



Cleaning and Disinfecting Empty Greenhouses

Between crop cycles is a good time to thoroughly clean and disinfect your greenhouses, especially propagation houses. It is best to thoroughly clean at the end of the growing season and not just before opening greenhouses for spring production. This helps eliminate overwintering sites for insect and mite pests that may overwinter in unheated greenhouses, especially during warm winters.

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

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 with some live 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 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 treatment with chemical pesticides.

Adult female thrips tend to overwinter in cracks and crevices in the greenhouse and in plant debris.

Fungus gnat larvae can also survive in the soil as long as there is moisture and microorganisms present.

Cleaning and Disinfection of Empty Greenhouses

- Clean up clutter and debris from the previous crop.
- Sweep the floor or use a shop vacuum cleaner, and remove all organic crop debris, potting media, dust, algae, and left-over plant material. Organic matter inactivates many of the greenhouse disinfectants (oxidizing agents that kill fungi and bacteria). Microbes can also hide underneath the organic debris.
- Power wash with a high-pressure water to remove organic matter off the surfaces of walls, greenhouse benches and then the greenhouse floor. The greenhouse floor is a major source of root rot pathogens.
- Many growers use specific greenhouse cleaners such as Pace 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. This application with a foamer helps ensure better coverage and contact time. Then allow the cleaner to sit for 5 minutes before rinsing off with a high-powered hose.
- After the surfaces are cleaned of organic matter, you can then apply a greenhouse 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 surfaces (wood benches are notoriously difficult to clean), and plant safety precautions. Be sure to follow all label safety precautions including recommended rates, personal protective equipment (PPE) needed and all plant safety precautions.
- Some commercially available greenhouse disinfectants include quaternary ammonium compounds or “Q salts” such Kleen Grow and Physon 20; hydrogen peroxide and peroxyacetic acid products such as Xero Tol, Oxidate 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.

Q Salts

Q Salts or quaternary ammonium compounds include KleenGrow and Physan 20.

Kleen Grow is active against fungi, vegetative bacteria, some viruses, and algae and 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.

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.

Peroxy Acids

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

XeroTol 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 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 and pansy from chlorine bleach. Photos by L. Pundt

Remove and clean irrigation systems before re-use. Remove emitters and flush irrigation lines with a disinfectant that is labeled for use in irrigation systems. Allow it to set for several hours or even overnight. Then, flush the irrigation lines with plenty of clear water.

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

The following short videos on The Greenhouse Channel at UConn give more tips:

Sanitation of Hard Surfaces Between Crops in Greenhouses

<https://www.youtube.com/watch?v=n-016p1F6q4>

Weed Control as Part of Sanitation Practices in Greenhouses

<https://www.youtube.com/watch?v=eeAIB-KBPFw>

Consult the latest edition of **the New York and New England Management Guidelines for Greenhouse Floriculture and Herbaceous Ornamentals** for the latest information on sanitizers. It is available from [Northeast Greenhouse Conference and Expo](#).

By Leanne Pundt, Extension Educator, UConn Extension, 2019, latest revision 2024.

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