing from suppliers known to have infected boxwood or who do not follow BMPs.
    ii. Request a history of fungicide treatments with each shipment (fungicide name, application rate, and time).
    iii. Carefully inspect plants or cuttings for symptoms at the time of purchase or when received from supplier. Personnel should be trained to detect boxwood blight. All symptomatic plants should be immediately isolated and tested.
2. Newly purchased plants or rooted cuttings should be isolated from existing boxwood in nurseries, garden centers, or dealers for <u>at least four weeks</u>, but preferably for longer. Note: Boxwood blight develops under extended wet and warm conditions. Holding plants under dry conditions when the pathogen will not spread and disease will not develop will not ensure that plants do not have some low level of undetected disease.
    i. Keep plants labeled or barcoded to be able to track the vendor source.
    ii. Physically separate material by source—avoid co-mingling of plant material from different vendor sources.
    iii. Holding area should have a surface that can be easily cleaned of plant debris from incoming shipments, delivery trucks, and held plants.
        a) All plant debris should be removed on a regular basis by vacuuming, sweeping, or raking.
    iv. Suspend the use of fungicides on new isolated plants during the holding period.
    v. Monitor sanitation practices of delivery trucks and shipping containers.
        a) The most effective product for sanitizing is 70% alcohol (Isopropyl or ethanol). Conidia are killed on contact when wet and microsclerotia are killed with exposure (continuously wet) within 4 minutes. Other products (at label rates) kill conidia only and include: phenolics (e.g., Lysol concentrate); 1:10 dilution of household bleach (10% Clorox); hydrogen dioxide (e.g., ZeroTol, Oxidate); and hydrogen peroxide, peroxyacetic acid, and octanoic acid (e.g., X-3). Personal protective equipment may be necessary when handling some sanitizers.
        b) Products for sanitizing boots, shoes, and clothing in the field include alcohols or over-the-counter sprays (e.g., Lysol disinfectant spray).
    vi. Any boxwood with suspicious symptoms should be sent to CAES for diagnosis and testing.
3. No returns of boxwood plants should be accepted onto the property. Vehicles that have been on properties with blight or with boxwood debris should not be allowed on nurseries.
    i. The purpose is to avoid possible entry of plants or plant debris that may have been exposed to boxwood blight.

4. No dead boxwood plant material should be brought onto a commercial property for disposal.
    i. As a courtesy to their customers, many commercial properties currently allow customers to dispose of dead/removed plant material on their properties. However, this is discouraged, since it creates a potential pathway for boxwood blight to enter the property.

C. WATER MANAGEMENT

1. Water is very important for the spread and development of boxwood blight. Avoid overhead watering or working with plants when they are wet from rain, irrigation or dew. This includes pruning, moving or even walking through wet plants.
2. Increase spacing between plants (rather than placing them pot-to-pot) to maximize air circulation and minimize conditions favorable for disease development, when possible. Fungicide application may be appropriate when plants are in propagation or tightly packed under high moisture conditions.
3. Avoid or minimize accumulation of standing water in boxwood blocks.

D. SANITATION

1. Remove leaf debris by raking or vacuuming when conditions are dry. Debris should be bagged for incineration or burial.
2. Monitor plant debris in run-off water. Divert from other boxwood holding areas.
3. Routine operations to produce a commercially acceptable crop (e.g., canopy pruning, plant spacing) should involve extensive sanitation practices. As spores can be spread when dry and survive for days, then germinate under moist conditions, a suggested protocol is outlined as follows:
    i. Pruning crews should focus on a single house in order to complete the pruning as rapidly as possible.
    ii. Pruning should not occur if plants are wet or if there is high humidity.
    iii. Fungicide programs should include DMI fungicides (FRAC group 3) which inhibit sporulation.
    iv. The day before pruning is scheduled, plants should be thoroughly sprayed with ZeroTol.
    v. Immediately after the last plant is pruned in a house, the crop should be sprayed again with ZeroTol or with a fungicide with curative activity. Routine fungicide programs can resume after pruning, as applicable.
    vi. Tools and equipment should be sanitized with 70% alcohol when moving between different *Buxus* blocks within a house.
    vii. A similar program can be followed for other practices that require handling the plants such as spacing pots.
4. After every crop production cycle, remove all crop debris and disinfest propagation mist beds, sorting areas, cutting benches, machines, and tools.
    i. The most effective product for sanitizing is 70% alcohol (Isopropyl or ethanol). Conidia are killed on contact when wet and microsclerotia are killed with exposure (continuously wet) within 4 minutes. Other products (at label rates) kill conidia only and include: phenolics (e.g., Lysol concentrate); 1:10 dilution of household bleach (10% Clorox); hydrogen dioxide (e.g., ZeroTol,

