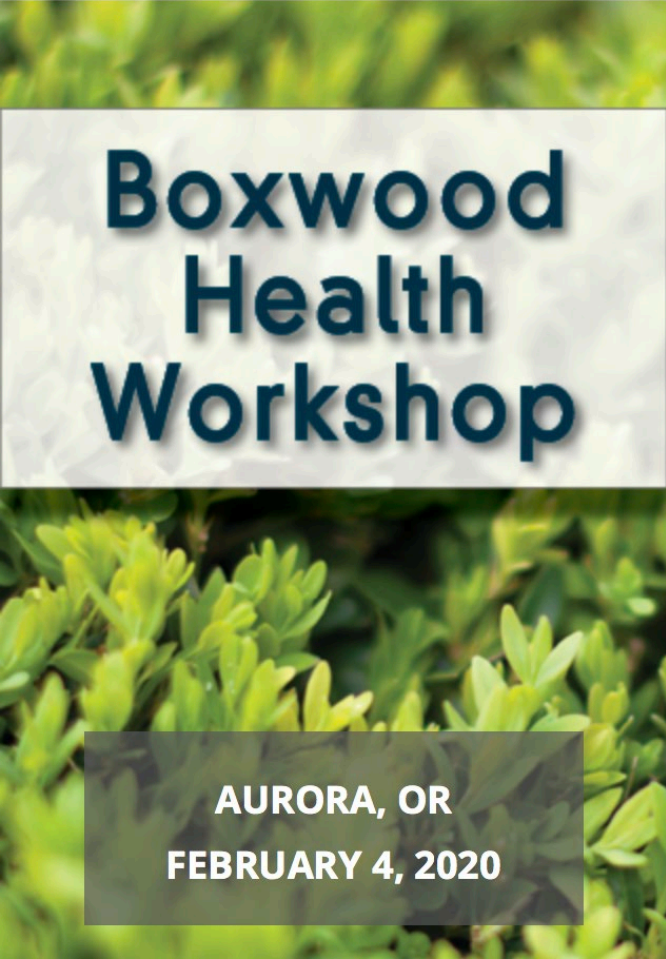


Sanitation for Boxwood Blight Management

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A poster for a Boxwood Health Workshop. The top half features a blurred background of green boxwood leaves. The text "Boxwood Health Workshop" is written in a bold, dark blue font. The bottom half of the poster shows a close-up of boxwood leaves with a semi-transparent dark grey box containing the event details.

