

Tomato brown rugose fruit virus (ToBRFV) policy review

March 2025

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1. Introduction

a. Context

The EU Commission has recently adopted new legislation to reclassify tomato brown rugose fruit virus (ToBRFV) from being a quarantine pest (QP) to a regulated non-quarantine pest (RNQP). In light of this change of approach, a policy review has been carried out to assess the current regulations for ToBRFV in GB and consider whether any changes are recommended.

b. ToBRFV

ToBRFV was first observed in Israel in 2014, and in Jordan in the following year (EPPO, 2024a; Salem et al., 2016). Since then, the virus has been officially reported from other parts of Asia (China, India, Iran, Lebanon, Saudi Arabia, Syria, and Uzbekistan), Africa (Morocco and the Western Sahara), Australia, Europe (Albania, Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Estonia, France, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Switzerland, Türkiye, and the UK), North America (Canada, Mexico and the USA) and South America (Argentina) (EPPO, 2024b).

Confirmed natural hosts of ToBRFV include tomato (*Solanum lycopersicum*) and pepper (*Capsicum annuum*) (Luria et al., 2017; Salem et al., 2016, 2019). The virus has also been detected in natural weed species, including *Amaranthus retroflexus* (pigweed), *Beta vulgaris* subsp. *maritima* (sea beet), *Convolvulus arvensis* (field bindweed), *Chenopodium murale* (nettle-leaved goosefoot) and *Solanum nigrum* (black nightshade), and experimentally in *Chenopodium amaranticolor*, *C. quinoa* (quinoa), *Nicotiana bethamiana* (benth), *N. clevelandii* (Cleveland's tobacco), *N. glutinosa* (tobacco), *N. tabacum* (cultivated tobacco) and *Petunia hybrida* (petunia) (Dombrovsky personal communication, 2019; Luria et al., 2017). The full list of wild/weed and experimental hosts are available on the EPPO Global Database (EPPO, 2024c).

Symptoms of the virus include mosaic patterning, deformation, narrowing and blistering of leaves; necrosis of pedicels, calyces, petioles and flowers; and discoloration, marbling, deformation, necrosis, uneven ripening and reduced number of fruit (EPPO, 2024a). In severe cases, ToBRFV may lead to the wilting and yellowing, and eventually the death, of the plant (EPPO, 2024a; Wilstermann and Ziebell, 2019).

ToBRFV can infect up to 100% of a crop and cause yield losses of between 25 and 70% (Alkowni et al., 2019; Avni et al., 2021; FDACS, 2019; Salem et al., 2016). These yield losses are the result of symptomatic fruit being unmarketable and the production period being shorter for less vigorous infected crops (EPPO, 2024a). Other economic costs, aside from direct yield losses, include hygiene and eradication costs, export costs, and the costs of switching to a non-host crop in a specialised tomato and/or pepper production facility (EPPO, 2024a). There are also potential social impacts for gardens and allotments, as well as for temporary workers in tomato and pepper production if not as many jobs are generated during the growing season (EPPO, 2024a).

The main pathways for long distance spread of the virus are seed, plants for planting and fruit (EPPO, 2024a). For fruit, the risk is higher if the fruit is stored or repacked at destination in facilities that also grow host fruits, or repacked at destination in facilities that also pack local fruits. The virus can also spread by mechanical transmission on people, equipment, used containers, vehicles, machinery, bees and via plant-to-plant contact, as well as in soil, water and nutrient film solutions (EPPO, 2024a; Levitsky et al., 2019; Luria et al., 2017; Smith et al., 2019). These are important for local transmission and may also allow for long distance spread of the virus. As for other tobamoviruses, the virus can remain stable on a number of different surfaces for weeks and months (Skelton et al., 2023).

c. GB legislation

ToBRFV is listed in Annex 2 part A of the assimilated Phytosanitary Conditions Regulation (EU) 2019/2072 (<https://www.legislation.gov.uk/eur/2019/2072>). Annex 2 part A is the list of GB quarantine pests that not known to occur in GB and as such they are prohibited from being introduced into, moved within or held, multiplied or released into GB.

Pest and host specific import requirements are listed in Annex 7 part B point 6 and 7 and movement requirements are in Annex 8 part B point 2 and 3 (Table 1).

Table 1. Schedule 7 requirements for tomato brown rugose fruit virus.

Plants, plant products or other objects	Special requirements
Introduction from a third country	

Seeds of *Solanum lycopersicum* and *Capsicum* spp., intended for planting

The seeds must be accompanied by:

- a) An official statement that they are of *Capsicum* spp. varieties which are known to be resistant to tomato brown rugose fruit virus, or
- b) An official statement:
 - i. That the mother plants of seeds have been produced in a production site* where tomato brown rugose fruit virus is known not to occur on the basis of official inspections carried out at the appropriate time to detect that pest, and
 - ii. That the seeds or their mother plants have undergone official sampling and testing for tomato brown rugose fruit virus and have been found, according to those tests, to be free from that pest, or
- c) In the case of any seeds which were in storage prior to 15th August 2020, that the seeds have been sampled and tested for tomato brown rugose fruit virus by the competent authority and found in those tests to be free from that pest.

*The name of the site(s) of production must be included in the phytosanitary certificate under the heading "Additional declaration".

For the purposes of point (b)(ii), the official sampling and testing of the seeds must be carried out in accordance with the paragraphs below.

