



Greenhouse Sanitation

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INTRODUCTION

Diseases are a major concern for greenhouse growers and can be a key limitation to profitable plant production. Disease management in greenhouses is critical because the warm, humid environment in these structures provides optimal conditions for reproduction of many pathogens. When disease management is neglected (FIGURE 1), pathogen populations build-up and continue to increase as long as there is susceptible plant tissue available for infection and disease development. Infected plant tissue (FIGURE 2), infested soil, and pathogen inoculum (such as fungal spores, bacterial cells, virus particles, and nematode eggs) all serve as sources of pathogens that can later infect healthy plants.

IMPORTANCE OF SANITATION

Reduction of pathogens by various sanitation practices can reduce both active and dormant pathogens. While actively growing plants can provide host tissue for pathogen multiplication, plant debris and dead plant material (FIGURE 3) can harbor overwintering propagules (fungal spores, bacterial cells, and virus particles) for months or years. These propagules can travel through wind/fan currents, stick to shoes or tools, or move with contaminated soil or water droplets. Thus, prevention of spread of pathogens to healthy plants and elimination of any disease-causing organisms from one cropping cycle to another is the basis for a disease management program using sanitation practices.



FIGURE 1. GREENHOUSE SANITATION INVOLVES THE ELIMINATION OF INFECTED PLANT TISSUE AND DEBRIS SO THAT PATHOGENS ARE NOT SPREAD TO HEALTHY PLANTS.

Sanitation is one of the most overlooked disease management practices but should be a focus of both organic and conventional growers. Often, growers presume that fungicides are the most important disease management tool at their disposal. However, basic cultural practices such as sanitation help reduce pathogen numbers and eliminate infective propagules that cause disease.

A good sanitation program can help reduce the need for chemical controls and can improve the effectiveness of other practices for managing disease. Likewise, fungicide effectiveness may be reduced when disease pressure is heavy and pathogen levels cannot be reduced sufficiently by chemical means.

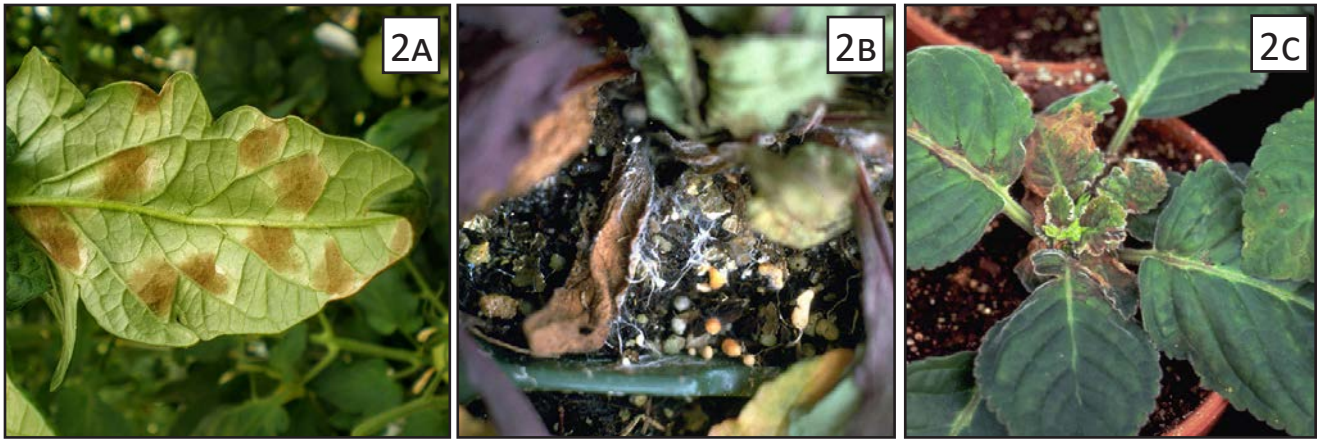


FIGURE 2. INFECTED PLANT TISSUE CAN HARBOR PATHOGEN INOCULUM, WHICH CAN LATER INFECT HEALTHY PLANTS. INOCULUM CAN INCLUDE (A) SPORES, (B) SCLEROTIA AND MYCELIA, AND (C) VIRUS PARTICLES WITHIN INFECTED TISSUES.

