

# Tomato brown rugose fruit virus (ToBRFV) process flow risk assessment

This document has been produced to help you identify the risk points in your business and production cycle at which you need to assess what hygiene protocols you have in place. It is important to assess your business and the protocols in place at each stage of production. You can then make necessary changes to help protect your business from crop virus threats and improve resilience. Ensure that staff are trained in all hygiene protocols and that they implement and adhere to them. Also train them on basic symptom recognition so they can be vigilant for signs of virus.

All materials and methods suggested for use are currently recommended with the best information available to date. All materials must be legal to use in the situation and country in which you are using them and it is your responsibility to check this. Reference to the most recent COSHH must be made by the user.

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## Staff and visitors

Before entering the glasshouse or packhouse, all staff should be trained in hygiene and handwashing protocols. Any visitors must also be thoroughly briefed on these protocols and expectations before entering the production areas.

- Handwashing (primary control)
  - ALL personnel and visitors should wash hands upon arrival using soap and then hand sanitiser
  - Hands should be washed before entering or leaving the glasshouse/packhouse and entering common areas (lunch and all break times)
  - Gloves should be worn after handwashing and at all times when working with the crop. These should be changed at regular intervals, particularly when entering/leaving the glasshouse
- On site, dedicated footwear provision is recommended to change into on arrival (replacing 'day shoes')
- The provision of laundered workwear for all staff entering the production area is recommended
- Staff and visitors should be prohibited from bringing tomatoes or peppers on site from outside sources (lunch boxes, etc.)
- Staff movement between packhouses (especially those importing third-party produce) and production areas to be strictly controlled/prohibited
- Staff should be assigned one glasshouse to work in and should not move between glasshouses/crops
- Use of mobile phones on production sites should be restricted and sanitisation facilities should be provided (alcohol gel/wipes)
- Common meeting areas and common areas of contact need to be regularly cleaned
- Regular cleaning of handrails and equipment should be carried out, particularly those in common areas
- Visitors should be limited to 'business critical' only
- Have dedicated staff (one or two) with responsibility for managing visitors. They should abide by all hygiene protocols
- Provide a change of clean clothing upon entry to the site
- Contractors are high-risk – ensure suitable biosecurity controls, including sanitisation of tools and equipment

## Preparation for new crop season

- Install:
  - New, clean floor plastic
  - Clean irrigation systems
  - New rockwool/substrate
  - New wound string
- Hang new sticky traps, keep vents closed to prevent birds, etc. entering glasshouse, ensure vermin control is in place
- Ensure common areas of contact are cleaned thoroughly and regularly
  - Door handles; handrails; door plates
- Have foot dips and handwashing procedures in place
- Ensure any brought-in machinery and equipment (e.g. Restrain ethylene generators) have either low risk of being contaminated (never been on a tomato/pepper nursery) or are sanitised with suitable materials (check with supplier regarding risk to working of machinery/equipment)
- Have protocols and system for cleaning equipment and machinery in place, when entering and leaving the glasshouse

## Seeds and propagation of plants

All testing protocols and recommendations should be discussed with your seedhouse and propagator.

- Ensure seed is securely sourced and certified free of virus – GSPP verified\*
- Ensure seed is appropriately treated with European acceptable standards (seed surface sanitisation)
- Seed testing:
  - Fera Science Ltd is the only UK organisation to offer seed testing for ToBRFV at present. Contact: [Adrian.fox@fera.co.uk](mailto:Adrian.fox@fera.co.uk). Seed numbers required and costs are outlined in the table below:

Seed volume	Detection limits (95% confidence)	Cost	Turnaround
3000	0.1% infection	£450 + VAT	10 working days
1000	0.3% infection	£226 + VAT	10 working days

- In each case, samples will be tested as subsamples of 250 seeds per subsample. Testing will be carried out using a molecular diagnostic tool (real-time PCR)
- The 3000 seed limit is in line with a protocol from the International Seed Foundation that is being validated by research organisations and seed companies. Fera has requested to be part of this validation testing ('ring tests') to ensure data from different testing laboratories is comparable
- A similar service is provided by Naktuinbouw in the Netherlands. Contact: Harrie Koenraadt (Head of seed testing) [h.koenraadt@naktuinbouw.nl](mailto:h.koenraadt@naktuinbouw.nl)
- Ensure seed handling and storage at propagation meets the required plant health protocols, which should be discussed with your propagator
- Hard and fast guidance on approaches for testing for ToBRFV in propagation plants is not yet available, but possible approaches include:
  - A single test on a plant batch (requires large numbers, potentially impractical and expensive)
  - Repeated tests done before plants leave the propagators on a smaller number of plants (e.g. plants tested on a fortnightly basis, with a final test of a statistically significant proportion of the plants before dispatch). This procedure is being used by at least one UK grower
- Grafting – ensure grafting equipment is sanitised by an agreed process

## Propagators

Specific controls and processes should be checked and agreed with your propagator.