The official sampling of seeds for testing must be carried out in accordance with the following sampling schemes referred to in the relevant table of ISPM31: —in the case of seed lots which include 3000 or fewer seeds, a hypergeometric sampling scheme that is able to identify with 95% reliability a level of presence of infected plants of 10% or above, —in the case of seed lots which include 30000 or fewer seeds, but more than 3000

	<p>seeds, a sampling scheme that is able to identify with 95% reliability a level of presence of infected plants of 1% or above, —in the case of seed lots which include more than 30000 seeds, a sampling scheme that is able to identify with 95% reliability a level of presence of infected plants of 0.1% or above. Sub samples must consist of no more than 1000 seeds for Polymerase Chain Reaction (PCR) methods. The testing of seeds must be carried out using one of the following methods and the method used must be included in the phytosanitary certificate under the heading “Additional declaration”: —real-time RT-PCR using the primers and probes described in the ISF protocol (2020), or —real-time RT-PCR using primers and probe of Menzel and Winter (Acta Horticulturae, in press).</p>
<p>Plants for planting of <i>Solanum lycopersicum</i> and <i>Capsicum</i> spp.</p>	<p>The plants must be accompanied by:</p> <ul style="list-style-type: none"> a) An official statement that they are of <i>Capsicum</i> spp. varieties which are known to be resistant to tomato brown rugose fruit virus, or b) An official statement that: <ul style="list-style-type: none"> i. The plants are derived from seeds which have undergone sampling and testing for tomato brown rugose fruit virus in the manner set out in the row above which has shown them to be free from that pest, and

- ii. The plants have been produced in a production site* which is registered and supervised by the national plant protection organisation in the country of origin and is known to be free from tomato brown rugose fruit virus on the basis of official inspections carried out at the appropriate time to detect that pest, and where the plants have shown symptoms of tomato brown rugose fruit virus, the plants have undergone official sampling and testing for tomato brown rugose fruit virus and have been found, according to those tests, to be free from that pest.

*The name of the site(s) of production must be included in the phytosanitary certificate under the heading “Additional declaration”.

For the purposes of point (b)(ii), the official sampling and testing of the seeds must be carried out in accordance with the paragraphs below.

In the case of plants for planting, 200 leaves must be collected per site of production and cultivar. In case of symptomatic plants, sampling for testing must be performed on at least 3 symptomatic leaves. One of the following testing methods must be carried out for the detection of tomato brown rugose fruit virus: —in the case of symptomatic material only, ELISA, —conventional RT-PCR using the primers of Alkowni et al. (2019), —conventional RT-PCR using the primers of Rodriguez-Mendoza et al. (2019), —real-time RT-PCR using the primers and probes described in the ISF protocol (2020), —real-time RT-PCR using primers and probe of Menzel and Winter (Acta Horticulturae, in press). In case of a positive result of the detection test, a second testing method, different from the one used for detection, must be carried out with one of the RT-PCR methods

	mentioned above, using the same sample to confirm the identification.
Introduction from a Crown Dependencies territory or moved within GB	
<p>Seeds of <i>Solanum lycopersicum</i> and <i>Capsicum</i> spp., intended for planting, other than plants for planting of <i>Capsicum</i> spp. varieties which are known to be resistant to tomato brown rugose fruit virus</p>	<p>The seeds must be accompanied by an official statement:</p> <ol style="list-style-type: none"> a. That the mother plants of seeds have been produced in a production site where tomato brown rugose fruit virus is known not to occur on the basis of official inspections carried out at the appropriate time to detect that pest, and b. That the seeds or their mother plants have undergone sampling and testing for tomato brown rugose fruit virus by the competent authority, or have been subjected to sampling and testing by professional operators under official supervision of the competent authority, and have been found, according to those tests, to be free from that pest, or c. In the case of any seeds which were in storage prior to 15th August 2020, that the seeds have been sampled and tested for tomato brown rugose fruit virus by the competent authority and found in those tests to be free from that pest. <p>For the purposes of point (b), the sampling and testing of the seeds must be carried out in accordance with the paragraphs below. The official sampling of seeds for testing must be carried out in accordance with the following sampling schemes referred to in the relevant table of ISPM31: —in the case of seed lots which include 3000 or fewer seeds, a hypergeometric sampling scheme that is able to identify with 95% reliability a level of presence of infected plants of 10% or above, —in the case of seed lots which include 30000 or fewer seeds, but more than 3000 seeds, a sampling scheme that is able to identify with 95% reliability a level of presence of infected</p>

	<p>plants of 1% or above, —in the case of seed lots which include more than 30000 seeds, a sampling scheme that is able to identify with 95% reliability a level of presence of infected plants of 0.1% or above. Sub samples must consist of no more than 1000 seeds for Polymerase Chain Reaction (PCR) methods. The testing of seeds must be carried out using one of the following methods and the method used must be included in the phytosanitary certificate under the heading “Additional declaration”: —real-time RT-PCR using the primers and probes described in the ISF protocol (2020), or —real-time RT-PCR using primers and probe of Menzel and Winter (Acta Horticulturae, in press).</p>
<p>Plants for planting of <i>Solanum lycopersicum</i> and <i>Capsicum</i> spp., other than plants for planting of <i>Capsicum</i> spp. varieties which are known to be resistant to tomato brown rugose fruit virus</p>	<p>The plants must be accompanied by an official statement:</p> <ul style="list-style-type: none"> a) That the plants are derived from seeds which have undergone sampling and testing for tomato brown rugose fruit virus in the manner set out in the row above which has shown them to be free from that pest, and b) That the plants have been produced in a production site where tomato brown rugose fruit virus is known not to occur on the basis of official inspections carried out at the appropriate time to detect that pest, and, where the plants have shown symptoms of tomato brown rugose fruit virus, the plants have undergone official sampling and testing for tomato brown rugose fruit virus and have been found, according to those tests, to be free from that pest. <p>For the purposes of point (b)(ii), the sampling and testing of the seeds must be carried out in accordance with the paragraphs below.</p> <p>In the case of plants for planting, 200 leaves must be collected per site of production and cultivar. In case of symptomatic plants, sampling for testing</p>

