



Tips on Cleaning Your Empty Greenhouses

Between crop cycles is a good time to thoroughly clean and disinfect your greenhouses, especially paying close attention to propagation houses. Cleaning earlier is better than just before opening greenhouses for spring production. This helps eliminate overwintering sites for insect and mite pests that may overwinter in unheated greenhouses, especially if the winter is warm.

Eliminating Overwintering Sites for Insects and Mites

Remove all weeds that will harbor aphids, two-spotted spider mites, thrips, and whiteflies. Take the time to remove weeds hidden behind furnaces and along the greenhouse sidewalls. It is also a good time to repair any tears or holes in weed barrier mats. Do not add stone or gravel over landscape fabric. The gravel traps spilling potting media providing an ideal environment for the growth of weeds.



Figure 1: Aphids on weeds growing in gravel mulch. Photos by L. Pundt

But, can't you just wait and freeze out insects and mites during the winter?

Whiteflies, aphids, and tarsonemid mites (broad and cyclamen mites) all need living plant material to survive. Whiteflies eggs can survive for up to 15 days at 27° F and five days at 21 °F as long as there are some living plants in the greenhouse. Aphids can survive in temperatures as low as 39° F as long as plant material is present.

Two-spotted spider mites enter a hibernation phase known as “diapause” during shorter day lengths, decreasing temperatures and a decline in their food supply. Females change color to orangish-red. These overwintering females tend to walk off the plants to hide in cracks and crevices in the greenhouse, away from the light. During this hibernation phase, they do not eat, or lay eggs, and are less susceptible to chemical pesticides.

Adult female thrips tend to overwinter in cracks and crevices in the greenhouse and in plant debris. Thrips have been found to overwinter in central PA where the minimum air temperature during the winter is from 0 to -10° F. During this overwintering study, the lowest air temperature was 20° F with temperatures below freezing for 35 days. Temperatures are often not as low in protected greenhouses compared to outdoors, so it seems unlikely that you can freeze out adult female thrips in the greenhouse during the winter. Fungus gnat larvae can also survive in the soil as long as there is moisture and microorganisms present.

Cleaning and Disinfection

Clean up clutter from the previous crop. Sweep and remove all organic crop debris and plant material. Organic matter inactivates many of the disinfectants (oxidizing agents that kill fungi and bacteria). Microbes can also hide underneath the organic debris.

Sweep, scrub or power wash organic matter off the surfaces of walls, floors and benches. The greenhouse floor is a major source of pathogens and pests. This is why you should always keep hose ends off the floor.



Figure 2: Keep hose ends off the greenhouse floor. Photos by L. Pundt

Sweep the floor or use a shop vacuum cleaner on concrete floors or floors covered with landscape fabric to remove all plant debris, potting media, algae and mosses. Follow with a high-pressure water cleaning. Non-porous surfaces are much easier to clean than porous surfaces such as wooden benches. However, wire mesh benches can still harbor algae and pathogens in crevices.

Remove and clean irrigation systems.

Many growers use specific greenhouse cleaners such as Strip It Pro, which is a blend of acids, surfactants and wetting agents that can be applied with a foaming attachment removing organic matter and mineral deposits without scrubbing. Apply with a foamer and allow to sit for 5 minutes before rinsing with a high-powered hose.

After the surfaces are cleaned of organic matter, you can then use a disinfectant. There are many different commercially available disinfectants developed specifically for greenhouse use. Carefully read the label of the product you are interested in using. Each product has a specific range of activity on different types of surface (wood benches are notoriously difficult to clean), and plant safety precautions. Be sure to follow all label safety precautions including recommended rates, PPE equipment and plant safety precautions.

Some commercially available disinfectants include quaternary ammonium compounds or “Q salts” such as Green Shield II and Kleen Grow; hydrogen peroxide and peroxyacetic acid products such as Xero Tol 2.0, Oxidate 2.0 and Sanidate that are all strong oxidizing agents. Use chlorine bleach with caution, as it is highly volatile, can irritate mucus membranes and lungs. It can also corrode metal. Use the proper protective equipment recommended on the labels and follow all safety precautions. OMRI listed products include Oxidate 2.0, SaniDate, Perpose Plus and ZeroTol 2.0.

Q Salts

Q Salts or quaternary ammonium compounds include Green Shield 11, Physan 20 and Kleen Grow.

Green Shield 11 is labeled as a general disinfectant for use on hard, non-porous surfaces. Green Shield controls fungal, bacterial and viral plant pathogens as well as algae. Treated surfaces must remain wet for at least 10 minutes. Prepare a fresh solution daily or when visibly dirty. Green shield lasts four times longer in solution than bleach without the volatility and odor of bleach. It provides residual control as long as surfaces remain wet.