**Boxwood
Health
Workshop**

**AURORA, OR
FEBRUARY 4, 2020**



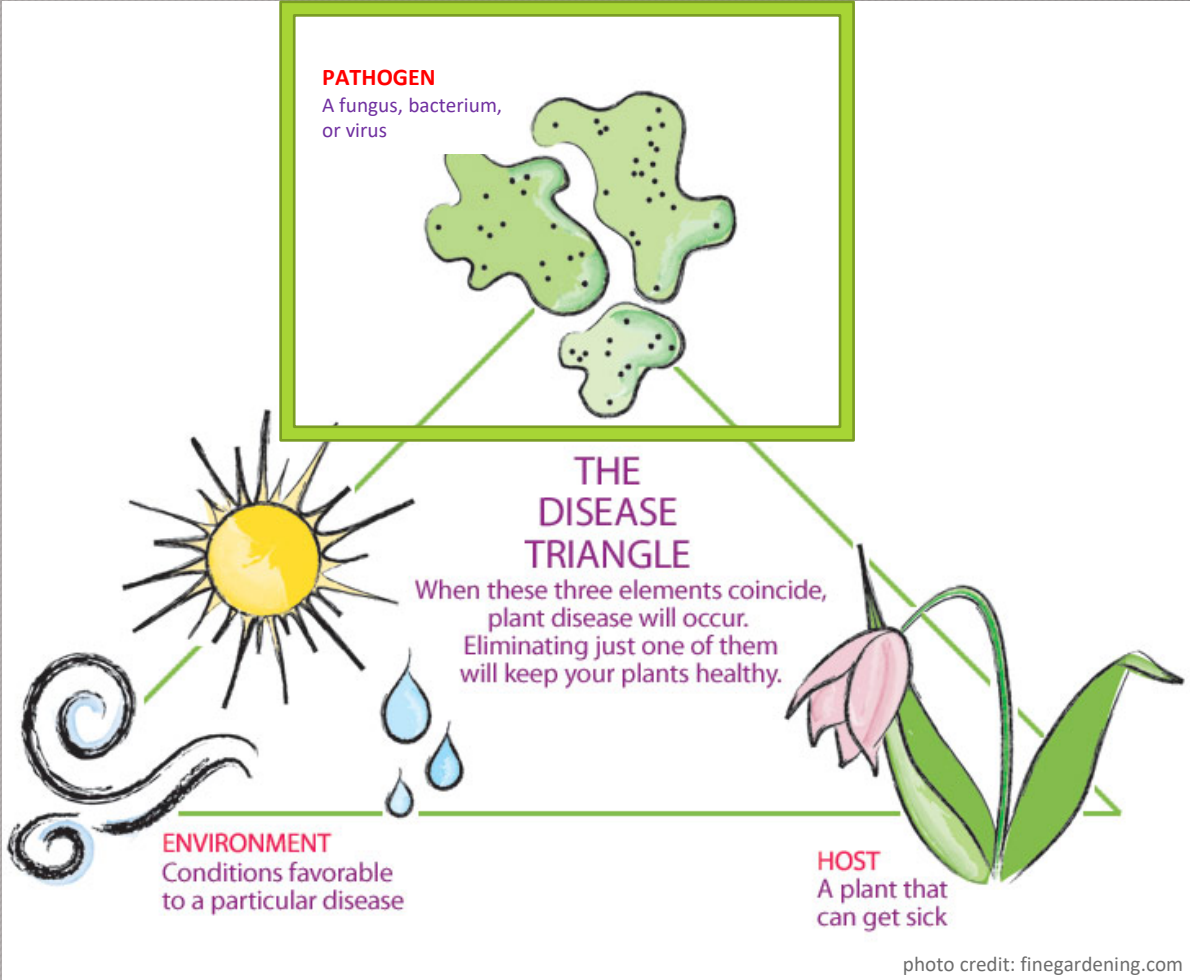
Agenda

- Section 1: Boxwood blight
- Section 2: Sanitation
- Section 3: Why you should use sanitation practices at boxwood production
- Section 4: Sanitation for boxwood blight management
- Questions
- Exercise

Objectives

- Understand the importance of sanitation practices for boxwood blight management
- Use practical tools and methods to implement your own sanitation plan

Plant Disease Triangle



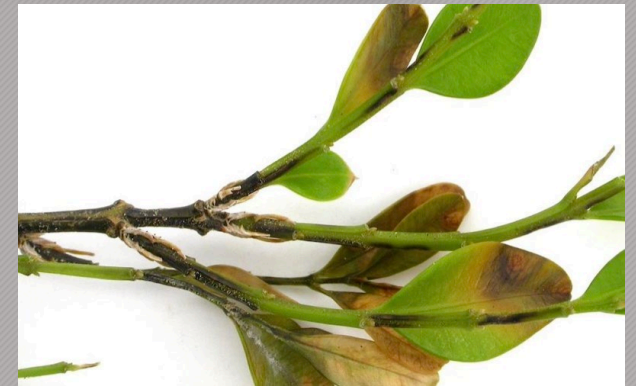
Section 1: Boxwood blight- Potential impact

- Two fungal species:
 - *Calonectria pseudonaviculata* (syn. *Cylindrocladium pseudonaviculatum*, *C. buxicola*)
 - *C. henricotiae* (Five countries in Europe- Belgium, Germany, Netherlands, Slovenia and United Kingdom)
- Landscapes, gardens and nurseries