	<p>must be performed on at least 3 symptomatic leaves. One of the following testing methods must be carried out for the detection of tomato brown rugose fruit virus: —in the case of symptomatic material only, ELISA, —conventional RT-PCR using the primers of Alkowni et al. (2019), —conventional RT-PCR using the primers of Rodriguez-Mendoza et al. (2019), —real-time RT-PCR using the primers and probes described in the ISF protocol (2020), —real-time RT-PCR using primers and probe of Menzel and Winter (Acta Horticulturae, in press). In case of a positive result of the detection test, a second testing method, different from the one used for detection, must be carried out with one of the RT-PCR methods mentioned above, using the same sample to confirm the identification.</p>
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d. GB outbreaks, interceptions and surveillance

ToBRFV was first found in the UK at a tomato production site in south-east England in the summer of 2019, and phytosanitary measures were taken, resulting in eradication of the virus (IPPC, 2024). Since 2019, there have been a further 11 outbreaks of ToBRFV in commercial tomato production sites in England, five in 2020 (West Midlands and East of England), one in 2022 (Yorkshire and Humberside), two in 2023 (South and South-East) and three in 2024 (South-East and East of England) (IPPC, 2024). The five outbreak sites from 2020 were declared eradicated in 2021 following surveillance (IPPC, 2024). However, one of these outbreak sites was reinfected and the outbreak was redeclared in 2022, before eradication was achieved in 2023 (IPPC, 2024). A new outbreak was also declared at another tomato production site in 2022, which was subsequently declared eradicated in 2024 (IPPC, 2024). The two outbreaks in 2023 were declared eradicated in 2024 too (IPPC, 2024). Eradication measures are being applied at the three remaining outbreak sites.

ToBRFV has also been intercepted on imported tomato and pepper seed. Where the virus is confirmed in seed, official action is being taken by the Plant Health and Seeds Inspectorate (PHSI) to contain and eradicate the virus.

In spring 2020 - 2024, the PHSI carried out surveillance of tomato and pepper propagating nurseries, production nurseries and packing sites for ToBRFV, including sampling and testing of plants and fruit where appropriate, and tracing activities at confirmed positive sites. A surveillance programme is also being scheduled for spring 2025.

e. Outbreak management and impacts

As described in the ToBRFV contingency plan (Everatt and Honey, 2024).

Interceptions

If ToBRFV is detected moving in trade, the consignment of plants and seeds should be destroyed by either incineration, deep burial or another approved method. The risk posed by fruit infected with ToBRFV is lower and as such statutory plant health notices should be served if ToBRFV is suspected on fruit, permitting the fruit to move direct to retail or wholesale prior to confirmation. If the fruit is being moved to other premises, such as packhouses, adequate hygiene measures should be in place to prevent cross-infection. Guidelines on hygiene measures should be placed on the notice.

Outbreaks

Propagation site

If ToBRFV is detected in a plant propagation crop, host plants should not be moved off site, except for plants being moved for destruction under statutory plant health notice. Note that plant propagation growers may routinely choose to send germinated seedlings to Fera as commercial samples (and therefore chargeable) for testing as a means for early detection of ToBRFV. If confirmed, the crop should be removed immediately, and the site should be subject to a post-crop clean up. The clean-up consists of the following:

- Once the infected crop has been removed, all remaining material e.g. string, plastic flooring, and growing media, should be destroyed by incineration, deep burial or another approved method, or recycled. Rockwool / coconut coir / other growing media can be recycled for non-horticultural use. For production systems that grow plants in soil, the soil may not be able to be removed and destroyed.
- All areas of the glasshouse (aside from soil) should subsequently be cleaned with water and detergent to remove traces of organic matter and then disinfected using appropriate disinfectants. Cleaning of surfaces prior to disinfection is essential as many disinfectants are inactivated by the presence of organic matter.

- Measures should be taken to prevent the germination of self-sown tomato and pepper seeds prior to the introduction of a new crop e.g. using herbicide or salt treatment on areas where self-sown plants are likely to occur.
- Water is also a potential route of transmission. As a precaution, the irrigation system should be decontaminated and cleaned out as per manufacturer guidelines at the end of the season. Water for hydroponic and irrigation systems should subsequently come from sources free from the virus, and, if possible, water should not be mixed between infected and non-infected lots.

After the new host crop has been planted, regular monitoring should be carried out to ensure that self-sown seedlings or potential host weeds are not growing in or in close proximity to the glasshouse. If any are found, these should be removed wearing disposable gloves, and both plants and gloves disposed of by incineration, deep burial or another approved method. Early removal is important, as self-sown seedlings from the infected crop can transfer ToBRFV to the next crop.

An official inspection should be conducted at an appropriate time for symptom development, with a possible follow up inspection carried out later in the growing season if no symptoms are seen at the first inspection. Samples will also be taken of asymptomatic host material.

Fruit production site

As for findings at propagation sites, host plants should not be moved off site, except for plants being moved for destruction under statutory plant health notice. However, the crop does not need to be removed immediately, and fruit is allowed to move directly to retail/wholesale or to other production sites for packing under statutory plant health notice, provided there are deemed to be suitable hygiene measures in place to prevent infection of growing crops or transfer to other premises. While plants are being grown at the production site, precautionary measures should be carried out to minimise spread. Following harvest of the crop, a post-crop clean-up, monitoring and inspection should be carried out as specified for a finding in a propagation site.

Declaration of eradication

ToBRFV can be declared eradicated (by the Chief Plant Health Officer) from either a propagation or production site after a full cycle of the next host crop, if it has not been found following inspection and sampling of the new crop. In cases where no crop, or a non-host crop, is intended to be grown in the affected glasshouse(s) for more than one year following the outbreak and clean up, eradication can be declared one year after eradication action, without the need for follow up inspection and sampling. As a grower may not know immediately what they intend to plant more than one year following the outbreak, the decision on whether eradication can be declared will be made at least one year after eradication action.