Physan 20 is a disinfectant for use on pre-cleaned non-porous surfaces such as floors or walls. Treated surfaces must remain wet for at least 10 minutes.

KleenGrow is a more advanced Q salt than Green Shield and is more tolerant of organic matter, pH and temperature changes, as well as hard water. Kleen Grow is active against fungi, vegetative bacteria, some viruses and algae. KleenGrow also has some residual activity from seven to 30 days after

application. It is also labeled as a fungicide and bactericide on ornamental crops, but not on greenhouse food crops.

Peroxy Acids

Peroxy acid products such as XeroTol 2.0, SaniDate 5.0, PerPose Plus and X3 are commercially available general disinfectants. Their concentrated form can cause irreversible eye damage, and they are skin irritants. Wear all PPE and follow all safety precautions as recommended on their labels. Peroxy acids are effective against fungi, vegetative bacteria, bacterial spores, viruses and algae.

ZeroTol 2.0 is a broad-spectrum bactericide and fungicide that works on contact to kill plant pathogens and their propagules, including spores. It sanitizes all greenhouse structures, benches and walkways. This strong oxidizing agent works by surface contact. All surfaces must be wet before treatment.

SaniDate 5.0 is used to disinfect and suppress algae, fungi, viruses and bacterial growth on hard non-porous surfaces such as walkways, benches, and glazing. Remove all plant debris before use. Treated surfaces must remain wet for at least 10 minutes.

PER Pose Plus (hydrogen peroxide and hydrogen dioxide) can be used on greenhouse structures, benches and walkways. All surfaces should be thoroughly wetted.

X3 (hydrogen peroxide, peroxyacetic acid and octanoic acid) can be used on greenhouse structures and walkways. Allow treated area to remain wet for 10 minutes. It is also labeled as a fungicide and bactericide on ornamental crops, but not on greenhouse food crops.

Sodium hypochlorite

Clorox (sodium hypochlorite) can be volatile, and irritating to skin and eyes. For your personal safety, it should be used in a well-ventilated area. Mix fresh solutions every two hours because its efficacy drops, as the chlorine gas is lost at the liquid surface. Exposure to sunlight also reduces its efficacy. Sodium hypochlorite can also be phytotoxic to certain sensitive plants, such as poinsettias and begonias. Walks, benches, tools and plant containers can be treated in nurseries.



Figure 3: Phytotoxicity damage to poinsettia from chlorine bleach. Photo by L. Pundt

Properly cleaned, weed free greenhouses ready for spring production. Proper greenhouse sanitation helps to reduce your costs and improve crop quality.



Figure 4: Clean, weed-free greenhouses ready for production. Photos by L. Pundt

See the latest edition of **the New England Greenhouse Floriculture Guide - A Management Guide for Insects, Diseases, Weeds and Growth Regulators** for the latest information that is available from [Northeast Greenhouse Conference and Expo](#) and the [UCONN CAHNR Communications Resource Center](#).

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References:

- Chase, A. 2014. Sanitation through Disinfecting Still a Front Line Defense. Greenhouse Product News. February 2014.
- Copes, W.E. 2016. Sanitation for Management of Florists' Crops Diseases. *In* Handbook of Florist Crop Diseases. Edited by R.J. McGovern and W. H. Elmer. Springer International Publishing.
- Felland, C.M., L. A. Hull, D. J. Teulon and E. A. Cameron. 1993. Overwintering of Western Flower Thrips in Pennsylvania. Canadian Entomologist. 125: 971-973.
- Ferguson, G. 2009. Low Temperatures and Pest Populations. Greenhouse Grower Notes. Ontario Ministry of Agriculture, Food and Rural Affairs.
- Kleczewski, N. M and D.S. Egel. 2011. Sanitation for Disease and Pest Management. Purdue Extension HO_250W
<https://www.extension.purdue.edu/extmedia/ho/ho-250-w.pdf>
- Smith, T. 2015. Cleaning and Disinfecting the Greenhouse – UMass Extension Fact sheet
<https://ag.umass.edu/greenhouse-floriculture/fact-sheets/cleaning-disinfecting-greenhouse>
- Thomas, P. A. 2015. The Do's and Don'ts of Using Chlorine Bleach as a Surface Disinfectant in Greenhouses. E Gro Alert Feb 2015.
- Vance, K. 2018. How Greenhouse Sanitation helps you Start Clean and Stay Clean. Greenhouse Grower. <https://www.greenhousegrower.com/production/how-greenhouse-sanitation-helps-you-start-clean-and-stay-clean/>

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