



College of Agriculture, Food and Environment
Cooperative Extension Service

Plant Pathology Fact Sheet

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Cleaning & Sanitizing Commercial Greenhouse Surfaces

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IMPORTANCE

Greenhouse and nursery sanitation practices help prevent the introduction and spread of plant diseases and pests, as well as eliminate safety hazards. In general, being proactive in maintaining a clean growing environment will often be less expensive and more effective than reacting to a disease or pest issue after it emerges.

Pathogens that cause plant disease can survive in organic matter or plant debris, weeds in or around greenhouses and nurseries, in contaminated soil or soilless media (substrate), on surfaces (such as

benches and nursery pads), and in irrigation nozzles and lines. Cleaning and sanitizing greenhouses, benches, groundcovers, containers, and tools are important steps in eliminating microscopic propagules that can cause disease in subsequent crops. This is particularly important for sites where disease was a problem previously.

The following cleaning and sanitation protocol applies to all commercial greenhouses, regardless of size.

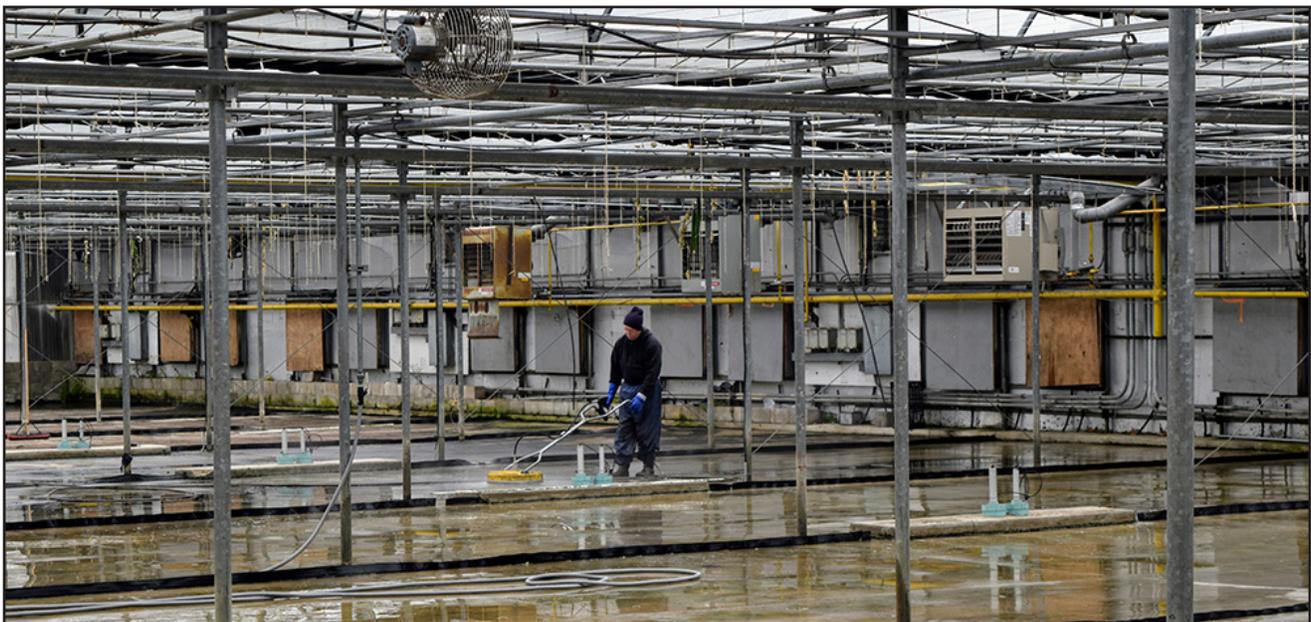


FIGURE 1. GREENHOUSES SHOULD BE EMPTIED, CLEANED, AND SANITIZED BETWEEN CROPS IN ORDER TO ELIMINATE DISEASE-CAUSING PATHOGENS.



FIGURE 2. NURSERY PADS, THOUGH POROUS, SHOULD BE CLEANED IN A MANNER SIMILAR TO HARD SURFACES (A). LATE SEASON BUILDUP MAY INCLUDE VISIBLE ALGAE, SOIL OR SOILLESS MEDIA, AS WELL AS NON-VISIBLE PATHOGEN PROPAGULES (B).

FIGURE 3. WOOD SURFACES ARE DIFFICULT TO CLEAN AND SANITIZE. COMMERCIAL SANITIZERS OFTEN DO NOT PENETRATE WOOD WELL.

BASICS OF SANITIZING

Greenhouses and nursery pads should be followed (emptied) after each crop cycle or at least once per year for proper cleaning and sanitizing (FIGURE 1). Remove weeds, unhealthy plants, carryover or stock plants, and other potential reservoir hosts.

Next, clean and sanitize all surfaces, including greenhouse sidewalls, groundcovers or floors (FIGURE 2), benches, containers, tools, equipment, irrigation lines, and breaker nozzles or heads, in order to inactivate any remaining propagules.