Financial implications

Financial implications at GB outbreak sites have included yield loss, fruit quality (e.g., on the vine), retention of staff while production areas are empty, and the costs of post-crop clean up and eradication (Kaye, 2020). At one site, 11 weeks of production was lost, while two other sites experienced yield losses exceeding 40%.

2. EU regulation

a. Legislation

The EU Commission recently adopted new legislation, reclassifying ToBRFV from being a QP to an RNQP (Commission Implementing Regulation (EU) 2024/2970; [Implementing regulation - EU - 2024/2970 - EN - EUR-Lex](#)). This legislation came into force on 1st January 2025. This change has been made, as ToBRFV is now widely distributed in the Union territory and has increased its area of distribution worldwide. It therefore cannot qualify as a Union QP or be subject to the measures pursuant to Article 30 of Regulation (EU) 2016/2031. However, ToBRFV fulfils the criteria to be an RNQP in the EU. It has a clear taxonomic identity, it is present in the EU, it is mainly transmitted through specific plants for planting, its presence on those plants has an unacceptable economic impact, and feasible and effective measures are available to prevent its presence on the plants for planting concerned.

The full list of legislation changes, following reclassification of ToBRFV as an RNQP, are below:

1. ToBRFV has been added to Annex IV Part F (RNQPs concerning vegetable seed) and Part I (RNQPs concerning vegetable propagating and planting material, other than seeds)

Table 2. Annex IV Part F amendments.

RNQPs or symptoms caused by RNQPs	Plants for planting (genus or species)	Threshold for the vegetable seed concerned
Tomato brown rugose fruit virus (ToBRFV)	<i>Solanum lycopersicum</i> L. and hybrids thereof	0%

	<i>Capsicum annuum</i> L. other than seeds belonging to a variety known to be resistant to ToBRFV	
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Table 3. Annex IV Part I amendments.

RNQPs or symptoms caused by RNQPs	Plants for planting (genus or species)	Threshold for the vegetable propagating and planting material concerned
Tomato brown rugose fruit virus (ToBRFV)	<i>Solanum lycopersicum</i> L. and hybrids thereof <i>Capsicum annuum</i> L. other than plants for planting belonging to a variety known to be resistant to ToBRFV	0%

2. ToBRFV has been added to Annex V Part E (measures to prevent the presence of RNQPs on vegetable seed) and Part H (measures to prevent the presence of RNQPs on vegetable propagating and planting material other than seeds)

Table 4. Annex V Part E amendments.

RNQPs or symptoms caused by RNQPs	Plants for planting	Requirements
Tomato brown rugose fruit virus (ToBRFV)	Seeds of <i>Solanum lycopersicum</i> L. and hybrids thereof	(a) the seeds originate in a country established as being free from ToBRFV by the national plant protection organisation of that country, in accordance with the International Standards for Phytosanitary Measures; or

		<p>(b) (i) the seeds have been subjected to official testing or testing by professional operators under official supervision of the competent authority for ToBRFV, on a representative sample and using appropriate molecular methods, and have been found, in those tests, free from that pest; or</p> <p>(ii) in the case of a seed lot originating from 30 or less than 30 mother plants, the seeds, or the mother plant of those seeds, have been subjected to official testing, or testing by the professional operator under official supervision of the competent authority, for the presence of ToBRFV on a representative sample and using appropriate molecular methods, and have been found, in those tests, free from that pest.</p>
<p>Tomato brown rugose fruit virus (ToBRFV)</p>	<p>Seeds of <i>Capsicum annuum</i> L., other than seeds belonging to a variety known to be resistant to ToBRFV</p>	<p>(a) the seeds originate in a country established as being free from ToBRFV by the national plant protection organisation of that country, in accordance with the International Standards for Phytosanitary Measures; or</p>

		<p>(b) (i) the seeds have been subjected to official testing or testing by professional operators under official supervision of the competent authority for ToBRFV, on a representative sample and using appropriate molecular methods, and have been found, in those tests, free from that pest; or</p> <p>(ii) in the case of a seed lot originating from 30 or less than 30 mother plants, the seeds, or the mother plant of those seeds, have been subjected to official testing, or testing by the professional operator under official supervision of the competent authority, for the presence of ToBRFV on a representative sample and using appropriate molecular methods, and have been found, in those tests, free from that pest.</p>
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In order to avoid an excessive destruction of seeds in the case of small seed lots of *Solanum lycopersicum* and hybrids thereof and *Capsicum annuum* originating from 30 or less than 30 mother plants, the EU Commission consider it is appropriate to allow that only mother plants, and not their seeds, be subject to testing.

Table 5. Annex V Part H amendments.

RNQPs or symptoms caused by RNQPs	Plants for planting	Requirements
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<p>Tomato brown rugose fruit virus</p>	<p><i>Solanum lycopersicum</i> L. and hybrids thereof</p>	<p>(a) the plants for planting originate in a country established as being free from ToBRFV by the national plant protection organisation of that country, in accordance with the International Standards for Phytosanitary Measures; or</p> <p>(b) the plants for planting derive from seeds that comply with the requirements laid down in Part E of this Annex, and have been maintained in appropriate hygiene conditions to prevent infection.</p>
<p>Tomato brown rugose fruit virus</p>	<p><i>Capsicum annuum</i> L, other than plants for planting belonging to a variety known to be resistant to ToBRFV</p>	<p>(a) the plants for planting originate in a country established as being free from ToBRFV by the national plant protection organisation of that country, in accordance with the International Standards for Phytosanitary Measures; or</p> <p>(b) the plants for planting derive from seeds that comply with the requirements laid down in Part E of this Annex, and have been maintained in appropriate hygiene conditions to prevent infection.</p>

3. Annex XI (List of plants, plant products and other objects subject to phytosanitary certificates and those for which such certificates are not required for their introduction into the Union territory) Part A Point 9 (vegetable seed) has been amended to include *Capsicum annuum* and *Solanum lycopersicum* and its hybrids

Table 6. Annex XI requirements.

