



Disinfection guidelines for glasshouses and polytunnels

DISINFECTION GUIDELINES FOR GLASSHOUSES & POLYTUNNELS

What is disinfection and why is it important?

Disinfection procedures are vital in helping to prevent the spread of disease in professional production nurseries, growing media suppliers and greenlife market businesses. Disinfecting is a process that uses suitable chemicals to kill disease-causing bacteria, viruses and other microorganisms that may be present on surfaces or objects.

The Disinfection Process

1 - CLEAN & SCRUB



Remove all growing media, plant material and debris using water or compressed air. Use a brush, water and detergent to scrub all surfaces. Dispose of all waste material appropriately.

2 - RINSE



Rinse all surfaces with clean water to remove any residual detergent that could reduce the effectiveness of disinfectant products used. Use low pressure to prevent any splashing onto adjacent crops, work surfaces or materials.

3 - DISINFECT



Apply a broad-spectrum disinfectant. Remember to always follow product label and only use disinfectants that have an APVMA registration or permit. Dispose of disinfectant chemicals as per the product label.
Note: Porous surfaces require additional contact time for the disinfectant to be effective.

4 - DRY



Some disinfectants such as 70% methylated spirits/30% water solutions must be allowed to dry to be effective. If required, rinse any excess disinfectant chemical with clean water.

5 - CHECK & RECORD



Check all surfaces to ensure cleanliness and then record the details of the procedure to keep an up-to-date equipment cleaning record.



If a suspect emergency or quarantine plant pest, disease or weed is found, isolate and secure the consignment and contact the **Exotic Plant Pest Hotline on 1800 084 881**.

Disinfection Tips



Ensure any surfaces to be disinfected are clear of visible signs of growing media and plant residues

Understand your high priority pests and diseases

Ensure disinfectant products are allowed sufficient drying time

Always follow product label safety and use directions on the product label and APVMA permit

Only use freshly prepared disinfectant solutions

Keep an up-to-date equipment cleaning record

Use seed handling best practice to prevent infection. Mother stock plants should also be regularly monitored for pests and diseases

Perform regular, hygienic removal of discarded plants, seeds and spilt growing media

Source materials including seed, growing media and other inputs from approved suppliers who can supply and transport these materials free from plant pests and diseases

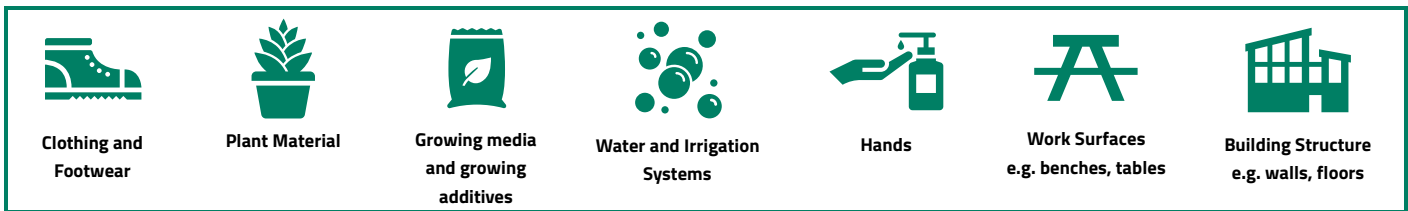
Ensure biosecurity best practice and good hygiene are observed across the production nursery, including contamination on footwear by using designated footwear for certain areas, cleaning and disinfecting footwear, and/or installing footbaths at all entries to the production area



Image: Greenlife Industry Australia (GIA)

Managing Risk Areas in a Glasshouse Production Environment

The Nursery Industry Accreditation Scheme Australia (NIASA) has developed best practice guidelines for the nursery industry. These complement the BioSecure HACCP Guidelines. Businesses that are BioSecure HACCP certified must also be NIASA accredited. These guidelines outline a number of pathways and activities that can limit pests and diseases.