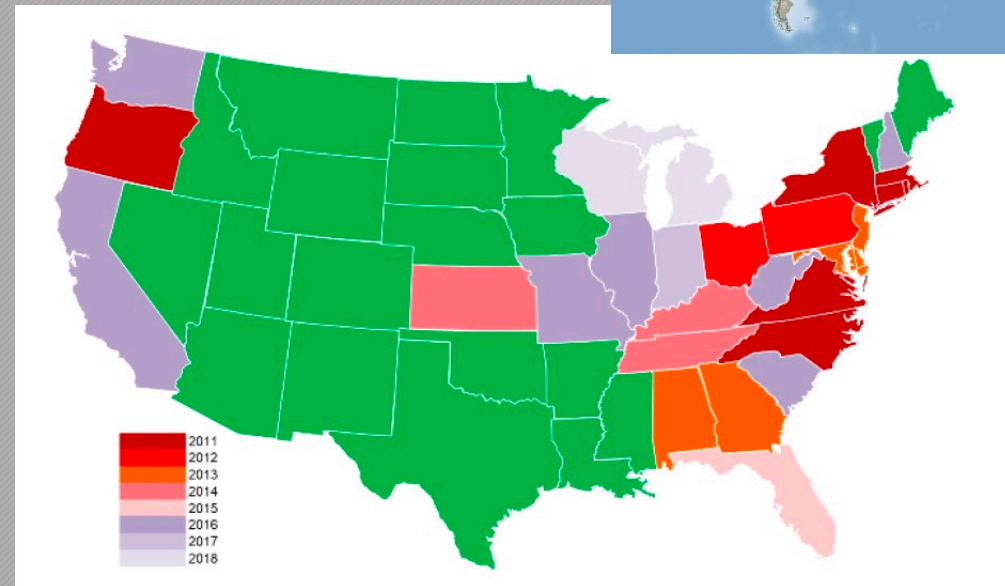
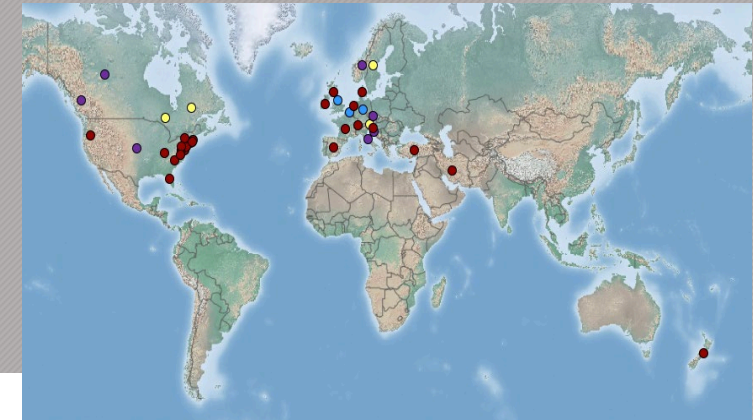
Section 1: Boxwood blight- Potential impact

- The pathogen can infect all growth stages of boxwood plants and the disease results in defoliation and decline of susceptible boxwood.
- This fungus spreads over short and long distances.
- Once introduced to a nursery, landscape or garden, boxwood blight is very difficult and costly to manage.



Section 1: Distribution of Boxwood Blight

- 1994: First identified in United Kingdom
- 2011: First identified on boxwood in nurseries and landscape plantings in North Carolina and Connecticut.
- 2020: Confirmed in 26 additional states and the District of Columbia in the United States.



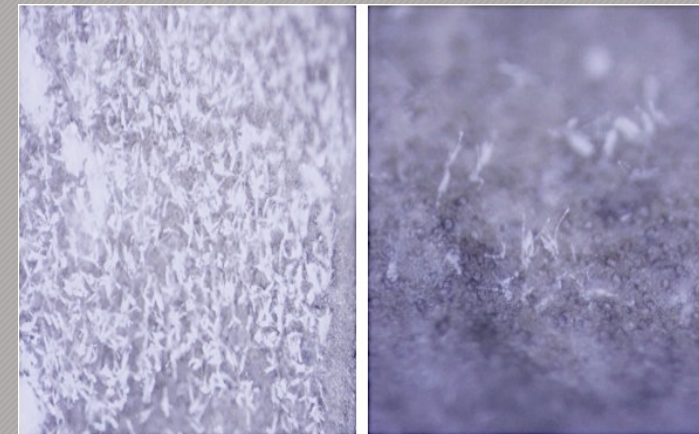
Section 1: Boxwood blight- Pathogen spread

- Short distance:

- Rain or irrigation water
- Wind
- Plant debris
- Contaminated tools and equipment (such as pruning tools)
- Workers (contaminated boots and clothing) and
- Animals (pets, insects, mites, birds etc.)

