



Greenhouse Pest Message, October 14, 2021

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For those of you with empty greenhouses, take advantage of this time to clean and get ready for next spring!!

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 your greenhouses for your spring production. This helps eliminate overwintering sites for insect and mite pests in unheated greenhouses, especially if the fall and 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 broad 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 with living plants in the greenhouse. Aphids can survive in temperatures as low as 39° F with any live plants 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.



Figure 2: Diapausing spider mite on right and younger, active two spotted spider mite on left. Photo by L. Pundt

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 and debris with both moisture and microorganisms present.

Tips on Cleaning and Disinfection Empty Greenhouses

- 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.

- 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 KleenGrow; hydrogen peroxide and peroxyacetic acid products such as Xero Tol 2.0, Jet-Ag, 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, Jet Ag, SaniDate, Perpose Plus and ZeroTol 2.0.

Q Salts

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

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 if 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. KleenGrow 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, Jet Ag, 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.

PERPose 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

Use chlorine bleach with caution, as it is highly volatile and can irritate skin and eyes. It should only be used in a well-ventilated area. Mix fresh solutions just before use. Its half-life, (the time required for a 50% reduction in the strength of a chlorine solution) is only two hours. Chlorine is also corrosive. Repeated use may be harmful to plastics or metals.

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 begonia from chlorine bleach. Photos by L. Pundt

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

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