Clothing and Footwear



Dirty footwear can be a source of soilborne pathogens, pests, and weed seeds. To disinfect footwear, first remove any dirt from the boots/shoes soles, then wash them in water containing soap or detergent using a scrubbing brush. This can be done by setting up a bucket for visitors to stand in and perform initial washing of their shoes prior to disinfection. Once washed, immerse the shoes in disinfectant solution, such as by directing visitors to step into a second footbath being a container filled with disinfectant solution. Ensure shoes are exposed to the disinfectant solution for adequate time and afterwards, rinse with fresh water to avoid damage to shoe leather or fabric. Also, regularly inspect clothing for contamination and wash regularly in a mix of water and detergent.

Tips:

- ✓ Provide boot covers
- ✓ Introduce footbaths to disinfect footwear upon entry and exit – ensuring the chemical solution is changed regularly
- ✓ Provide designated footwear for use in high-risk areas
- ✓ Use bleach diluted to 1% active sodium hypochlorite or any other farm detergents and disinfectants
- ✓ Ensure safety and use directions specified on the label are followed
- ✓ Regularly inspect clothing for contamination and wash regularly in a mix of water and detergent

Plant Material



Visually inspect plant material for signs of abnormal plant growth, weeds, pests and diseases. Where possible inspect the roots and growing media. Pests like mites and whiteflies are commonly found on the underside of leaves. If a problem is suspected, collect a sample for identification.

Tips:

- ✓ Familiarise yourself and with your key pests and diseases and their symptoms
- ✓ Regularly collect and dispose spilt material and plant waste
- ✓ Maintain a Crop Monitoring Record and note presence or absence of pests and diseases
- ✓ Ensure seedlings are monitored for pests and diseases
- ✓ Rotate crop plantings where possible to act as a disease break and reduce the chance of pests migrating to new plants

Growing media and growing additives



Under NIASA best practice, it is recommended that on-site vegetation is prevented from contaminating growing media or other inputs such as seeds. There is no requirement for routine disinfestation of growing media if they are sourced from an approved supplier and are free of major pathogens.

Tips:

- ✓ Source all materials including seed, growing media and growing additives from approved suppliers who can supply and transport these materials free from plant pathogens and pests
- ✓ Store growing media away from soil and crop material
- ✓ Avoid re-using media

Water and Irrigation Systems



Contaminated water and water systems may harbor pests and diseases, including root pathogens. Under NIASA, businesses are advised to check the pH and EC of all water sources as least once per month. NIASA also requires that water from non-approved sources such as unlined or uncovered dams, creeks and streams is **disinfested with an approved method***. NIASA guidelines require all irrigation or fertigation water to be free from plant pathogens and other pests and any treatment recorded using a Water Disinfestation Record (NIASA) sheet.

Tips:

- ✓ Regularly check water sources for pH, EC and other quality factors and treat as needed
- ✓ Check and treat water used for washing and preparing root balls
- ✓ Test water to determine disinfestation has been successful (e.g. chlorine, pH, filtration)
- ✓ Prevent offsite water from entering the production area
- ✓ Select a suitable irrigation system and ensure it is regularly maintained
- ✓ Flush water systems with approved disinfectants regularly

*Refer to the latest version of the NIASA Guidelines for further details on approved methods for water disinfestation.



Report anything unusual to the
Exotic Plant Pest Hotline on 1800 084 881.



Hands



Many plant diseases are easily transmitted on people’s hands. Clean hands when entering and leaving the glasshouse using hand sanitiser. Where possible where disposable gloves and dispose of them after a single use to limit the chance of spreading any unidentified diseases.

- Tips:**
- ✓ Clean hands thoroughly with antiseptic soaps and disinfectants
 - ✓ Use disposable gloves and change between different activities

Work Surfaces – Benches, Tables



Remove all organic matter, including vegetative material, roots and growing media by rinsing with fresh, clean water. Scrub all surfaces clean with a brush, or pressure clean with an approved disinfectant. To allow disinfection, work surfaces should be constructed from non-porous materials such as stainless steel or laminate. These surfaces can be scrubbed or pressure-cleaned with disinfectant or detergent, such as 70% methylated spirits and 30% clean water solution.