Plants, plant products and other objects	CN code and its respective description under Council Regulation (EEC) No 2658/87	Country of origin or dispatch
9. Vegetable seeds of:		All third countries
<i>Capsicum annuum</i> L.	ex 1209 91 80	
<i>Pisum sativum</i> L.	Peas (<i>Pisum sativum</i>) seeds, for sowing: 0713 10 10	
<i>Solanum lycopersicum</i> L. and hybrids thereof	ex 1209 91 80	
<i>Vicia faba</i> L.	Broad beans and horse beans seeds, for sowing: ex 0713 50 00 – Other, seeds for sowing: ex 0713 90 00	

4. Annex XIII (List of plants, plant products and other objects for which a plant passport is required for movement within the Union territory) Point 6 has been amended to include hybrids of *Solanum lycopersicum*

'6. Seed, where its movement is carried out within the scope of application of Directive 2002/55/EC, and for which specific RNQPs have been listed according to Article 37(2) of Regulation (EU) 2016/2031 in Annex IV, of: — *Allium cepa* L., — *Allium porrum* L., — *Capsicum annuum* L., — *Phaseolus coccineus* L., — *Phaseolus vulgaris* L., — *Pisum sativum* L., — *Solanum lycopersicum* L. and hybrids thereof, — *Vicia faba* L.'

5. Frequency of sampling and testing of plants for planting of *Solanum lycopersicum* and hybrids thereof and *Capsicum annuum* has been amended

Sampling and testing as part of the physical checks for the presence of ToBRFV shall be carried out on at least 20% of the consignments of plants for planting of *Solanum lycopersicum* and hybrids thereof and *Capsicum annuum* originating in third countries. This change has been made as there have been a lower number of interceptions of ToBRFV on plants for planting of *S. lycopersicum* and *C. annuum* during the last three years.

However, sampling and testing for the presence of ToBRFV shall be carried out on 50% of consignments of plants for planting of *Solanum lycopersicum* and hybrids thereof and of *Capsicum annuum* originating in Israel, and on 100% of consignments of those plants originating in China. This is because the number of interceptions of ToBRFV from these two countries has been higher than for other countries.

These rates will apply until 31st December 2026, following a review of their necessity and effectiveness. A further review is needed for the other changes being made. This review will be concluded by 31st December 2026, as this time is sufficient to collect the necessary scientific and technical evidence.

The measures provided are in accordance with the opinion of the Standing Committee on Plants, Animals, Food and Feed. Implementing Regulation 2023/1032 (EU) will be repealed.

b. Consultation

The EU Commission held a public consultation on the reclassification of ToBRFV from being a QP to an RNQP, and the amended measures ([Protective measures against the plant pest, Tomato brown rugose fruit virus – amendment](#)).

i. Demographic

There were 13 responses to the consultation. Nine were from business associations, two were from non-governmental organisations, one was from a business, and one was from an EU citizen.

ii. Support for reclassification

Seven of the consultees explicitly supported the reclassification of ToBRFV from a QP to an RNQP, and none of the consultees disagreed with the reclassification. One consultee emphasised that the January 1st 2025 date should be respected. Another

was explicitly supportive of the change to sample leaves of mother plants when there were 30 or less mother plants, as this would help protect rare varieties, which would otherwise require extensive seed testing.

iii. Withdrawal of *Capsicum annuum*

Six of the consultees suggested removing *C. annuum* from the ToBRFV regulations altogether, often referencing the EPPO PRA, which states that the area where tomatoes are grown covers the area where peppers are grown, and thus far no impact has been recorded on peppers, due to the resistance of most pepper varieties, and also to date, impact on pepper production has not been important.

iv. Exemption of resistant *Capsicum annuum* varieties from sampling and testing at the border

Five of the consultees suggested exempting resistant *Capsicum annuum* varieties from article 2, which covers the frequency of sampling and testing for import of *S. lycopersicum* and *C. annuum* into the EU. This is in line with recital (8) on page 3 of the Draft Commission Implementing Regulation (EU) where it states that Plants for planting belonging to varieties of *Capsicum annuum* L. which are known to be resistant to the specified pest, should not be subject to the requirements of this Regulation and the respective rates of controls, as the respective phytosanitary risk is acceptable and that resistance is sufficiently documented and controlled by the competent authorities.

v. Exemption for resistant *Solanum lycopersicum* varieties

Eight of the consultees suggested exempting “resistant” *S. lycopersicum* varieties from the regulation. It was noted that the EPPO PRA stated that new resistant varieties could minimise impacts. One of the consultees also highlighted that the number of resistant tomato varieties in the EU market is expected to increase to 80-90% in the next two years. While one of the consultees agreed with the option to exempt “resistant” varieties, they mentioned that this should only occur when the varieties have been found to be resistant in a standardised and approved manner. They also recommended that all varieties on the list of permitted resistant varieties must be the same throughout the EU to avoid competitive advantage for some countries and that the regulations are updated quickly following the development of new varieties.