- Long distance:

- Movement of contaminated plants
- Cuttings, including boxwood greenery used for holiday decorations

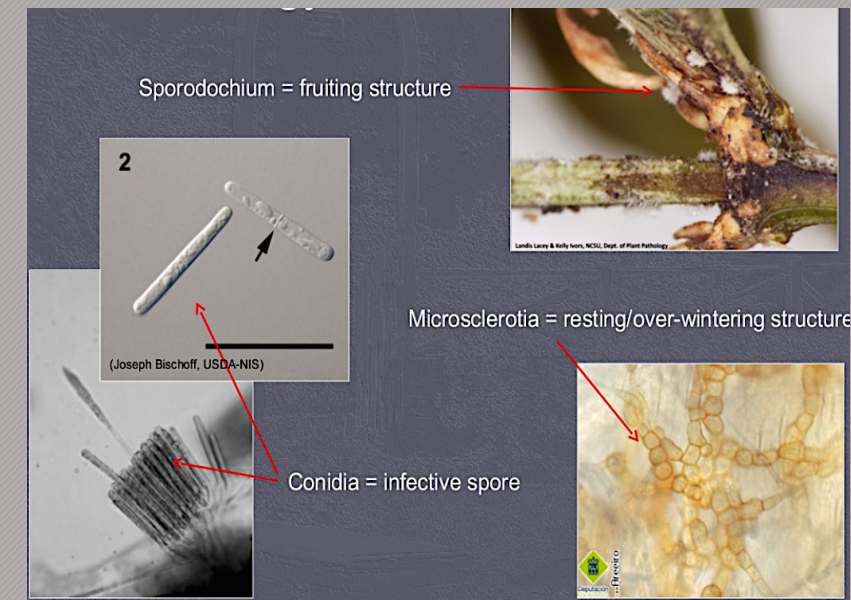


Section 1: Boxwood blight- Pathogen spread

- Boxwood blight spreads wherever runoff goes within fields.
- But runoff containment reservoirs or a redistribution center is **unlikely** an important **source of inoculum** for boxwood blight unless a pump house is located very close to a runoff entrance.
- True fungi are generally considered terrestrial in habitat, as opposed to aquatic.
- Boxwood blight conidia maintain infectivity for approximately 2–3 days in water at 20°C, 4–6 days at 12°C, and 1 week at 4°C.

Section 1: Boxwood blight- Pathogen biology

- Persist as mycelium in infected leaves left on the soil surface or on those buried in the soil for at least 5 years.
- Conidia of *C. pseudonaviculata* can remain viable in soil for 3 weeks, microsclerotia were shown to survive for at least 40 weeks at optimal conditions in soil.
- When the environmental conditions are favorable, microsclerotia produce new mycelium and new lesions can be observed within one week.
- The fungal pathogen gains leaf entry through stomatal openings and not by direct penetration of the cuticle.