DISEASE MANAGEMENT

Elimination and/or reduction of pathogens from greenhouses results in fewer pathogen propagules. The following sanitary practices can reduce amounts of infectious pathogens:

- **Do not reuse soil or potting media.** Do not bring outside soil into greenhouses.
- **Discard prunings and culled plants.** Never leave cuttings in greenhouses, as pathogens may continue to multiply by producing spores or other propagules. Infected plant material should be buried, burned, or placed in cull piles that are located at least 100 yards from the greenhouse. Do not compost diseased cuttings or soil because incomplete composting (temperatures below 160°F) may result in survival of propagules.
- **Discard heavily infected plants and those with untreatable diseases** (e.g. root rots). Some diseases (e.g. fungal leaf spots) can be managed using fungicides; when possible, isolate infected plants until disease is eliminated. Fungicides won't bring dead tissue back to life, but using fungicides will help protect new growth, allowing plants to overcome disease outbreaks. Contact your local Extension agent for more information.
- **Clean excess soil and plant debris from floors and benches.** Gravel, concrete, or landscape cloth can be used to cover dirt walkways. Soilborne pathogens can remain dormant in soil for months or years, becoming infective when temperature and humidity increase or when susceptible plant material becomes available.



FIGURE 3. CLEAN UP SOIL AND PLANT DEBRIS FROM FLOORS, INCLUDING (A) WALKWAYS AND (B) UNDER BENCHES, IN ORDER TO ELIMINATE SOURCES OF DISEASE PATHOGENS.



FIGURE 4. (A) WEEDS, SOIL, AND RUNOFF CAN ALL SERVE AS SOURCES FOR PATHOGEN SPREAD AND/OR OVERWINTERING. GREENHOUSE FLOORS SHOULD REMAIN CLEAN AND DRY; BARE SOIL SHOULD BE COVERED WITH GRAVEL OR CONCRETE. **(B)** HOSES AND **(C)** SPRAYER NOZZLES SHOULD NOT BE DRAGGED ALONG THE GROUND WHERE THEY CAN PICK UP PATHOGENS.

- **Prior to treating plants with fungicides, prune or remove infected tissue** (flowers, leaves) to eliminate sources for spore production or propagule multiplication before fungicide application.
- **Remove weeds and volunteer plants** to prevent establishment of a “green bridge” between crops (FIGURE 4). Be sure to remove aboveground parts AND roots. A green bridge allows pathogens to infect alternate hosts until a more suitable one becomes available.
- **Disinfest pots, benches, floors, and tools** to remove spores and propagules. Use a commercial disinfectant such as quaternary ammonium (Green-Shield®, Quattro, Physan), 10% bleach (1 part household bleach to 9 parts water), peroxide (Oxidate, Terraclean), or 10% Lysol® concentrated disinfectant. Note: bleach and peroxide are corrosive, so tools must be rinsed after 5 to 10 minutes of exposure.
- **Do not drag hoses and other tools along floors**, where infested soil and plant debris can stick and be moved to clean surfaces (FIGURES 4B & 4C).
- **Use pathogen-free irrigation water** – either municipal water or sterilized. Install a water-treatment system if using recycled pond water. Consult your local Cooperative Extension office for information on treating surface (pond, etc.) water for use in irrigation systems.
- **Use footbaths containing sanitizers** to prevent carrying propagules to clean areas.
- **Follow a thorough sanitation regime after each cropping cycle** or at least once per year. Begin with an empty greenhouse; clean and sanitize all surfaces to insure that pathogens are not carried over from one season to the next.

ADDITIONAL RESOURCES

- Cleaning & Sanitizing Commercial Greenhouse Surfaces (PPFS-GH-07)
<https://plantpathology.ca.uky.edu/files/ppfs-gh-07.pdf>
- Damping-off of Vegetables and Herbaceous Ornamentals (PPFS-GEN-03)
<http://plantpathology.ca.uky.edu/files/ppfs-gen-03.pdf>
- Fungicides for Management of Diseases in Commercial Greenhouse Ornamentals (PPFS-GH-03)
<http://plantpathology.ca.uky.edu/files/ppfs-gh-03.pdf>
- Managing Greenhouse & High Tunnel Environments to Reduce Plant Diseases (PPFS-GH-01)
<http://plantpathology.ca.uky.edu/files/ppfs-gh-01.pdf>

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