

# Greenhouse disinfection with Intra Hydro pure



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A growing number of greenhouses are built as large monoculture production facilities in order to be competitive and cost effective. The risk of diseases which are rapidly spreading through these greenhouses is very imminent and a continuous awareness and a vigilant hygienic strategy is therefore very important. Many chemicals are used to control the level of microbiological contamination in greenhouses, and the amounts of biocides used is still increasing.

Bacteria, fungi and viruses are known plant pathogens causing different diseases. Examples of harmful bacteria found in horticulture are species of *Agrobacterium*, *Xanthomonas*, *Pseudomonas* and *Clavibacter*.

Oomycetes like *Pythium* and *Phytophthora* are known to cause root rot, and the fungus *Fusarium* forms spores that are difficult to eliminate. Harmful viruses found in horticulture are for example the Tomato brown rugose fruit virus (ToBRFV) and cucumber mosaic virus (CMV).

Each micro-organism has its own susceptibility to a specific biocide and other important parameters that determine the efficacy are the concentration, contact time, temperature, and water quality. In addition, chemical biocides may leave harmful residues on plants, equipment and in the environment. Worldwide there is a rising awareness of food safety, human health and environmental consequences of biocidal use. **This paper describes the safe and effective disinfection of greenhouses without residues with Intra Hydro pure.**

## Hydrogen peroxide, the natural biocide

Hydrogen peroxide is a natural biocide that mechanically destroys a wide range of pathogens and decomposes after reaction in water and oxygen. In 1977 the Environmental Protection Agency (EPA) recognized hydrogen peroxide as the first antimicrobial disinfectant, since then it is registered for the use on ornamental plants and in fruits and vegetables. It is also registered for the use on stored food. The strong oxidizing capacity of hydrogen peroxide has the negative consequence that it is inherently unstable and decomposes too fast.

## Intra Hydro pure

In the biocidal product Intra Hydro pure, hydrogen peroxide is used as an active ingredient and it is stabilized with silver chelate. The combination of silver chelate and hydrogen peroxide is also excellent to disrupt the functions of enzymes in micro-organisms. The complete micro-organism, including the DNA, is destroyed due to oxidation when in contact with hydrogen peroxide. Today, Intra Hydro pure is used extensively in several of applications in horticulture during different stages of production:

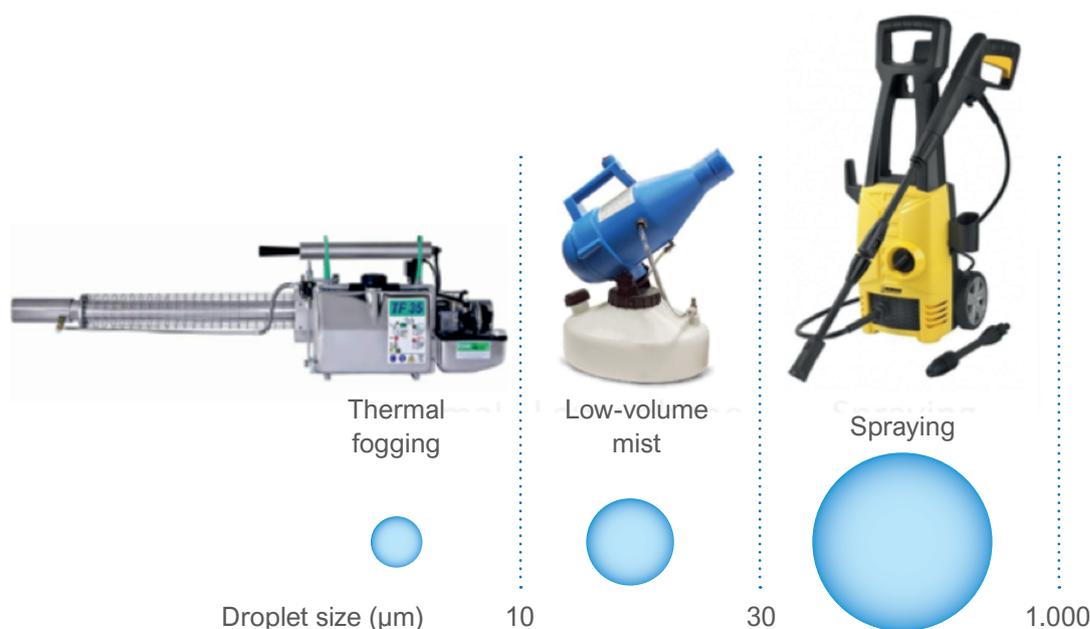
- Disinfection of irrigation systems.
- Disinfection of hydroponic nutrient solution.
- Sanitizing compost and soil.
- Disinfection of seeds and killing seed borne pathogens.
- The production facility, greenhouses, nurseries, surfaces, tools, equipment, utensils, trays, etc.