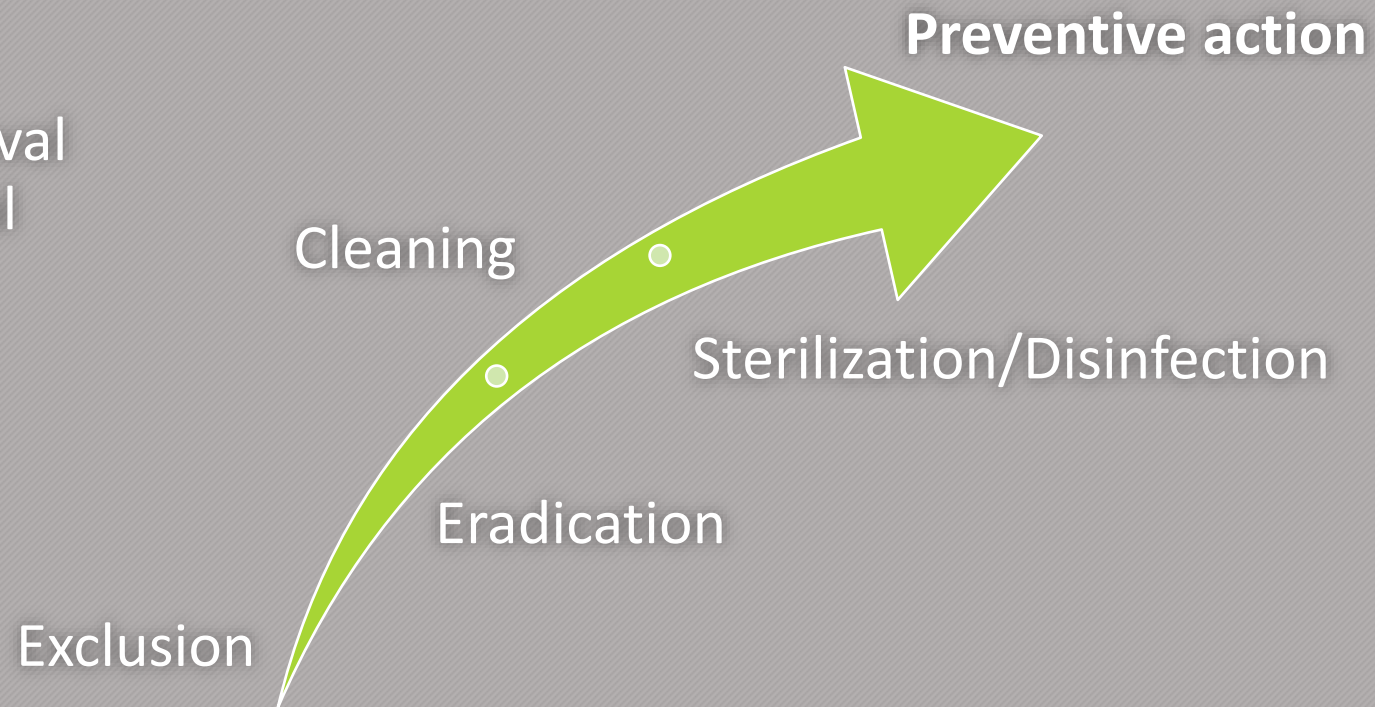


Section 2: Sanitation

- Sanitation is the formulation and application of measures designed to protect plant health.
- It is an important cultural strategy for reducing the impact of diseases on crops.

Section 2: Sanitation

Generally, sanitation involves the removal of both infected materials and potential sources of infection, followed by disinfection of surfaces/sterilization of soil/propagation substrates.



Exclusion

- Use clean plant materials (boxwood cuttings)
- Examining plant materials
- Use clean soil, potting mix-propagation substrates, packing material, boxes, containers, flats
- Keep storage room, floors, working surface clean
- Use clean production equipment

Eradication

- Hot water treatment, chlorine bleach treatment, aerated steam treatment
- Monitoring/inspecting plant materials
- Removal and burning of diseased plant materials
- Always work in infected areas at the end of the workday. Alternatively, shower and change entire work gear before entering uninfected areas
- Removal potential/alternate hosts
- Destroying weeds, volunteer plants that are reservoirs of pathogens
- Elimination of cull piles
- Soil/substrate treatments (steam/heat treatments, solarization)

Cleaning

- Clean clothes
- New or disinfected lab coats/coveralls
- Shoe covers or new or disinfected boots/shoes
- Gloves
- Install a footbath at the entrance to the production area to be used by all persons
- Install a disinfection mat for all vehicles
- Keep the disinfectant in footbaths and disinfection mats fresh at all times

