

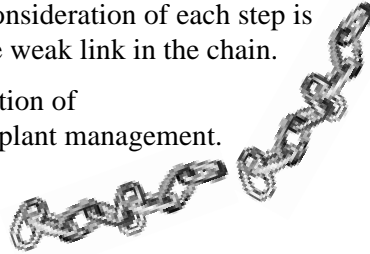
Greenhouse Vegetable Crop Clean-up

The clean-up period at the end of the cropping cycle is an efficient, low cost way to get rid of problems and start fresh. Pests and disease organisms are always looking for the chance to have a free lunch. Careful consideration of each step is important during clean-up. A missed step becomes the weak link in the chain.

Success against diseases and pests requires a combination of good environmental control, inoculum reduction, and plant management.

The checklist is divided into the following sections:

- ✓ end of season preparation before crop removal
- ✓ cleanup after crop removal
- ✓ new crop establishment



End of Season Preparation Before Crop Removal

- Inventory diseases and insects within the greenhouse.
- Ensure the RH in the crop canopy is below 85-90%. Adjust your computer settings as needed.
- Reduce insect populations by late summer. Pay special attention to spider mites, loopers, aphids and echinotrips. Increase mite predators (*Persimilis*) from the end of summer to the end of the crop. Consult with an entomologist if you have psyllid, echinotrips or other exotic pests present. Use an insecticide program as early as possible to reduce insect levels. Use Vendex in September if two-spotted spider mites are present.
- Begin clean-up to reduce pests and disease inoculum in early fall. In general, eliminating 90% of disease inoculum reduces the incidence of disease from 60% down to 10%.
- Continue to remove dead plants promptly.

Crop Protection

FACTSHEET



BRITISH
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Ministry of Agriculture,
Fisheries and Food
Abbotsford Agriculture Centre
1767 Angus Campbell Road
Abbotsford, BC V3G 2M3
Phone: (604) 556-3001
Fax: (604) 556-3030

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Dry down the growing media as you prepare to remove the crop. Reduce the EC as needed.

Plan your crop removal strategy. Arrange for disposal bins if the crop debris is removed off-site, OR excavate a hole that is large enough to hold the crop debris and then cover debris with soil. Do not pile crop debris near the greenhouse.

After the last pick, use Dibrom in the greenhouse. Ensure all vents are closed and the temperature is turned up (20°C+). This is best done on a sunny day.

After the last harvest, clean out irrigation lines. Keep lines charged at a low rate prior to cleaning to prevent drying out. Once they dry out, it is difficult to remove dried salts and other debris.

- ① Remove EC and pH electrodes.
- ② Divert cleaning solutions away from slow sand filters. Keep the slow sand filter units charged with old solution.
- ③ Pressure flush the irrigation lines with air or water before acid or bleach treatment.
- ④ Flush lines with nitric or phosphoric acid at a pH of 1.6 to 1.7 for 24 hours. This is prepared by adding 1 part 60 to 70% acid concentrate to 50 parts water. Apply twice if you have older lines or narrow orifice capillary lines.
CAUTION, some newer lines, eg. Netafim, have neoprene diaphragms. These can be damaged with exposure to solutions with a pH less than 3.0 or buffered bleach. Consult your supplier for information on compatible disinfectants.

⑤ **RINSE WELL.** When acid contacts bleach, dangerous chlorine gas may form.

⑥ Flush lines and tanks with a disinfectant. Buffered bleach has worked well in the past. There is no data yet on the efficacy of DDAC* or hydrogen peroxide for this application although we know they work well as contact disinfectants. Hydrogen peroxide could be used as a trial at 1000 – 3000 ppm. Use procedures recommended for bleach but leave the solution in irrigation lines overnight. The efficacy of hydrogen peroxide decreases with the increase in organic matter in irrigation lines. Hydrogen peroxide is not recommended for use on greenhouse surfaces or equipment.

It is more effective to flush the lines as a ‘pulse charge’ four times with one hour intervals than to flush with one pulse charge and leave the solution in the line for four hours. Do not drop the pH of the buffered bleach solution below 5.0. Target your pH for 6.5 to 7 and follow all safety recommendations on the label. Use a non-phytotoxic surfactant such as Superspred* at the rate of 1L/1000 L of water solution. Used buffered bleach solution must be collected and disposed of in accordance with Ministry of Environment guidelines. It can be used for other disinfection purposes. It can also be dechlorinated.

⑦ Rinse with fresh water.

⑧ Disinfect regular sand filters with bleach. Do not treat slow sand filtration (biological) systems with bleach.