- Tips:**
- ✓ Where possible, use non-porous work surfaces
 - ✓ Remove any materials like plants and growing media from work surfaces that can contain pests and diseases
 - ✓ Disinfect work surfaces regularly with APVMA registered disinfectants

Building Structure – Walls, Floors



Regularly clean floors with a broom to remove growing media, plant debris and organic matter, and afterwards wash down with detergent. Treat walls and floors with disinfectant as per the product label and using an appropriate method, such as fogging. Where possible, install sealed concrete surfaces in greenhouses to enable easy cleaning.

- Tips:**
- ✓ Regularly collect and dispose of spilt growing media and plant waste
 - ✓ Insects are vectors of many plant viruses that pose a threat to plant production. It is important to reduce the risk of their entry and to monitor for their presence:
 - ✓ Use insect sticky traps to help with pest monitoring in glasshouses and polytunnels
 - ✓ Ensure the building is sealed and consider installing mesh on any vents to reduce thrips and whiteflies entering the building
 - ✓ Record where pests and diseases occur in and around your production areas to help identify pests hotspots
 - ✓ Remove any weeds around the greenhouse or polytunnel which may shelter pests and diseases and be a source of contamination for workers entering or exiting the building

Managing viruses in Glasshouses

Some viruses such as Tomato Brown Rugose Fruit Virus (ToBRFV), are easily transmitted through seed, pollen and sap. Insect movement and feeding as well as plants coming into contact with each other when in high densities, like those in glasshouses, can transmit viruses. Infected surfaces can also lead to new infections in other plants therefore, disinfection is an important in reducing the risk of new disease outbreaks. Glasshouse surfaces, including glass, concrete, aluminium, hard plastic, polythene and stainless steel, all have the capacity to harbour viruses like ToBRFV from infected leaf sap. A recent study by Skelton et al (2023) found ToBRFV can continue to infect other plants even when left on glasshouse surfaces like benches after 7 days and on concrete after 6 months. The virus may also be spread via contaminated human hands. It is recommended that people working in a glasshouse environment wear disposable gloves because hand washing has been shown to be an unreliable method to remove contamination. To clean contaminated plastic trays, it is recommended to soak trays in water at 90°C for 5 minutes OR in water at 70°C for 5 minutes followed by application of a disinfectant such as Virkon. Consider the timing of these activities to minimise disruption to business operations.



Tomato Brown Rugose Fruit Virus (ToBRFV) causes fruit to appear yellowed and bleached, negatively impacting marketable yield. Image: Luria et. al. CC. BY 4.0).

Table 1. Disinfectant efficiency on different glasshouse surfaces.









| Active ingredient | Surface Type | | | | | |
|--|---------------------|---------------------|-----------|--------------|---------------------|---------------|
| | Glass | Stainless steel | Aluminum | Hard plastic | Polythene | Concrete |
| Benzoic acid* | Effective | Effective | Effective | Effective | Effective | Not effective |
| Sodium hypochlorite** | Partially effective | Partially effective | Effective | Effective | Partially effective | Effective |
| Potassium peroxymonosulfate*** | Effective | Effective | Effective | Effective | Effective | Not effective |
| Glutaraldehyde and quaternary ammonium compounds**** | Effective | Effective | Effective | Effective | Effective | Effective |








*Menno Florades (disinfectant with active ingredient benzoic acid) at a 16-hour contact time was 100% effective on every surface except concrete.
** Sodium hypochlorite at a 60 minute contact time was partially effective on polythene, glass and stainless steel and completely effective on other surfaces.
*** Virkon S, a disinfectant with active ingredient potassium peroxymonosulfate (20 minutes exposure/contact time) was 100% effective on every surface except concrete.
**** Viroid (60 minutes exposure time) and Unifect G (10 minutes exposure time) (disinfectants with active ingredients glutaraldehyde and quaternary ammonium compounds) were effective against ToBRFV on all surfaces.

What disinfectants should I use?

A range of different disinfectants are currently available to Australian producers to help limit pest and disease spread. The Australian Pesticide and Veterinary Medicine Authority (APVMA) is responsible for approving chemical disinfectants for retail sale in Australia and publishes information about available registered products on its PubCRIS (<https://portal.apvma.gov.au/pubcris>) and permits (<https://portal.apvma.gov.au/permits>) databases. State and territory governments are responsible for regulating the use of these chemicals once purchased. **It is important to use disinfectants that are registered for use in your state or territory and to follow the product label or APVMA permit directions for use. Persons are recommended to wear disposable gloves to minimise cross contamination when disinfecting surfaces and equipment and to follow all safety and use recommendations on the product label.** Greenlife Industry Australia provides access to all nursery production minor use permits (<https://nurseryproductionfms.com.au/pesticide-minor-use-permits/>).