Two consultees were against exempting “resistant” *S. lycopersicum* varieties. One noted that varieties that are currently being called “resistant” are in fact just tolerant and could still spread the virus to non-tolerant varieties. Similarly, the other consultee pointed out that the current varieties have not been officially qualified as resistant.

vi. New requirement for vegetable seed

Five of the consultees suggested adding a new requirement option for vegetable seed (Annex V, Part E) to allow for visual inspection only. Some consultees proposed wording along the lines of “no symptoms of disease caused by ToBRFV have been observed in visual inspections at the appropriate times during the complete cycle of vegetation of plants at the site of production”. They noted that seeds would still be tested before being marketed into the EU as part of general industry practice. Although, one consultee suggested that analysis should be required as part of import controls.

vii. Other recommendations

- **Consideration of micro-enterprises:** One consultee noted that some small part-time businesses still propagate old tomato and paprika seeds. In these cases, there are usually only one or two mother plants per variety and the varieties are not physically separated. Having to sample each variety individually leads to high laboratory costs, which exceed the income generated from selling the seeds, and there is a higher workload within the laboratories. They therefore recommend that in cases where there are few mother plants and varieties are not physically separated, mixed samples from several varieties should be able to be taken. This results in no extra phytosanitary risk as all the plants growing together are sampled and, if there is a positive result, all plants will be subject to requirements.
- **Transition to the new regulation:** One consultee wanted to ensure a smooth transition by asking that all seed produced before the new regulation comes into force is left alone and is free for trade. They wanted the new regulation to apply to new seed only.
- **Testing requirements for plants for planting (excluding seeds):** One consultee suggested that there should be regular testing of plants for planting (excluding seed), particularly for producers growing seedlings intended for planting. They considered that visual inspection and seed quality control alone are not sufficient, given that the virus can spread asymptotically in seedlings.

- **Sampling and testing methods:** One consultee suggested adding the sampling and testing methods to the new regulation, to standardise the methods and ensure labs maintain accreditation for these methods.
- **Sampling and testing frequency:** One consultee suggested that the 20% frequency of sampling and testing should apply to all countries. This would include China and Israel.
- **Amateur growers:** One consultee wanted information for amateur growers to be included in the legislation. This information would include not bringing tomato and pepper fruit from outside into homes and gardens, and that plants should be burnt, not composted.

3. GB RNQP assessment

a. Assessment against the RNQP criteria

Below, ToBRFV is assessed against the six RNQP criteria.

1. **The taxonomic identity of the pest shall be clearly defined or, alternatively, the pest shall have been shown to produce consistent symptoms and to be transmissible.**

ToBRFV has a clearly defined taxonomy and meets this criterion.

Kingdom: Viruses and Viroids; Classification: Viruses; Family: Virgaviridae; Genus: Tobamovirus; Species: *Tobamovirus fructirugosum* (ICTV, 2024).

2. **The pest must be present in the GB territory.**

The pest status of ToBRFV is present: not widely distributed and under official control. There are three active outbreaks of ToBRFV, which are subject to eradication measures (IPPC, 2024). The pest therefore currently meets this criterion.

3. **The pest is not a quarantine pest or a pest that meets the criteria of a quarantine pest if not yet listed.**

ToBRFV is listed as a GB quarantine pest in Annex 2, Part A of the assimilated Phytosanitary Conditions Regulation (EU) 2019/2072. It currently fulfils all the criteria to be a quarantine pest:

- a. Identity of the pest
 - i. The taxonomic identity of ToBRFV is clearly defined (ICTV, 2024)

- b. Presence of the pest in the territory of concern
 - i. ToBRFV is present in the territory in question, but only in a limited part of it; it is not considered to be widely distributed (IPPC, 2024). The number of outbreaks have not significantly increased over the last five years.
- c. Capability of entry, establishment and spread of the pest in the territory in question
 - i. ToBRFV is capable of entering on plants for planting (including seed) and fruit, is able to survive during transport, and can be transferred to a suitable host plant, plant product or other object in the territory in question (EPPO, 2024a). This has been evidenced by the outbreaks at tomato production sites (IPPC, 2024).
 - ii. It is capable of establishment in GB (EPPO, 2024a). Hosts are present, and environmental factors and cultivation practices are favourable (or at least do not prevent its ability to establish).
 - iii. It is capable of spreading on plants for planting and fruit (EPPO, 2024a)
- d. Potential economic, social and environmental impact
 - i. ToBRFV has been shown to cause significant impacts in GB, including costs relating to crop losses and control measures (Kaye, 2020)

ToBRFV therefore does not meet this criterion.

4. The transmission of the pest shall be assessed to take place mainly via specific plants for planting, rather than via natural spread or via movement of plant products or other objects.

According to EPPO (2024a), ToBRFV is highly likely to enter on seeds and plants for planting (excluding seeds). It is also highly likely to enter on fruit, if the fruit is stored or repacked at destination in facilities that also grow host fruit. The likelihood is lower for repacking at destination in facilities that also pack local fruit. When imported fruit is not stored or repacked at destination in facilities that also grow tomatoes (e.g. already packed for the final consumer before export), or repacked at destination in facilities that also pack local fruit, fruit is considered to be an unlikely pathway of entry.

Used containers, tools, equipment and conveyance vehicles associated with the tomato and pepper production and supply chain are considered to provide a medium likelihood of entry, while persons working in places of production of host plants has been assessed as a low likelihood of entry.

Although ToBRFV is highly likely to enter on fruit, because this is only in certain circumstances, plants for planting is still considered to be the most significant pathway of entry. The pest therefore meets this criterion.

5. Infestations of the plants for planting with the pest shall have an unacceptable economic impact on the intended use of those plants.

ToBRFV can infect up to 100% of a crop and cause yield losses of between 25 and 70% (Alkowni et al., 2019; Avni et al., 2021; FDACS, 2019; Salem et al., 2016). These yield losses are the result of symptomatic fruit being unmarketable and the production period being shorter for less vigorous infected crops (EPPO, 2024a). Other economic costs, aside from direct yield losses, include hygiene and eradication costs, export costs, and the costs of switching to a non-host crop in a specialised tomato and/or pepper production facility (EPPO, 2024a).

Although tolerant varieties are becoming more common and could minimise impacts, these have yet to be fully adopted and do not completely negate impacts.