## Application methods

Intra Hydro pure can be applied to surfaces by means of different techniques (**figure 1**), for example:

- 1 Thermo-kinetic nebulization (or Thermal fogging) uses heat and kinetic energy to generate droplets smaller than 10 micron. Due to the small droplet size, Intra Hydro pure can easily distribute through the entire greenhouse to reach and cover all surfaces.
- 2 Low-volume mist, also called cold fogging, uses kinetic energy to generate droplets smaller than 30 micron.
- 3 Spraying, for example with a high-pressure sprayer, generates relatively large droplets and is labour-intensive.



**Figure 1.** Examples of a thermal fogger, low-volume mist fogger and high-pressure sprayer and their corresponding droplet size.

## Effective greenhouse disinfection with Intra Hydro pure

Intra Hydro pure was used to disinfect three different greenhouses, further specifications and the used methods are listed in **Table 1**. The degree of surface contamination was determined before and after disinfection using the Intra Clean Quick Scan. All living cells, including bacteria, yeasts and fungi, contain the energy carrier adenosine triphosphate (ATP). The Intra Clean Quick Scan contains a real-time measuring device for the on-site determination of the ATP level of swabbed surfaces. Within the device, the ATP in a sample is used to generate light, resulting in a Relative Light Unit value. The higher the RLU of a surface, the more contaminated.

**Table 1.** Overview of the locations and methods used to assess greenhouse disinfection with Intra Hydro pure.

METHOD	THERMAL FOGGING	LOW-VOLUME MIST	SPRAYING
<b>Pre-cleaning</b>	No	No	Yes
<b>Concentration</b>	3%*	2%	3%
<b>Greenhouse</b>	Cucumber	Tomato	Bell pepper
<b>Surface (ha)</b>	4.5	5.9	5.5
<b>Location</b>	Someren (NL)	Bleiswijk (NL)	Bleiswijk (NL)
<b>Number of sampled surfaces</b>	12	34	17

\*Relatively low concentration used for this specific application

Specific surfaces (Gutter, Window glass, Rails, Substrate) on different locations in the greenhouses were swabbed before and after disinfection. Without pre-cleaning, the initial high degree of pollution was significantly reduced after disinfection with Intra Hydro pure, with a 73% to 97% decrease in RLU (Figure 2). Thus even on dirty surfaces, it is possible to significantly reduce the organic/microbiological load and infection pressure with Intra Hydro pure treatment. However, without pre-cleaning, the remaining degree of pollution may still be noticeable on some surfaces. This quick approach may be useful in situations of limited time and resources, but when possible it is recommended pre-clean the surfaces before disinfection. One location was pre-treated with a greenhouse cleaner before spraying with Intra Hydro pure (Figure 3). Pre-cleaning already resulted in a lower initial degree of pollution, but also on these cleaner surfaces Intra Hydro pure treatment was able to realize a 26% to 88% further reduction in pollution.