Oxidate); and hydrogen peroxide, peroxyacetic acid, and octanoic acid (e.g., X-3). Personal protective equipment may be necessary when handling some sanitizers.

ii. Products for sanitizing boots, shoes, and clothing in the field include alcohols or over-the-counter sprays (e.g., Lysol disinfectant spray).

5. Work in blocks with exposed and potentially infected plants last—after completing work with healthy plants.
    i. Wearing of protective gear can be helpful.
6. If a block exposed to or known to have boxwood blight has been visited, wash and sanitize shoes, tools, equipment, and vehicles that may have become contaminated before traveling to other areas on the nursery.
    i. Use of protective gear can be helpful.
7. Use new or clean and properly disinfested pots or flats for boxwood production. Use new, not reused potting mixes. Sanitize shipping containers, benches, and equipment.
8. Train all nursery personnel to avoid movement through areas with infected or exposed and potentially infected plants and to regularly sanitize clothing and equipment as part of standard operating procedures.

E. INSPECTION

1. Inspect all boxwood weekly throughout the growing season by trained personnel. Inspect plants when they are dry.
    i. If boxwood blight symptoms are detected, immediately pull and remove whole plants and place them in plastic bags to avoid carrying infected material through the house or nursery.
    ii. Infected plant material should NOT be composted.
    iii. If you observe suspicious symptoms on boxwood, it is important to have the disease accurately identified by a specialist (state inspector or CAES plant pathologist).
2. Routinely monitor and inspect all incoming boxwood material.
3. Routinely inspect boxwood in the landscape on the growing grounds or surrounding area for boxwood blight.

F. FUNGICIDE MANAGEMENT

1. Fungicides for boxwood blight management should be used preventatively whenever possible in conjunction with cultural controls and scouting. Combinations of systemic and protectant fungicides in different FRAC classes with different modes of action are desirable both for increased efficacy and for fungicide resistance management. We have observed that propiconazole, benzovindiflupyr and fluxapyroxad have some curative activity within 48 hours after infection and that fungicides in FRAC group 3 inhibit can sporulation. Managing to prevent disease using fungicides as a part of best management practices is our best approach. Fungicide use may be especially important when plants are held under conducive environmental conditions or when they are not spaced at least 6 inches apart. Current fungicide information is available at: https://portal.ct.gov/CAES-boxwood-blight-fungicides

G. RECORD KEEPING/TRACEABILITY

1. Keep accurate, detailed records of:
    i. Incoming and outgoing plants.
        a) Maintain a complete history for plants while they are in the nursery;
    ii. Shipping records (plants shipped, location);
    iii. Propagation of plant material;
    iv. Mortality due to any cause;
    v. All chemical/fertilizer applications;
    vi. Weather records, if available.

H. TRAINING

1. Educate and train personnel for early detection of recognized boxwood blight.
2. Train personnel in BMPs, including sanitation.

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: https://portal.ct.gov/CAES/PDIO/Boxwood-Blight/Boxwood-Blight

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

Another source of useful information can be found at the AmericanHort Knowledge Center: https://www.boxwoodhealth.org/

Version 4.0 (February 2023)