

2017-2018 FLORIDA CITRUS PRODUCTION GUIDE:

Tristeza¹

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Citrus tristeza virus (CTV) is a major cause of the decline and eventual death of trees on sour orange rootstocks. Initially, affected trees have small leaves and twig dieback. Diseased trees often produce a crop of very small fruit. Eventually, large limbs die back and the tree gradually declines. In some cases, trees may suffer from quick decline and wilt and die in a matter of weeks. On sour orange rootstock, some isolates of CTV cause an incompatibility at the budunion, which results in the loss of fibrous roots and reduced ability for water uptake. Bark flaps cut from across the graft union of declining trees often show pitting consisting of small holes (honeycombing) on the inside face of the bark flap from the rootstock side of the union. Quick decline trees may only have a yellow-brown stain at the budunion, and not show the honeycombing. Only trees on sour orange rootstock are affected by tristeza decline. Sweet oranges usually are more affected than grapefruit, whereas lemons on sour orange rootstock are not affected by tristeza decline.

Citrus tristeza virus has a wide range of isolates of varying symptom severities. Mild isolates have been widespread in Florida for many years and these have been widely disseminated by aphids and in budwood. Such isolates do not usually cause decline of scions on sour orange rootstocks. Budwood infected with decline-inducing isolates often produces stunted trees when propagated on sour orange. The incidence of decline has gradually increased since the introduction of *Toxoptera citricida* (the brown citrus aphid), possibly due to more effective spread of the virus by this vector. Groves on sour are declining rapidly, and many trees on tolerant rootstocks are now infected but show no symptoms.

In some countries, CTV isolates occur that also cause stem-pitting in citrus scions regardless of the rootstock used. Grooves and pits appear in the wood of the trunk, branches, twigs and rootstocks. Externally, branches may be twisted and ropy, and

twigs may become brittle. Trees affected severely by stem-pitting grow poorly and have lower yields and smaller fruit. Limes and grapefruit are most commonly affected by stem-pitting, but sweet oranges also may be affected. Tangerines are generally tolerant of stem-pitting isolates, and show no symptoms. Isolates that cause decline of sweet orange on sour orange also may cause stem-pitting in trees on other rootstocks, but many decline isolates produce no stem pitting in grapefruit or oranges. Isolates that are closely related to severe stem-pitting isolates found in other countries recently have been found in Florida. Some of these isolates give a degree of sweet orange stem pitting, but it is not yet known whether they cause economic losses in field trees.

Virtually all isolates of CTV can be detected by graft-inoculation of sensitive biological indicators such as Mexican lime or by ELISA using polyclonal antisera. The monoclonal antibody, MCA-13, detects most CTV strains which cause decline on sour orange rootstocks in Florida, and also reacts with most stem-pitting isolates, but does not react to mild Florida isolates. Private commercial and public research laboratories are certified by DPI to test samples for detection of CTV using microtiter plate-based ELISA or tissue printing techniques.

Budwood propagated for commercial distribution must be free of MCA-13 reactive CTV. As more registered trees become infected with MCA-13 reactive CTV, many nurseries are either screening their budwood source trees or are buying budwood from Foundation or other screened source trees. The key to preventing problems with stem-pitting in Florida is to avoid introduction, propagation, and distribution of stem-pitting isolates. Most stem-pitting isolates are MCA-13 reactive, but MCA-13 does not selectively identify stem-pitting isolates. Polymerase-chain reaction (PCR)-based methods identify isolates that are from groups that contain mostly stem-pitting isolates, but the

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only absolute means to detect stem-pitting isolates is by graft inoculation of grapefruit and sweet orange seedlings and examination of symptoms after 6-15 months.

Citrus tristeza virus is transmitted by aphids in a semi-persistent manner. The aphid can acquire the virus within minutes of feeding on an infected plant and transmit it to healthy plants within minutes after acquisition of the virus. Aphids lose the ability to transmit the virus within 24-48 hours after acquiring the virus from an infected plant. The brown citrus aphid, which first appeared in Florida in 1995, is considered the most efficient vector of the virus, but experiments indicate that transmission efficiency may vary between isolates. The cotton or melon aphid (*Aphis gossypii*) is a less efficient but still effective vector, whereas the green citrus or spirea aphid (*Aphis spiraecola*) and the black citrus aphid (*Toxoptera aurantii*) are relatively inefficient vectors of CTV in Florida. The establishment of *T. citricida* in Florida is believed to have resulted in a more rapid spread of decline-inducing isolates of tristeza, as evidenced by an increased incidence of decline of trees on sour orange rootstock.

insecticide. However, rigorous aphid control in nurseries and on budwood source trees could reduce infection rates (see ENY-604 Soft-bodied insects).

4. Cross protection, which is the practice of inoculating trees with mild virus strains to protect them from the effects of severe strains, has been effective in South Africa and Australia in reducing losses in grapefruit due to stem-pitting, and against losses in sweet orange in Brazil. Cross protection against tristeza decline on sour orange rootstock has not yet been developed as an effective control measure.

RECOMMENDED PRACTICES

1. Once tristeza-affected trees on sour orange rootstocks begin to decline, there is no treatment that will reverse the decline. Generally, individual diseased trees should be replaced with certified trees on tolerant rootstocks as the yields of affected trees decline to uneconomical levels. However, if blocks on sour orange rootstock are planted on an inappropriate row spacing, are not properly bedded, or are in need of drainage or other structural work, or the scion variety is not the preferred one, it may be desirable to allow the trees to decline to uneconomical levels and replace the entire block. (See Citrus Rootstock Selection Guide <http://frootstockselectionguide.org/>).
2. Within groves with trees on sour orange rootstock that are currently unaffected by tristeza decline, it may be possible to inarch trees with seedlings of a tolerant rootstock. Inarching is most effective with relatively young groves that are still actively growing, and in order to be effective, the inarches must be well-established before trees become infected. Given the high cost of the practice, it is probably advisable only in the case of high value crops in groves that are well separated from areas with severe strains of tristeza virus. It is more likely to be successful with younger than with older trees.
3. Chemical or biological control of the aphid is unlikely to reduce the spread of the virus in commercial groves, since acquisition and transmission of the virus by the aphid usually occurs before the aphid is killed by an