Table 2. Products currently registered for agricultural use by the Australian Pesticide and Veterinary Medicine Authority (APVMA) as of September 2024. All products are registered in all Australian states and territories (ACT, NSW, NT, QLD, SA, TAS, VIC and WA) unless otherwise stated.

| Registered Product | APVMA Product # (Permit #) | Active Ingredient(s) | Uses | | | | | | | | Notes |
|--|----------------------------|---|--|--|--|--|--|--|---|--|---|
| | | |  Facilities including packing sheds, tunnels etc. |  General equipment and/or machinery |  Pre-cleaned greenhouse surfaces & equipment |  Irrigation Water (Non-food crops only) |  Water & Irrigation Systems |  Footwear, Foot dips & Foot baths |  Growing medium (Inert or non-organic) |  Seed trays | |
| Agrisan Disinfectant and Litter Spray | 41451 | CRESYLIC ACID | | | | | | ✓ | | | Also suitable for use on floors. Registered in NSW, QLD and VIC only. |
| Bacrasan Phenolic Sanitiser | 60300 | CHLOROPHEN ORTHO BENZYL PARA CHLORO PHENOL ORTHOPHENYLPHENOL | | ✓ | | | | ✓ | | | Suitable for use on knives, tools, machinery, benches, floors, walls and most other surfaces. |
| Bactex cf sanitiser | 59643 | BENZALKONIUM CHLORIDE | | ✓ | | | | | | | Treatment of fungi and bacteria on farming equipment, vehicles, benches, floors, tables and walls. Safe for use on most surfaces including metal, stainless steel, plastic and glass. |
| Biovx Broad Spectrum Concentrated Water Soluble Powder (Sp) Disinfectant | 89005 | POTASSIUM PEROXYMONOSULPHATE TRIPLE SALT SODIUM CHLORIDE SODIUM DODECYL BENZENE SULFONATE | ✓ | ✓ | ✓ | | ✓ | ✓ | | | For disinfection of viruses, bacteria and fungi on agricultural machinery and facilities. Suitable for aerial misting and fogging, on porous and non-porous surfaces, wheel dips and water and irrigation systems (pipes and irrigation lines). Not suitable for ferrous metal or aluminium pipework. |
| Chemisan | 93437 | DIDECYL DIMETHYL AMMONIUM CHLORIDE | ✓ | ✓ | | ✓ | | ✓ | ✓ | ✓ | Broadspectrum sanitation and water treatment. Can be used on hands, equipment including pruning shears, on hard surfaces or for plant sanitation and post-harvest treatments (refer to product label). |
| Des-O-Germ | 62317 | DIDECYL DIMETHYL AMMONIUM CHLORIDE | ✓ | ✓ | | ✓ | | | ✓ | ✓ | May also be used for plant sanitation and post-harvest treatment (refer to product label). |
| EuroChem Sanitex Horticultural Disinfectant | 88875 | DIDECYL DIMETHYL AMMONIUM CHLORIDE | ✓ | ✓ | | ✓ | | ✓ | ✓ | ✓ | Broadspectrum sanitation and water treatment product. Can be used on hands, equipment including pruning shears, on hard surfaces or for plant sanitation and post-harvest treatments (refer to product label). |
| Hyperox Farm Disinfectant | 61606 | HYDROGEN PEROXIDE ACETIC ACID PERACETIC ACID | ✓ | ✓ | | | ✓ | ✓ | | | Suitable for disinfection of pre-cleaned surfaces, difficult surfaces and thermal fogging. |
| Neogen Viroxide Super Broad Spectrum Disinfectant | 90354 | POTASSIUM PEROXOMONOSULFATE TRIPLE SALT SODIUM CHLORIDE SODIUM DODECYL BENZENE SULPHONATE SULFAMIC ACID | ✓ | ✓ | | | | ✓ | | | Disinfectant cleanser for industrial, animal and agricultural equipment and facilities. Suitable for both porous and non-porous surfaces. |
| Path-X | 53331 | DIDECYL DIMETHYL AMMONIUM CHLORIDE | ✓ | ✓ | | ✓ | | ✓ | ✓ | ✓ | For broadspectrum sanitation and water treatment against a range of fungal and bacterial pathogens. Can be used on hands, equipment including pruning shears, on hard surfaces or for plant sanitation and post-harvest treatments (refer to product label). |