The pest therefore meets this criterion.

6. Feasible and effective measures are available to prevent its presence on the plants for planting concerned.

Feasible and effective measures are available, including a pest free production site and seed testing (EPPO, 2024a). The pest therefore meets this criterion.

Conclusion - Based on this assessment, ToBRFV still qualifies as a quarantine pest for GB and does not qualify as an RNQP.

b. Cost/benefit of changing ToBRFV to an RNQP

Costs

- Reduced notification requirements
- Less stringent import and control measures

By reclassifying ToBRFV as an RNQP, there would be an increased likelihood of the virus spreading in trade and causing impacts to tomato production.

Benefits

- Opportunity to reduce costs of eradication
- We already take minimal action on fruit

The main benefit will be the possibility to reduce the impact of an outbreak at a tomato production site. While ToBRFV remains a QP, there will be an increased onus on the site owner to carry out extensive clean up to eradicate the pest.

4. Review of policies

a. *Capsicum* spp.

GB measures currently apply to seed and plants for planting (excluding seed) of *Capsicum* spp., except *Capsicum* spp. varieties which are known to be resistant to ToBRFV (see section 1c). However, one of the most popular recommendations from the EU consultation responses was the de-regulation of *C. annuum*, because of the low impact of ToBRFV on this commodity.

ToBRFV has been reported on pepper from the following countries:

- Czechia - ToBRFV was detected in a greenhouse of a breeding station of a seed company as part of a pre-export examination in a seed crop of *C. annuum* in August 2020 (EPPO, 2024b). Three lots representing individual cultivars/breeding lines were visually inspected and sampled, but no disease symptoms were observed. Two of the three samples tested positive for ToBRFV.
- Iran – ToBRFV has been reported from symptomatic bell pepper crops in late December 2001 (Esmailzadeh & Koolivand, 2021)
- Italy – 85% of red sweet pepper plants were infected in a greenhouse in Sicilia (Ragusa province). This was in a greenhouse where ToBRFV had previously been reported and then used to grow pepper (Panno et al., 2020).
- Jordan – ToBRFV has been reported on *C. annuum* (Salem et al., 2019) not harbouring L resistance genes/alleles.
- Lebanon and Syria – In early 2020, virus-like symptoms consisting in chlorosis, mosaic and leaves discolorations accompanied with brown stems and fruit deformation were observed on greenhouse-cultivated sweet pepper plants in the coastal regions of Syria (Tartous) and Lebanon (Byblos) (EPPO, 2024b).
- Mexico – severe symptoms and economic impacts have been observed on pepper (Cambrón-Crisantos et al., 2018; SENASICA, 2019)

Ortiz-Martinez et al. (2021) has also observed a reduction of the size of the plant, of the number of internodes, of the size of the fruits and number of seeds in the laboratory.

In spite of these recorded impacts, pepper is not seen as an important host for ToBRFV, largely because most commercial varieties of pepper harbour L1, L3 and L4 genes/alleles that provide resistance to the virus. Due to the limited data on impacts of the virus on pepper, the EPPO PRA Expert Working Group in 2020 did not propose an impact rating for pepper.

There is justification to remove regulations on pepper in GB, because impacts are so low. However, the main reason for such low impacts is the presence of resistance. For plants which do not harbour L1, L3 or L4 genes/alleles, there may be justification for keeping regulations in place. Defra has also never been provided with a list of resistant pepper varieties.

b. Resistant tomato varieties

The GB measures do not currently cover exemptions for resistant tomato varieties. However, eight of the consultees from the EU Commission consultation suggested exempting “resistant” *S. lycopersicum* varieties from the regulation. It was noted that resistant varieties could minimise impacts and that the number of resistant tomato varieties in the EU market is expected to increase to 80-90% in the next two years.

EPPO (2024a) provides the following information on resistance in tomatoes:

Twenty-six tolerant Solanum accessions were identified with a 0-20% Disease Severity Index (DSI) and presence of virus confirmed by RT-PCR and bioassays (Jewehan et al., 2021). Kabas et al. (2022) identified 3 accessions with a low disease severity. Jewehan et al., (2021) also identified a high level of resistance in 3 S. ochranthum accessions, showing no symptoms and detection of ToBRFV only in inoculated leaves. Two other accessions, found with a low DSI and virus content at an early stage, recovered with no further detection of the virus. In a further study Jewehan et al. (2022a), identified segregating resistant accessions, 9 of S. habrochaites and one of S. peruvianum, with plants with no symptoms and ToBRFV detection by real-time RT-PCR. These plants expressed symptoms at 33°C. A mutant ToBRFV strain breaking the resistance of these accessions was identified (Jewehan et al., 2022b). Zinger et al. (2021) identified 29 tolerant accessions (no symptoms and high viral levels) and one resistant one (no symptoms and extremely low viral level). Nunhems (2021) described plants with improved Tobamovirus resistance in a patent. Zisi et al. (2024) observed virus symptoms on leaves and fruits of newly introduced ToBRFV-resistant varieties under high virus pressure, concluded on a resistance breaking ToBRFV isolate, and identified the causal point mutation.

The EPPO PRA Expert Working Group noted that there is no official protocol for assessing resistance of varieties and different terms are used in literature or industry communication: resistance, tolerance, intermediate resistance, without describing the level of symptom expression and virus load of the plants. A CPVO co-funded project is currently evaluating protocols and a set of varieties to define these levels of resistance (P. Gentit, pers. comm., 2024). Research on alternative approaches to conventional resistance strategy is still going on: Ishikawa et al. (2022) used CRISPR/Cas9 to knock out TOM1 genes in tomato and obtained quadruple mutants

with no capsid detection nor disease symptoms. The same technique was used by Kravchik et al. (2022) with double mutants showing a lower accumulation of the coat protein and RNA than in the wild type and no symptoms. Resistance to ToBRFV was obtained by chemical mutagenesis (Vilmorin & Cie, 2022).

