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**Syngenta Vegetable Seeds**



# ToBRFV virus in Pepper and Tomato

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**ToBRFV is first seen  
in 2017 and breaks  
the TMV and ToMV  
resistance**

## Q What is ToBRFV?

A Tomato Brown Rugose Fruit Virus (ToBRFV) is a newly discovered Tobamovirus related to Tobacco Mosaic Virus (TMV) and Tomato Mosaic Virus (ToMV). It infects tomato and pepper. Unlike other Tobamoviruses it breaks the widely deployed Tm2-2 gene in tomato providing resistance to TMV and ToMV. In public information the pepper L-genes providing Tobamovirus resistance are sometimes suggested to be effective against ToBRFV. This is however not yet supported with scientific evidence and may make pepper materials even be a hidden source of infections if pepper is not taken into account sufficiently.

Symptoms caused by ToBRFV in tomato are like those caused by other Tobamoviruses in susceptible plants: mosaic pattern on leaves, narrowing of leaves, necrosis on pedicle, calyces or petioles and/or yellow spots on the fruits. A large risk is in the fact that symptoms can be seen as PepMV or TSWV. It is very important that suspected plants get sampled and tested by an accredited laboratory.



The impact of ToBRFV on pepper crops so far seems to be low.

Rapid spread throughout Israel has been reported. In 2018 tomato crops in Mexico, United States, Germany and Italy were found to be infected. Ever since the spread has continued to other countries while also attempts were made to eradicate the virus. For example, Germany has successfully freed itself of ToBRFV through significant disinfection measures.

ToBRFV does have a quarantine status in the US and the EU at this moment because the impact to the crop can be significant.

## **Q** How does ToBRFV spread?

**A** Fruit, tobacco, host plants (e.g. ornamentals), crop handling and seeds are potential sources of spread of Tobamoviruses. ToBRFV is expected to be the same in this respect. Tobamo viruses are known to survive for long periods in soil, water, plant material and inert material such as clothes and tools. Being a contact disease, infected plants and fruits are the main factor of Tobamo spread within and to new crops.

It's known on Tobamoviruses that the risks from mechanical transmission are significantly larger than that of seed to seedling transmission. Especially when the seeds have been going through health treatments and the seed-skin has been disinfected.

## **Q** What measures does Syngenta take to prevent supply of contaminated lots?

### **A** Seed Production

Syngenta runs most seed productions under strong hygiene measures and with professional growers in remote (isolated) locations. Up to date technology is being used. Remote locations from for example fresh fruit production protects us from disease pressure and other sorts of contaminations. New seed production cycles start with fully tested parental line seeds, using facilities, equipment and growing media that is secured via approved disinfection methods and/or replacement.

During seed production the teams are continuously scouting the crop for symptoms of infection. When these are observed, validated tests are performed to conclude if the pathogen is present. Where possible, ImmunoStrip testing is done at the grower location as a first test. Syngenta uses ImmunoStrips that are validated to detect ToBRFV. Positive ImmunoStrip results are confirmed by a laboratory test for a reliable conclusion.

Until a final conclusion is available, measures are put in place to avoid further spread of the suspected pathogen. These measures are extended when the infection is confirmed. Measures include a separation of the infected plants, limiting access to the growing unit, restrictions on movement of tools and the use of dedicated protective clothing. After working in this zone, individuals are no longer allowed to visit other areas on the same day. After completing the crop cycle there is thorough disinfection of the soil, tools, equipment etc.

### **Quality testing**

Syngenta follows the directions from the International Seed Federation (ISF) and their ISHI-Veg methods for Seed Health testing. These are internationally recognized as reference methods and accepted as industry standards. In addition to Syngenta strict Quality Management controls, it

complies with phytosanitary requirements imposed by different countries, such as the USDA's National Seed Health System (NSHS).

Current methodology is based on grinded seeds, which means that not only the outside of the seed is tested, but also the inside. Based on good sampling, testing accuracy and the seed-to-seedling transmission rate, this test results in an extremely high reliability that no ToBRFV infected plants will grow from our seeds.

Besides Syngenta's strong internal Quality Management system, the vast majority of Syngenta's Tomato and Pepper Seed Health testing is done under Naktuinbouw Authorized Laboratories (NAL) authorization. The system ensures that the seed laboratory offers and maintains the required levels of reliability.

It includes sampling prior to testing, the quality assurance system at the laboratory, the expertise of the analysts, the protocols and issuing the results via NAL quality certificates and/or EU plant passports. This is confirmed for example via frequent proficiency testing and auditing by an independent, external party.

See <https://www.naktuinbouw.com/nal-authorized-laboratories> for a list of all NAL authorized labs.

On supply strategy all materials are restricted from trading, until proven to be free of pathogens with the above-mentioned methods and accreditations. The ISHI method for Tobamo testing describes Elisa, ToBRFV-PCR and Biotest methods for Tobamo testing is applied on all tomato and pepper batches.

## Health treatments

All tomato and pepper seed lots receive a sanitation treatment active against Tobamoviruses within the seed extraction process. On tomatoes, Sodium Hypochlorite and Trisodium Phosphate treatments are applied, effective against bacteria and viruses. On peppers, Trisodium Phosphate treatments are applied.

### **Q** Do we have resistance to ToBRFV in our material?

**A** We have seen that the levels of infection and symptoms can be different between varieties within our portfolio. Resistances have been observed in our internal screenings and we are working to deploy this across our portfolio using modern technology, as quickly as we can.

