



# On-Farm and Greenhouse Sanitation and Disinfection Practices to Minimize the Impact of Plant Pests

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The following information is meant to provide growers with options for biosecurity and sanitation measures for their production facilities, dependent on the degree of risk.

**Caution:** Some of the chemicals recommended here may not be registered for the use under certain circumstances or in crop production facilities. Please follow carefully the product label instructions and make sure that a particular product of your choice is registered for application.

Disinfectants are oxidizing agents that kill microorganisms. Some common disinfectants used in crop production facilities include alcohols (e.g. ethanol, isopropanol), halogens (e.g. chlorine bleach), peroxides (e.g. Hyperox®, Virkon®), and quaternary ammonium (e.g. KleenGrow®, Viroid®). All of these disinfectants are fast-acting, broad spectrum and low toxicity biocides.

There are a number of factors to consider when selecting a disinfectant. Some of these factors are presented in Table 1. Other factors to consider are safety to workers and the environment. Disinfectants can irritate eyes, skin and/or mucous membranes. Use safety equipment recommended on the label when mixing, loading and applying disinfectants. Never mix bleach with ammonia or acidic solutions because these combinations will produce toxic chlorine gases.

**Table 1. Factors to consider when selecting a disinfectant.**

Disinfectant	Factors that Reduce Efficacy	Corrosive	Residual Activity
70% Alcohol	<ul style="list-style-type: none"> <li>Organic matter (alcohol does not readily penetrate organic matter)</li> <li>High concentrations of alcohol (&gt;90%)</li> </ul>	no	low
Bleach	<ul style="list-style-type: none"> <li>Bleach is unstable. Efficacy is reduced by organic matter, sunlight, water pH, and temperature &lt; 20 °C</li> </ul>	Yes (to metals)	low
Peroxide	<ul style="list-style-type: none"> <li>Organic matter</li> <li>Sunlight</li> </ul>	moderate (to metals)	limited
Quaternary Ammonium	<ul style="list-style-type: none"> <li>Soap</li> <li>Hard water (&gt;400 ppm Ca<sup>2+</sup>)</li> </ul>	no	good (9-day ½-life in soil)

Prior to disinfecting a surface, it is critical that it is free of soil and organic matter. Always clean and rinse soiled surfaces prior to applying disinfectants. Textured surfaces will require additional cleaning. It is also important to remove inorganic salt deposits because they can shield spores of microorganisms from the disinfectant. An acid-based cleaner will be necessary to remove salt deposits.

## Disinfectants for Staff and Visitors

Locate hand wash stations and foot baths at entrances and exits of the facility.

**Hand wash stations** - Regular or antimicrobial hand soaps are highly recommended as sanitizers for hand washing. However, in the absence of hand washing facilities at the site, alcohol-based gels (e.g. OneStep®, Purell® etc.) are a reasonable substitute for hand washing as long as hands are free of soil or dirt. These products usually contain alcohol in a quick-drying gel formulation.

**Foot bath or boot spray** – a plastic tub lined with foam can be used as a foot bath. Cover the tub with a lid to reduce evaporation and to prevent pets from consuming the disinfectant solution. There are also foot bath mats that can be purchased from a number of local agriculture suppliers. The foot bath will not be too effective on soiled footwear. Footwear should be exposed to the foot bath solution for at least 30 seconds.

- Virkon® (1% or 10 g/L) – change weekly; use test strips to measure disinfectant activity
- KleenGrow® (1.5% or 15 g/L) – change biweekly; use test strips to measure disinfectant activity
- Hyperox® (0.8% or 8 g/L) – change solution daily or when soiled

### **Quick Dip Disinfectant Treatments for Tools/Cutting Knives**

There are pruners on the market that automatically dispense a disinfectant solution to the blades when a cut is made. Pruners must be immersed in the appropriate disinfectant for at least 2 minutes to ensure thorough disinfection.

- 70% alcohol
- 10% household bleach (prepare by mixing 100 mL of bleach in 900 mL of water). Caution: bleach solutions are corrosive to metals.
- 0.1 or 0.2 % KleenGrow® (mix 1 or 2 mL of KleenGrow® per litre of water). Use the lower rate for plants that are sensitive to KleenGrow®. Due to its long residual period, toxic levels of KleenGrow® can accumulate on cutting tools. Periodically rinse the blades to remove the disinfectant residue.
- 5% Virkon® (dissolve 50 g in one litre of water).

### **Disinfection of Production Areas**

- KleenGrow® is the only disinfectant registered for use in greenhouses and other crop production facilities. Thoroughly wet the surface and do not rinse off. Use 8 mL of KleenGrow® per litre of water for greenhouse surfaces and equipment. Use 30 mL of KleenGrow® per litre of water for wood, painted and concrete surfaces.

### **Disinfection of Vehicles**

- Clean the truck in a commercial vehicle steam-cleaning facility before returning to the farm or facility. Steam cleaning will significantly reduce the risk of pathogen propagules being present on the vehicle.
- KleenGrow® - Pace Chemicals recommends applying KleenGrow® at the rate of 4 mL per litre of water to disinfect the box of shipping vehicles. If there are plants in the box, the rate is to be reduced to 1 mL per litre of water.
- Virkon® - wash and rinse all surfaces of the vehicle prior to disinfection. Disinfect all vehicle surfaces inside and outside using a 1% dilution rate (= 1 mL Virkon® + 99 mL of water). The inside of the cab can be wiped down with a cloth soaked in Virkon®. (From: “Vehicle Biosecurity Procedure Checklist” produced by the manufacturer of Virkon®, Vetoquinol)