Cleaning-*cont.*

- Locate hand disinfection dispensers at all entrances
- Request that visitors remain on the walkways and do not enter the production areas
- When visitors leave, dispose of their shoe covers and gloves into a bin specially provided for this purpose
- Ensure that used coveralls are laundered after each use
- Prevent pets from entering into the production area
- Assign coveralls, tools, carts and other equipment to specific production sections

Sterilization/Disinfection

- Dipping tools and gloved hands in an approved disinfectant between plants or at least between rows or blocks
- If knives or scissors are used, disinfecting them between plants and use a different tool for each row
- After leaving each production site, properly discard disposable gloves and shoe covers, leave shoes/boots for disinfecting and leave coveralls for laundering and disinfecting

Sterilization/Disinfection- *Cont.*

- Power washing, cleaning and disinfecting all equipment at the end of each day
- Disinfecting work surfaces and structures
- Disinfecting irrigation water and re-circulated water
- Disinfecting irrigation lines and possible drip stakes

Section 3: Why you should use sanitation practices at boxwood production

- Reduced risk of the introduction and spread of diseases
- More effective disease suppression
- Management of fungicide resistance
- Improved biological control programs
- A more vigorous, healthy crop

Section 4: Sanitation for boxwood blight RISK management

- **Purchase boxwood plants** from the suppliers or nurseries that have **been inspected by the state's department of agriculture** and found to be apparently free from boxwood blight and hold a **boxwood blight cleanliness program compliance agreement**.

Boxwood blight RISK management

- Careful inspections need to be done prior to and also after the purchase of host plant material.
- **Hot water treatment has been tested for sanitizing boxwood cuttings.** Conidia and microsclerotia are both sensitive to hot water but cultivar, isolate, and exposure time all affected the results. *C. pseudonaviculata* germination was decreased significantly more than that of *C. henricotiae* at 47.5°C and 50°C, but the microsclerotia of both species were killed quickly at 55°C.
- **Scouting and early diagnosis** of infected plants are critical for the avoidance of boxwood blight disease spread and the implementation of effective disease control strategies. **If the plant is symptomatic, contact Oregon Department of Agriculture.**

Boxwood blight RISK management

- Newly purchased plants should be isolated from existing boxwood, sweet box or spurge plantings at holding or isolation areas for at least one month by a minimum of 10 ft.
- During this isolation period fungicide applications are not recommended since the fungicide treatments can suppress symptom development and mask proper diagnosis. In particular, moderately tolerant or tolerant cultivars need to be inspected carefully during this period since they may carry the pathogen without obvious symptoms.

Boxwood blight RISK management

- Blocking the plants using 10 ft. distance between the blocks or separating the boxwood blocks with another non-host plant is critical.
- Ensure good air circulation in plantings by providing adequate spacing between plants in nursery.



Boxwood blight RISK management

- Good drainage system in the holding or production area.
- Prevent runoff from the one holding or production block to another.
- Proper irrigation can reduce disease spread. Drip irrigation is better than overhead irrigation, as it supplies water to the root system of the plant without the potential of spreading the disease through splashing.
- Gardening experts recommend that boxwood be shaped with a convex rather than a flat top to aid the canopy in shedding water

Boxwood blight RISK management

- Using boxwood greenery for holiday decorations is not recommended in close proximity to boxwood production areas.



Boxwood blight management

- Once infected plants are detected, they should be destroyed immediately to reduce the potential for spread of the disease.
- Along with the plants (including roots), leaf and stem debris should be removed from the area because the pathogen can survive for a long time (up to five years) in plant debris.



Boxwood blight management

- Before leaf debris has been blown by wind, buried by erosion or begun to decompose, **flaming the soil surfaces with a propane push flamer (1 m/45 sec)** and using **leaf vacuum** can significantly reduce levels of inocula of boxwood blight in the upper layer of soil.