- Propagators' own processes should be monitored – restriction of access onto site, including visitors, contractors, growers and agronomists
- Check and agree propagator specific controls and processes

- All general hygiene best-practice recommendations should be strictly integrated with your propagator's processes (see the [ToBRFV knowledge hub](#) page), including handwashing, provision of on-site footwear and clothing, moving restrictions, clean water supply, etc
- Recommend segregation of individual crops within the propagation site
- Arrange regular visits to inspect plants for suspect symptoms
- Have an independent third party/consultant sampling crops to test for virus presence using approved protocols (see above testing protocol)
- Agree a transport lorry sanitisation process with propagator, e.g. sanitise inside of the trucks; sanitise the trays for dispatch (see recommendations for picking and propagation trays)

## Trials

- Practice caution when sourcing and using less regulated, potential new varieties for rootstock and scion material. These may lack significant pathogen resistances
- Check provenance and balance the relative risk

## Receipt of plants

- Agree a process with transport company to control driver access and movements once arrived on site, as the driver and cab may be contaminated and should be considered high-risk
- Driver to use separate handwashing and toilet facility on site (e.g. portable toilet) and change into nursery clothing in this dedicated area, which should be thoroughly sanitised once the driver leaves
- Driver should unload plants from inside the trailer. Nursery personnel should operate forklift unloading
- Paperwork exchanges could be a potential risk point – suggest digital exchange of documents where possible

## Managing the crop

Agree hygiene and cleaning processes for crop workers and crop management. Train and monitor/manage activities.

- Dedicate machinery and equipment to specific production area if possible and clean down between areas if this is not feasible
- Keep everything, as far as possible, segregated (the largest unit area being the glasshouse, the smallest unit area being the dedicated area for each crop worker within the glasshouse), including:
  - Dedicated areas for workers – limited or no movement between these areas
  - Removal of work clothes, thorough cleaning of hands, etc. before entering common areas
  - Tools kept and used in one area and are regularly cleaned

## Picking crates

- Fruit storage area is a high-risk area for cross-contamination
- The project *PE 033 ToBRFV survival and disinfection* has shown that the virus can survive on trays after a five-minute wash at 70°C. It is likely (although not proven) that the virus will be denatured after a five-minute wash at 90°C
- APS salads recommends steam-cleaning trays at 90°C
- Consider contracted tray washing – care must be taken to confirm tray-washing process meets the requirements for sanitisation of tobamoviruses. Audit the process and ensure suitable monitoring controls are in place
- Ensure you have separate storage for unclean and clean trays
  - Retailer trays should be kept with unclean trays
  - Only after sanitisation should trays be stored with clean trays
- Alternative options include single-use cardboard packing that can be recycled

## Packhouses

- Imported fruit, or fruit received from other growers, must be treated as high-risk
- If possible, stop/prohibit sorting/packing of produce from other locations
- You must ensure that before trays are reused in any glasshouse they are appropriately sanitised (see 'Picking crates' section for information)
- Ensure staff movement between packhouse and production site is appropriately controlled/prevented
- Have a separate, well-controlled waste fruit area and install pest/fly management measures

## End-of-season clean-up

- Completely remove all plant material from your production areas
- Composting – there is currently no evidence-based guidance for this specific to ToBRFV
  - It is very likely that ToBRFV will survive composting to some extent, but this is based on evidence from other tobamoviruses (TMV/ToMV)
  - It may be appropriate to export leaf/plant material for spreading onto arable fields, away from your crop
- Remove and dispose of all used (and non-reusable) equipment
- Clean:
  - All surfaces
  - All equipment that will be used next season
  - Irrigation pipes

## For further information

Please refer to AHDB ToBRFV symptom gallery (<https://ahdb.org.uk/tomato-brown-rugose-fruit-virus-pictures>) for information.

For general hygiene best-practice guidance and for the latest results from the AHDB-funded project *PE 033: ToBRFV survival and disinfection*, please refer to the ToBRFV knowledge hub web page – <https://ahdb.org.uk/knowledge-library/tomato-brown-rugose-fruit-virus>



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\*Good Seed and Plant Practices (GSPP) provides guidance for best practice in seed production and processing – *Good Seed and Plant Practices (GSPP) is an international, transparent business chain system. The purpose of Good Seed and Plant Practices (GSPP) is to prevent tomato seed and plant lots from being infected by *Clavibacter michiganensis* subsp. *michiganensis* (Cmm).* For more information, please visit: <https://www.gspp.eu/>

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