| Registered Product | APVMA Product # (Permit #) | Active Ingredient(s) | Uses | | | | | | | | Notes |
|---|-----------------------------|--|--|--|--|--|--|--|---|--|--|
| | | |  Facilities including packing sheds, tunnels etc. |  General equipment and/or machinery |  Pre-cleaned greenhouse surfaces & equipment |  Irrigation Water (Non-food crops only) |  Water & Irrigation Systems |  Footwear, Foot dips & Foot baths |  Growing medium (Inert or non-organic) |  Seed trays | |
| QT-SAN Disinfectant | 92751 | DIDECYL DIMETHYL AMMONIUM CHLORIDE | ✓ | ✓ | | ✓ | | ✓ | ✓ | ✓ | Broadspectrum sanitation and water treatment product for use in agriculture and horticulture. Can be used on hands, equipment including pruning shears, on hard surfaces or for plant sanitation and post-harvest treatments (refer to product label). |
| Quatrakill Sanitiser | 59056 | BENZALKONIUM CHLORIDE | | ✓ | | | | | | | Suitable for disinfection of general farm equipment. |
| Sporekill Agricultural Disinfectant | 51141 (PER80699 & PER92498) | DIDECYL DIMETHYL AMMONIUM CHLORIDE | ✓ | ✓ | ✓ PER80699 | ✓ | | ✓ | ✓ | ✓ | Broadspectrum sanitation and water treatment against a range of fungi and bacteria. Suitable for use on hands, hard surfaces, plant sanitation and post-harvest treatment (refer to product label). Under APVMA Permit PER80699 , can be used to disinfect nursery growing surfaces and equipment including: growing beds, weed mats, steel, timber, plastic, fibreglass and fibre board, benches, tables, floors, sand beds, hard surfaces (including paths, storage bays, trolleys, and pallets), tools and equipment. Under APVMA Permit PER92498 , can be used for the control of fungal diseases in non-food nursery stock. |
| Steri-Max Biocide | 59462 | DIDECYL DIMETHYL AMMONIUM CHLORIDE | ✓ | ✓ | | ✓ | | ✓ | ✓ | ✓ | Broad spectrum sanitation and water treatment product for use in agriculture and horticulture. Can be used on hands, equipment including pruning shears, hard surfaces or for plant sanitation and post-harvest treatments (refer to product label). |
| Viralfx The Broad Spectrum Virucidal, Bactericidal, Fungicidal Disinfectant and Cleaner | 65691 | POTASSIUM PEROXOMONOSULFATE TRIPLE SALT SODIUM CHLORIDE SODIUM DODECYL BENZENE SULFONATE | ✓ | ✓ | ✓ | | ✓ | ✓ | | | Broadspectrum virucidal, bactericidal and fungicidal disinfectant. Also suitable for both porous and non-porous surfaces, aerial misting and fogging and vehicle wheel dips. |
| Virkon Aquatic Broad Spectrum Virucidal Bactericidal Fungicidal Disinfectant | 68503 | POTASSIUM PEROXYMONOSULFATE SODIUM CHLORIDE | | ✓ | | | | ✓ | | | Suitable for cleaning and disinfecting of industrial, animal and agricultural equipment and wheel dips. |
| Virkon H The Broad Spectrum Virucidal Bactericidal Fungicidal Disinfectant | 89517 | SODIUM DODECYL BENZENE SULFONATE POTASSIUM PEROXOMONOSULFATE TRIPLE SALT SODIUM CHLORIDE | | ✓ | ✓ | | ✓ | ✓ | | | Suitable for use on both porous and non-porous surfaces, aerial misting and fogging and wheel dips. Effective in the control of viruses, bacteria and fungi in greenhouses and other horticultural settings prior to introduction or reintroduction of plants, seeds or soil. |
| Virkon Professional Tablets | 92230 | POTASSIUM PEROXOMONOSULFATE TRIPLE SALT SODIUM CHLORIDE | ✓ | ✓ | | | | ✓ | | | Suitable for general disinfection of both porous and non-porous surfaces, benches, tables, walls and floors. |
| Virkon S Tablets Broad Spectrum Virucidal Bactericidal Fungicidal Disinfectant | 68502 | POTASSIUM PEROXYMONOSULFATE SODIUM CHLORIDE | ✓ | ✓ | | | | ✓ | | | Suitable for general disinfecting of agricultural equipment and facilities. including porous and non-porous walls, floors, benches and tables. |
| Virkon S The Broad Spectrum Virucidal Bactericidal Fungicidal Disinfectant | 48185 | POTASSIUM PEROXOMONOSULFATE TRIPLE SALT SODIUM CHLORIDE SODIUM DODECYL BENZENE SULFONATE | | ✓ | ✓ | | ✓ | ✓ | | | Suitable for aerial misting, fogging and wheel dips. |
| Virocid Broad Spectrum Disinfectant | 86445 | GLUTARALDEHYDE DIDECYLDIMETHYLAMMONIUMCHLORIDE ALKYLDIMETHYBENZYLAMMONIUMCHLORIDE | ✓ | ✓ | ✓ | | | ✓ | | ✓ | Multipurpose disinfectant for animal housing, agricultural equipment and facilities. Also permitted for emergency use for control of Tomato Brown Rugose Fruit Virus on farm equipment and protected cropping areas under Permit PER95515 (Note: The product is NOT to be used in the presence of food-producing crops). |
| YM-FAB NYLATE | 47352 | BROMOCHLORODIMETHYL HYDANTOIN | | ✓ | | | ✓ | | | | Halogen based broad spectrum biocide. Suitable for tools, gloves, and bulk bins, as well as treatment of algae in irrigation lines. |