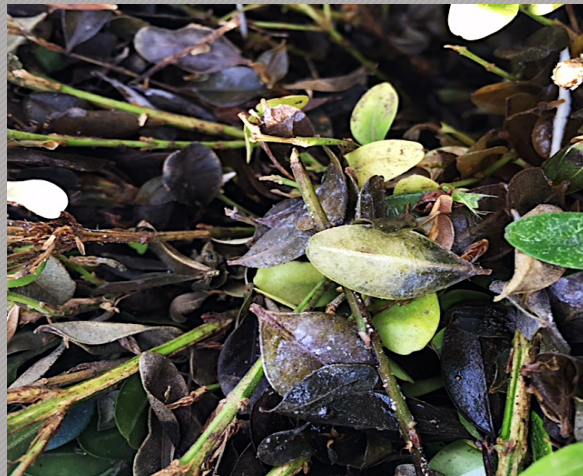


Boxwood blight management



Boxwood blight management

- Do not work in boxwood blight suspected areas when the plants are wet, and wear **clean disposable booties** and **coveralls** and dispose of the booties and coveralls before entering other boxwood areas.
- Do not go from areas of known infections to areas where infections have not been seen.



Boxwood blight management

- Gated entrance



Boxwood blight management

- Sanitation of tools, equipment, and hard surfaces is critical (spray hoses, pruning tools, wheelbarrows, tarps, vehicles etc.) for boxwood blight management.

Different types of disinfectants containing;

- Sodium hypochlorite (Clorox- 10%)
- Hydrogen dioxide (OxiDate, ZeroTol (1:100))
- Potassium peroxymonosulfate + Sodium chloride (Virkon S 2%)
- Phenolic compounds (O-benzyl-p-chlorophenol) (Lysol Brand Concentrate Disinfectant) (2.5 oz/ 1 qt)
- Ethanol (70%)
- Hydrogen peroxide + peroxyacetic acid + octanic acid (Xeroton-3 (X3))

Boxwood blight management



Boxwood blight management

- Automated disinfectant delivery systems (elimination plant-to-plant spread by cutting tools)