FIGURE 4. FOOTBATHS SHOULD BE FILLED WITH COMMERCIAL SANITIZING SOLUTION, AND THE SOLUTION SHOULD BE CHANGED REGULARLY.

The following steps are recommended:

- 1. Sweep floors and brush surfaces** to eliminate dry organic plant debris, soil or soilless media particles.
- 2. Wash surfaces** using a brush and heavy stream of water to dislodge large particles. Follow up with soap or detergent. Tools, containers, benches, and equipment should be brushed or rubbed to clean surfaces.
Note: Organic regulations indicate that soaps cannot come into contact with food products.
- 3. Rinse** away detergent and debris. Repeat steps 1 to 3 until all surfaces are clean.
- 4. Sanitize surfaces**, especially if disease was a problem in the previous crop. The key to effective disinfection is the length of time the product contacts surfaces; slow-drying increases contact time and optimizes effectiveness. Commercial disinfectant products are formulated and tested for stability, residual activity, safety, and sensitivity. Refer to the product label for specific instructions.
 - Porous surfaces, such as wood, are difficult to sanitize (FIGURE 3); many commercial sanitizers do not penetrate well.
 - Change footbath disinfectant regularly (FIGURE 4) throughout the growing season.

5. Flush irrigation lines with disinfectant to remove propagules that may have moved into water lines and emitters. Soak breaker nozzles or heads in disinfectants (FIGURE 5) and rinse thoroughly before use.



FIGURE 5. HOSE ENDS, BREAKER NOZZLES, AND IRRIGATION LINES SHOULD BE SOAKED AND FLUSHED IN ORDER TO INACTIVATE PATHOGEN PROPAGULES THAT MAY HAVE ACCUMULATED.

SANITIZERS & DISINFECTANTS

Commercial products are recommended for efficacy. The following is only a summary of information related to various disinfectants;

refer to product labels for detailed instructions. Personal protective equipment should always be worn when applying sanitizers.

Commercial Sanitizers & Disinfectants	
<p>Hydrogen dioxide (e.g. ZeroTol® 2.0, Oxidate® 2.0)</p>	<p>Effective against algae, bacteria, fungi. Contact time 1 to 10 minutes. Use on containers, greenhouse walls and floors, foot baths, tools. Use with a foaming agent for vertical surfaces. Some formulations are also labeled as fungicides. OMRI listed.</p>
<p>Hydrogen peroxide & peroxyacetic acid (e.g. Sanidate 5.0®)</p>	<p>Effective against algae, bacteria, fungi, viruses. Contact time 10 to 15 minutes. Use on containers, cooling pads, greenhouse walls and floors, foot baths, irrigation lines, tools. Foaming formulation available for vertical surfaces. Limited efficacy on porous surfaces such as wood. No residual effect. OMRI allowed if measures are taken to assure that residues do not come into contact with the fruit or harvestable tissues.</p>
<p>Quaternary ammonium compounds (e.g. Green-Shield®, Physan 20®, KleenGrow™)</p>	<p>Effective against algae, bacteria, fungi, viruses Contact time 10 to 15 minutes Use on containers, cooling pads, greenhouse walls and floors, foot baths, irrigation lines, tools Foaming formulation available Limited efficacy on porous surfaces such as wood. No residual effect. OMRI allowed if measures are taken to assure that residues do not come into contact with the fruit or harvestable tissues.</p>
<p>Chlorine bleach (10% to 20% dilution)</p>	<p>Extremely effective against algae, bacteria, fungi, viruses. Contact time less than 1 minute to 15 minutes; half-life 2 hours. Most effective product for use on porous surfaces such as wood, especially at higher concentrations. Highly corrosive to metals; damaging to soft plastic and rubber; dangerous to human health; never mix bleach with products containing ammonia or acidic products. OMRI allowed in certain circumstances. Chlorine dioxide (e.g. Selectocide®) effective against algae, bacteria, fungi, and viruses; penetrates wood and porous surfaces.</p>

The following alternative sanitizers and disinfectants lack efficacy data, and limited information is available for commercial applications.

Alternate Sanitizers & Disinfectants	
Alcohol (70%)	Practical for use on tools. Contact time 10 to 15 minutes. Flammable. OMRI allowed for disinfection of tools.
Trisodium phosphate (TSP) (10% solution)	Corrosive to metals. Harmful to human health. Not allowed by OMR.
Lysol® Disinfectant (concentrate)	Practical for containers, tools, equipment, and for hand-washing smaller surfaces. Not allowed by OMR.

ADDITIONAL RESOURCES

- Greenhouse Sanitation (PPFS-GH-04)
<http://plantpathology.ca.uky.edu/files/ppfs-gh-04.pdf>
- Synthetic Substances Allowed for Use in Organic Crop Production (OMRI Regulations)
https://www.ecfr.gov/cgi-bin/text-idx?c=ecfr&SID=9874504b6f1025eb0e6b67cadf9d3b40&rgn=div6&view=text&node=7:3.1.1.9.32.7&idno=7#se7.3.205_1601

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Disclaimer

Mention of trade names is solely for the purpose of providing examples. No endorsement is intended, nor is criticism implied of similar products that are not named.

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Photo credits

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