When ordering seedlings - specify that the propagator apply *Hypoaspis* to seedling blocks for fungus gnat control. Inspect seedlings routinely at the propagator house to ensure good plant hygiene and health. Insist on new container material for shipment.

Plan to use foot baths for the next crop. Order necessary equipment and materials. A container with a foam mat is effective. Use disinfectants such as Roccal* or DDAC*. Change solutions every two weeks.

Clean-up After Crop Removal

- Fumigate with Dibrom when the crop is out.
- Remove crop debris from the greenhouse. Pay special attention to debris on wires, screens, uninsulated pipes and under pipe stands.
- Take crop debris and bags off-site or bury and cover away from the greenhouse. Do not pile near the greenhouse. Cull piles contain fungi and bacteria that are transmitted by air currents and insects. Steam sterilize foam and rockwool slabs if re-using. See Production Guide for details.
- Soak dripper spikes in acid solution. **RINSE WELL.** Disinfect by soaking in buffered bleach (2000 ppm) for 24 hours.
- Wash tanks with bleach, or 1% Virkon*. Rinse well.
- Power wash the structure and glass with water to remove larger pieces of debris.
- Power wash the structure with a cleaner. Use registered products and follow label directions. If you have had a virus problem, use Virkon*. Apply Virkon with LVM or mist after the plastic is down. If using ammonium bifluoride, remove it within 5 minutes or it will damage glass. **AVOID MIXING BLEACH AND AMMONIA COMPOUNDS—HAZARDOUS CHLORINE GAS COULD BE PRODUCED.**
- Disinfect totes with bleach.
- Disinfect carts/tools/tractor tires, etc. with 1% Virkon* or DDAC*. Check the label to be sure that the disinfectants will not harm the equipment.
- Remove debris on walkways and headerhouse floors. Wash down with bleach or DDAC*. **Note:** If high levels of organic debris are present on glass or other surfaces being treated with products that work through oxidation such as bleach, DDAC*, hydrogen peroxide and Virkon*, their efficacy is significantly reduced. Remove as much debris with detergents and water before applying disinfectants. “One gram of dirt or just a pinch, contains over 10,000 Fusarium spores. Only one spore is needed for infection” Jarvis, 1997.
- Use a high pressure wash on the outside of the greenhouse. Control weeds around the greenhouse.
- Remove the old plastic.
- Put new plastic down. Seal the plastic to the walkways, posts and walls with non-phytotoxic glue. Some growers are putting hydrated lime at approximately 15 bags/acre using a drop fertilizer spreader on the entire floor before laying plastic. Some are also using dormant oil sprays on the soil and at the base of perlins before laying plastic.



- If painting pipes, be aware that you need a few days of 80-90°C pipe temperatures to properly dry and volatilize paint, and to prevent phytotoxic fumes from causing injury to seedlings.

New Crop Establishment

- Cover any cull piles with soil or a plastic tarp. Prepare an area to receive culls from the next crop. Plan to keep plant debris covered with soil or a tarp. Avoid traffic from the cull pile to healthy plants in the greenhouse.
- Meet with staff to discuss pest management in the new crop. Discuss the importance of early pest and disease detection. Explain the early symptoms caused by specific pests and diseases.
- If your new plant material originated off site, check for evidence of pests and diseases before plants arrive from the propagator. Inspect plants after arrival.
- Ensure that trays/carts with propagation material have been bleached before coming to your greenhouse.
- Install a foot bath this year. Ensure it is used. Post strict signage on use. Control visitor access and require them to use disposable coveralls at all times. Insects and disease organisms are carried on clothing.
- Monitor with sticky traps and add *Trichogramma* for loopers and *Encarsia* for whitefly every week.
- Pruning tools should be cleaned daily.
- Monitor pH levels closely, especially between April and May.
- Keep using ammonium-free calcium nitrate on tomatoes through the season, especially when using > 5L of nutrient solution per m².
- Monitor drippers to ensure they are delivering consistent and uniform volumes.
- Tomato growers—watch for nightshade plants around the greenhouse. It is an alternate host for powdery mildew.
- Monitor RH levels in the crop canopy closely with hand-held equipment. Adjust your computer settings accordingly.
- Remove diseased, insect or mite infested seedlings.
- Avoid putting ornamental house plants, etc. in the greenhouse. These are often a source of disease and insect inoculum.

**** Mention of a product name does not imply endorsement, and omission does not imply that a product is not effective. Products mentioned are examples only.***

For further information contact:

Jim Portree	(604) 556-3042
Leslie MacDonald	(604) 556-3029
Bob Costello	(604) 556-3031