Menno Knife
Royal Brinkman,
The Netherlands
royal@brinkman.com

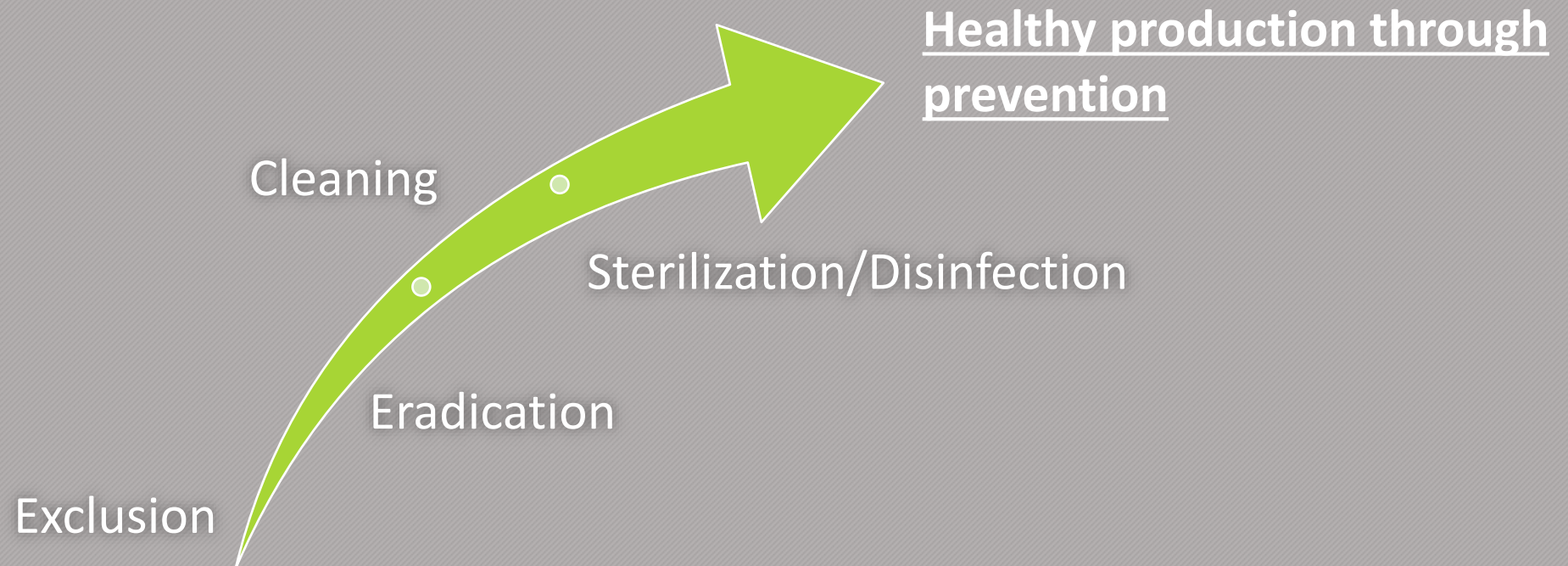


Metallo-Germo Knife
<http://www.metallotools.nl/>



Felco19 Shears with
spray device FelcoSA, Switzerland
<http://www.felcostore.com/pruners>

Summary



Ask yourself the following questions

- Is your staff trained in sanitation procedures?
- Do you keep records of your sanitation practices?
- Are they capable monitoring/inspecting plants for diseases/pests? Are you and your staff familiar with the common diseases of the boxwoods you are growing?
- Does the incoming boxwood plant material have existing disease symptoms?
- Do you have an isolation area that holds new or incoming boxwood plants?
- Are you using clean plant material? Are they treated such as hot water treatment, chlorine bleach treatment, aerated steam treatment, or fungicide?

Ask yourself the following questions

- Do you use sterilized soil, potting mix (steam or fumigate) before adding it to the pots/trays/liners etc.?
- Do you reuse your pots or trays?
- Do you fill pots, transplant, or seed in an area away from the production area?
- Are the areas where you store pots, flats, potting soil, etc., clean and free of dirt, old media, used pots, etc.?
- Do you routinely disinfect benches, floors, storage room and production structure?
- Do you properly clean and disinfect at the beginning of and between crop cycles?

Ask yourself the following questions

- Do you regularly clean tools and equipment with soap and water, and sterilize them periodically?
- Do you clean equipment before it enters the production site?
- Are your hose, nozzles or other irrigation tubing on the floor?
- Are you disinfecting irrigation lines, drip stakes etc.?
- Are there areas that retain water?

Ask yourself the following questions

- Do you use recirculated water? Do you apply any water treatments (Filtration (screen, spin, disc and sand filters), heat/pasteurization, UV radiation, activated peroxygen (hydrogen dioxide/hydrogen peroxide and peroxyacetic acid/peracetic acid), ozone, chlorine dioxide, sodium hypochlorite, chlorine gas)?
- Are workers going directly from old, potentially infested crops to newly planted crops?
- Do they wash their hands, use hand disinfection dispensers or change clothing before they go from crop to crop?
- Do you/your staff inspect boxwood blight infected plants and dispose of them properly?

Ask yourself the following questions

- Are there trash containers in each production area and are they used and emptied daily?
- Do you place crop debris (leaves, stems, etc.) into a closed or covered container or bag?
- Do you have a dump pile for old, dead or diseased plants? Are they close by to your nursery production?
- Do you reuse the soil from a dump pile?

Ask yourself the following questions

- Do you have a vegetation-free zone around the outside perimeter of your production facility?
- Do you have weeds, volunteer plants in pots, floors, walkways, or surrounding environment?
- Do you allow pets to enter into the nursery production area?
- Do you provide coveralls, shoe covers, gloves to your workers and visitors?
- Do you wash and disinfect coveralls after each use?
- Do you have a footbath and disinfection mat at the entrance to the nursery production?

BOXWOOD BLIGHT NURSERY PRODUCTION EXERCISE



CONTAINER NURSERY PRODUCTION EXERCISE



FIELD NURSERY PRODUCTION EXERCISE



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Any Questions?

Contact me or your local extension specialist

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