As has been pointed out in the PRA and by one of the consultees of the EU Commission consultation, most of the “resistant” varieties being grown commercially are not fully resistant to ToBRFV and are more appropriately described as being tolerant. As such, while symptoms may be reduced, these tolerant plants are still able to harbour the virus and spread it to other plants, including non-tolerant varieties. There are also occasional reports of “resistance breaking” isolates anecdotally from Netherlands, Belgium and from Canada. These tend to cluster in the Clade 7 grouping (cross protection and some Mexican isolates) (Adrian Fox Personal Communication). “High Resistant” strains may also breakdown at higher temperatures (Adrian Fox Personal Communication). In Great Britain for the 2025 season, 45% (94ha) of tomato cultivars have been declared as “resistant” from a total area of glasshouse grown tomatoes in GB of 209ha. Given the level of uptake and the possibility of spread, an exemption for resistant tomato varieties is not justified.

Research into the efficacy of tolerant plants and the impact of widespread use of tolerant plants on detection of the virus could be considered, including whether annual surveillance methodology should be amended. For example, if ToBRFV is more difficult to detect by visual examination.

c. Seed testing

In addition to the requirements set out in GB legislation, 100% of *S. lycopersicum* and *Capsicum* spp. seed that is imported into GB is sampled and tested (except consignments under a certain size which may not be sampled and tested). Since GB legislation came into force, this has been the case for non-EU countries. However, it was not until July 2021 when this was also agreed for EU countries. This change was introduced because of findings of ToBRFV in plants grown on from imported seed.

Table 7. Seed interceptions 2021-2024.

	Number of Interceptions					EU				
	total	2021	2022	2023	2024	total	2021	2022	2023	2024
Total: From Jan 2021- Dec 2024										

Tomato and pepper seeds	107	21	40	28	18	80	18	20	25	17
Tomato seeds	51	9	18	14	10	39	9	8	13	9
Pepper seeds	57	13	22	14	8	42	9	13	12	8
ToBRFV on all seeds	14	2	9	2	1	9	2	5	1	1
ToBRFV on tomato seeds	10	1	6	2	1	7	1	4	1	1
ToBRFV on pepper seeds	4	1	3	0	0	2	1	1	0	0

Table 8. Plants for planting (excluding seed) interceptions 2021-2024

	Number of Interceptions					EU				
	total	2021	2022	2023	2024	total	2021	2022	2023	2024
Total: From Jan 2021- Dec 2024										
Tomato and pepper plants	39	9	7	14	9	38	8	7	14	9
Tomato plants	10	6	0	1	3	10	6	0	1	3
Pepper plants	29	3	7	13	6	28	2	7	13	6
ToBRFV on all plants	0	0	0	0	0	0	0	0	0	0

Forty tomato and pepper seed interceptions occurred in 2022 and this reduced to 18 in 2024 (Table 7). The majority of ToBRFV interceptions also occurred in 2022 (9), with only one interception recorded in 2024. There have been no interceptions of ToBRFV in plants for planting since 2021 (Table 8).

It should be noted that 75% of tomato and seed interceptions were from EU countries. Most interceptions were from Italy (48) and the Netherlands (13). The other countries where interceptions were made from were Brazil, Bulgaria, China, Czechia, Germany, India, Israel, Japan, Lithuania, Poland, Spain, and the United States. The EU also accounted for the majority of ToBRFV interceptions at 64%. Four of the ToBRFV interceptions were from Israel, three were from Italy, two were from the Netherlands, and there was one finding for Bulgaria, India, Lithuania, Poland and Spain.

While the total number of seed interceptions has fallen, and there has only been one interception of ToBRFV on seed in 2024, a moderate number of interceptions are still being made on tomato and pepper seeds. Therefore, the current level of seed testing may still be justified.

It should be noted that seed importers have previously questioned the need for further testing of seed in addition to requirements laid down in the legislation. This has been viewed as a lack of trust in industry. However, this should not be viewed as such. Research has shown that testing 3000 seeds in large seed lots is unlikely to detect all instances of ToBRFV (Dall et al., 2019).

d. Pest free area option

Under the new EU regulations, a pest free country option is included for *S. lycopersicum* and *Capsicum* seed and plants for planting (excluding seed). A pest free area option was considered as part of EPPO (2024a), but it was not recommended as a phytosanitary measure for the following reasons:

- The current distribution of ToBRFV is very uncertain and very likely to be underestimated. The origin of the disease is unknown, the virus has only been reported and regulated recently, and confirmation requires molecular tests which are not widely used. There have been several new reports of presence made during the last year.
- Seed lots from different origins are mixed, so there is a risk of introduction with seeds or young plants grown from the seeds each season
- Tomato plants are extensively grown by amateurs in many countries worldwide
- There is a high risk of mechanical transmission

- Infected fruits are known to move around and are considered to be a pathway of introduction (including in amateur production)
- Host plants can be asymptomatic and require targeted testing to confirm the presence of the virus

A pest free area/country option is therefore not considered to be suitable for GB, whilst ToBRFV remains a quarantine pest.

5. Conclusion

Following an assessment of whether ToBRFV qualifies as an RNQP and a review of four policy/legislation areas, no changes are recommended. While the distribution of ToBRFV is limited and eradication remains a possibility, there is justification for keeping the virus as a QP. The measures should also remain strong to prevent the introduction and spread of the virus. However, the situation should be monitored. A further review could be considered if:

- ToBRFV becomes widespread in GB and eradication is no longer feasible;
- Tolerant and resistant varieties become widely adopted and reduce impacts to an acceptable level; or
- Seed interceptions are reduced to a marginal level

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