It has been seen that a variation of materials, with and without tolerance, also shows a variation of symptoms in the field. This can be due to growing conditions or natural sensitivity of the variety. It's seen that ToBRFV virulence can even be stronger in varieties that carry the Tm2-2 genes. Note that without the right measures in place, materials without strong phenotypical symptoms can become high risk sources for spread of the virus.

## **Q** What are Syngenta's recommendations to anybody visiting or working in greenhouses?

**A** As mentioned, Syngenta is taking utmost care to prevent delivery of material with ToBRFV to customers or growers. Production, sampling and testing is done following international seed trading standards and NAL or NSHS authorizations to ensure quality in all aspects of seed testing. An ISHI accredited method for detection of ToBRFV presence is applied.

When a customer suspects an infection by ToBRFV, it is advised to give rapid follow-up with testing (ImmunoStrip and/or laboratory) and to connect with a Syngenta representative who will be able to consult with other functions in Syngenta.

When working in the field people need to realize that an infection with ToBRFV is very easily spread; for example, through footwear, clothing or jewelry. Adhering to extreme hygiene rules when visiting a plant raiser or producer of seeds or fresh product is in the interest of the whole vegetable industry.

These measures include strong limitations on greenhouse visits and increased attention around wearing clean or disposable clothes. This is comparable with Clavibacter measures.

Note that the required types of disinfectants are different between Virus (Tobamo, Skim milk) and Bacteria (Clavibacter, Alcohol) and that ToBRFV can be present in both Tomato and Pepper.

The below is a unofficial translation of the document "Hygiene protocol tomato Version" that has been compiled by Glastuinbouw Nederland in collaboration with GroentenFruit Huis, Plantum and Groen Agro Control, and is communicated by the Dutch NPPO (NVWA) via their website provided for your reference only. The mentioned treatments have been selected based on their admission. The reagents must be applied in the prescribed manner or they will not be effective. However, not all treatments are known to be effective.

### **Personal and professional hygiene measures when visiting customers growing units:**

- Wear clean trousers and shirt at least every day.
- Wash hands on arrival and departure from the company using an effective disinfectant (Virus => Protein (milk), Bacteria => Alcohol).
- Wash hands between the business units (greenhouse, canteen, toilet), before and after entering.
- Avoid bringing jewellery, watches and phones into the greenhouse. When required phones can be put into a plastic bag which needs to be changed between units.
- Do not accept mobile phone calls when in the greenhouses.
- Clean glasses with alcohol tissues between business units.
- Enter the greenhouse through disinfection mat or hygiene lock where at least your shoes are cleaned.
- Wear protective clothing and footwear in the infected/suspected compartment.

- Wash or dispose clothing after finishing the work. Make sure the disposable clothing is indeed being discarded.
- Do not touch any plant without wearing disposable gloves.
- Pull off gloves from wrist upwards so the glove ends up inside out.
- Plant material, gloves, potting soil, sticks, etc. that has been in contact or comes from infected/suspected plants should be disinfected or disposed in closed bags or bins.
- When suspected plants are seen, confirm with the grower these plants are being lab-tested.
- Allow only the necessary people to join your visit. Limit visits and group size.
- Avoid visiting multiple greenhouses per day
- Avoid visiting plant raisers during plant-raising phase. This applies in particular when the old cultivation is still present at growers you visit the same day.
- In case of visiting a (suspected) infected greenhouse, change clothes directly before visiting the next grower.
- It is not allowed to take tomatoes or peppers from home or from one greenhouse to the other.
- Make growers aware on hygiene measures in case you recognize risk areas in their greenhouse.

Syngenta's customer relations teams are continuously up to date on the industry hygiene protocols. They will alert/advise growers when a gap in sanitary application is observed during a visit. They are advised to have own protective clothing when visiting customers.

ToBRFV related hygiene measures relate to water source, disinfection during crop maintenance and crop cycle changes. To some growers this may mean an increase of sanitary measures in which they will need to find new ways of working.

## **Q** More sources of information

### **A** International Seed Federation (ISF) and International Seed Health Initiative (ISHI)

- <https://www.worldseed.org/about/what-we-do/>
- <https://www.worldseed.org/resources/ishi-veg-protocols/>

### Naktuinbouw Authorized Laboratories (NAL)

- <https://www.naktuinbouw.com/floriculture/inspections/quality-plus-systemnal-naktuinbouw-authorized-laboratories>
- <https://www.naktuinbouw.com/nal-authorized-laboratories>

**Tomato Brown Rugose Fruit Virus is still very new but attention to ToBRFV is increasing within the seed industry. Some informative websites are:**

- <https://gd.eppo.int/taxon/TOBRFV>
- <https://www.fhalmeria.com/noticia-26119/un-nuevo-virus,-detectado-en-jordania-y-mexico,-seria-amenaza-para-el-tomate-almeriense> (in Spanish)
- [https://pflanzengesundheit.julius-kuehn.de/dokumente/upload/ToBRFV\\_express-pra.pdf](https://pflanzengesundheit.julius-kuehn.de/dokumente/upload/ToBRFV_express-pra.pdf)

**Tomato hygiene protocol release by the Dutch sector and NPPO:**

- [https://www.tuinbouwalert.nl/content/docs/Dossiers/ToBRFV/Hygi%C3%ABneprotocol\\_ToBRFV\\_en\\_Clavibacter\\_in\\_tomaat.pdf](https://www.tuinbouwalert.nl/content/docs/Dossiers/ToBRFV/Hygi%C3%ABneprotocol_ToBRFV_en_Clavibacter_in_tomaat.pdf)

**If you have any queries or require further information please contact your local Syngenta representative**