Want to learn more?

General:

- Australian Plant Protection Standard (APPS) website
<http://nurseryproductionfms.com.au/>

Nursery Industry Accreditation Scheme Australia (NIASA) and BioSecure HACCP:

- Nursery Industry Accreditation Scheme Australia (NIASA) Best Management Practice Guidelines:
<https://nurseryproductionfms.com.au/niasa-accreditation/>
- GIA BioSecure HACCP Guidelines 4th Edition 2019:
<https://nurseryproductionfms.com.au/biosecure-haccp-certification/>
- BioSecure HACCP Personal Disinfestation Procedures Video:
<https://www.youtube.com/watch?v=nWT-jl05ozw>

Disinfestation and Pest Management:

- Australian Plant Production Standard (APPS) Guidelines for 'Disinfestation of Nursery Equipment and Surfaces', Lex McMullin, Nursery & Garden Industry Queensland (2020):
<https://www.ngiq.asn.au/download/disinfestation-of-nursery-equipment-and-surfaces/>
- Preventing and managing root pathogens in nursery production:
<https://www.greenlifeindustry.com.au/communications-centre-content/media-releases-1/2022/root-pathogens-prevention-and-management-in-nursery-production>
- PestID Tool: <https://www.pestid.com.au/>

Tomato Brown Rugose Fruit Virus (ToBRFV):

- Advice for commercial growers to reduce the risk of ToBRFV (Factsheet):
https://www.pir.sa.gov.au/__data/assets/pdf_file/0009/469296/advice-for-commercial-growers-to-reduce-the-risk-of-ToBRFV.pdf
- Come clean, go clean – help stop tomato virus spreading (Poster):
https://www.pir.sa.gov.au/__data/assets/pdf_file/0008/469682/tobrfv-come-clean-go-clean.pdf
- ToBRFV – what to look for (Poster):
https://www.pir.sa.gov.au/__data/assets/pdf_file/0003/469704/tobrfv-what-to-look-for-poster.pdf
- Tomato brown rugose fruit virus (ToBRFV) (Article):
https://www.pir.sa.gov.au/biosecurity/plant_health/emergency_and_significant_plant_pests/tomato_brown_rugose_fruit_virus



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