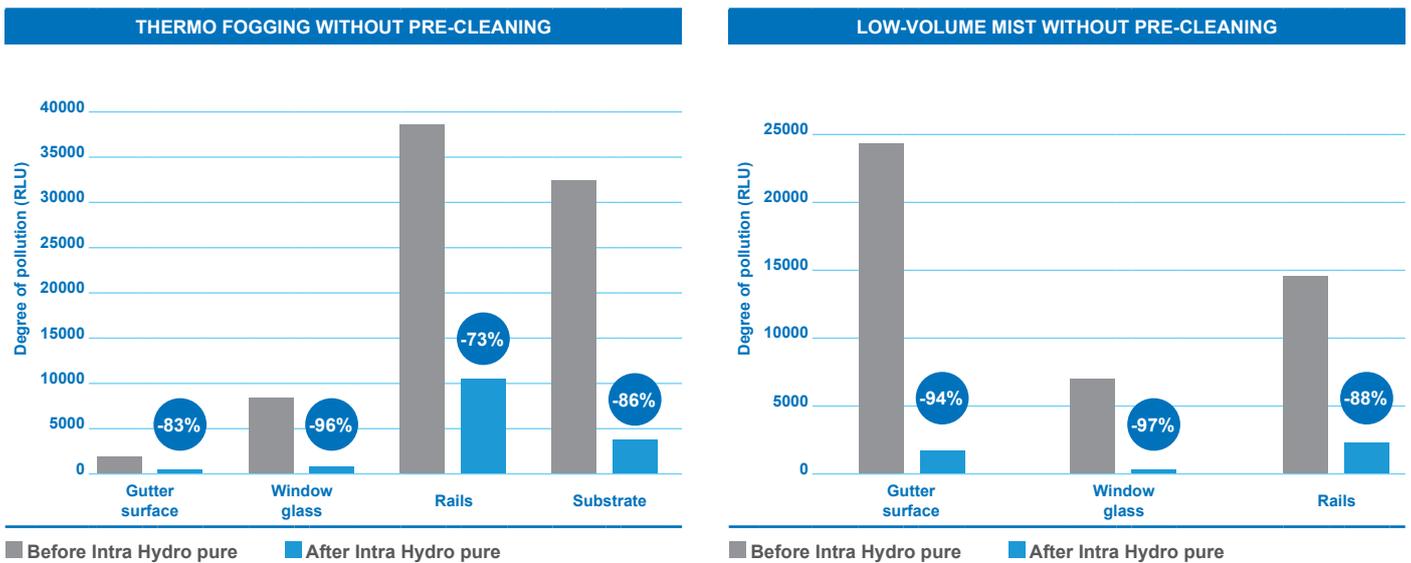


Figure 2. Degree of contamination before (grey bars) and after (blue bars) Intra Hydro pure disinfection of different greenhouse surfaces without pre-cleaning.

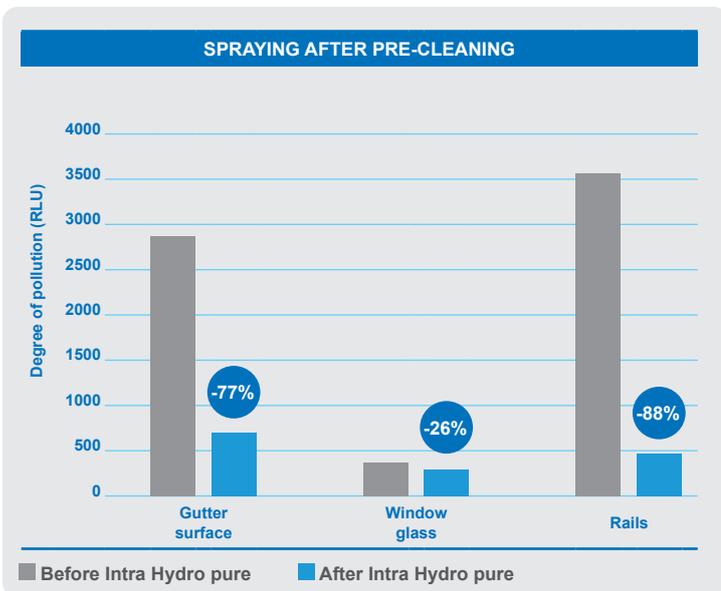


Figure 3. Degree of contamination before (grey bars) and after (blue bars) Intra Hydro pure disinfection of different greenhouse surfaces that have been cleaned on beforehand.

## Conclusion

Three different application methods (thermo fogging, low-volume mist, spraying) were successfully used for greenhouse disinfection with Intra Hydro pure, resulting in an up to 97% reduction in surface contamination. Pre-cleaning is recommended when possible to reach the lowest degree of organic/microbiological load and infection pressure.