

## 1. PATHOLOGICAL PROFILE

### 1.1 Distribution and status

*Citrus tristeza virus* (CTV) occurs naturally in all field-grown citrus in southern Africa but causes the decline of only certain scion/rootstock combinations and certain cultivars grown as seedlings. CTV is composed of a complex of closely related virus strains, which cause stem pitting in grapefruit and Mexican (West Indian) lime, seedling yellows in Eureka lemon and sour orange (Bitter Seville) and tristeza disease (known also as quick decline) when sour orange is used as a rootstock for sweet orange and grapefruit cultivars.

In southern Africa, disease symptoms are common only in grapefruit and Mexican lime orchards. Sweet orange cultivars, mandarins and the commercially used rootstocks are tolerant to CTV. Seedling yellows of Eureka lemon is rare. Sweet orange and Clementines on Volckameriana rootstock appear to be sensitive to certain strains of CTV. These strains cause pitting in the rootstocks and result in stunting of the trees.

### 1.2 Description

CTV is a long, flexuous, rod-shaped virus particle which is found primarily in the phloem of citrus tissue. Numerous strains of CTV occur which vary in their ability to be transmitted by aphids and in the symptoms they induce in specific hosts. A CTV strain is termed mild or severe depending on the severity of the symptoms they induce in a specific host.

### 1.3 Symptoms

The most common and typical symptom observed in grapefruit is stem pitting. The removal of bark patches from the stem and branches of the scion reveals pitting and grooving to varying degrees of severity. In addition, diseased trees have flattened tops, evidence of twig die-back and leaves which are small, cupped and which may exhibit trace element deficiencies. The fruit is also small and often lopsided. Affected trees rarely die but the productive lifespan of grapefruit trees may be reduced to between 10 and 15 years.

Navel oranges and Clementines on Volckameriana rootstocks are stunted by certain CTV strains. The fruit size and shape are not affected to any great extent; yield is, however, significantly affected. Removal of a bark patch from the rootstock reveals fine pitting, characteristic of CTV infection in sensitive tissues.

### 1.4 Transmission

CTV is readily graft-transmitted and is therefore easily spread by the use of infected budwood. CTV is also transmitted by several aphid species of which the brown citrus aphid, *Toxoptera citricida* (Kirkaldy) is the most efficient. This insect is endemic in all citrus orchards. It takes the virus from 8 to 17 days to pass into the rootstock seedling after budding and can be transmitted by the aphid within 30 minutes of feeding on the tree.

The decline of grapefruit trees, caused by the stem pitting strains of CTV, has been overcome to a great extent by the use of mild strain cross protection. This is the practice whereby susceptible cultivars are deliberately infected with specific mild isolates of CTV, which have been shown in practice to have the ability to protect these cultivars from natural infection by more severe strains. All budwood supplied to nurserymen from the Citrus Foundation Block is cross-protected with a mild isolate of CTV.

The term cross protection is frequently referred to as pre-immunization. However, the latter term is not entirely correct as plants do not possess immune systems.

### 1.5 Seasonal occurrence

All field-grown citrus in southern Africa is infected with CTV. As the trees develop new growth during the growing season this new tissue automatically becomes infected, as the virus is carried systemically within the tissues. However, it has been demonstrated that the new flush of vigorously growing young grapefruit trees can initially be virus-free. The new flush develops more rapidly than the translocation of the virus within the tissues. It is during this period, which may be a matter of hours or days, in which the new flush is not protected that aphids can transmit severe strains of CTV into the virus-free tissue. It is therefore imperative that this flush be protected from aphid infestation in non-bearing trees.

## 2. MANAGEMENT ASPECTS

### 2.1 Disease assessment

A citrus tree is usually naturally infected by more than one strain of CTV. These strains vary in their ability to cause decline. Mandarins and sweet orange selections are tolerant to the majority of these strains when propagated on tolerant rootstocks. However, grapefruit and Mexican lime trees are sensitive to most strains of CTV, even when propagated on tolerant rootstocks. These strains cause stem pitting to varying degrees depending on the virulence of the strain. A severe

strain can cause such severe stem pitting in grapefruit trees that they decline within 3 or 4 years after planting. When infected with a mild protective strain, grapefruit trees can remain productive for more than 30 years.

Generally, grapefruit trees which become infected at an early age with a severe strain of CTV are productive for only 10 to 12 years. Once the canopies begin to flatten out, become sparsely foliated and small lopsided fruit are produced in the upper part of the canopy, trees have reached the end of their economically productive lifespan.

The different grapefruit selections vary in their sensitivity to strains of CTV. Marsh grapefruit appears to be more tolerant than the red selections. Star Ruby, Rio Red and Henderson grapefruit have proved to be very sensitive to CTV, and can decline at an early age when infected with a severe strain.

Young grapefruit trees, which exhibit a loss of vigour, show deficiency type symptoms in the leaves and produce small fruit, can be suspected of being infected with a severe strain of CTV. To confirm this suspicion, pencil-thick branches can be examined for the presence of stem pitting by removing the bark.

The main stem of young grapefruit trees may exhibit no severe stem pitting symptoms but still be infected with a severe strain of CTV. In these cases the pits are so numerous and so small that they cannot be discerned by the naked eye. Trees infected with such a strain are usually stunted.

## 2.2 Control options

Control measures are aimed principally at grapefruit and Mexican lime at present as these are the most susceptible cultivars. However, research has shown that cross protection is advantageous for the tolerant sweet orange and mandarin cultivars. Currently all citrus cultivars, except lemons, are cross-protected with a suitable mild strain of CTV. This strategy should also prevent the inoculum buildup of severe CTV strains in the more tolerant cultivars. Trials to identify suitable strains have been established.

### 2.2.1 Cultural

Budwood for nursery trees should be obtained from the Citrus Foundation Block and growers should only purchase trees from CIS certified nurseries. (Consult the section of the Citrus Improvement Scheme in Volume 1 of these guidelines).

Trees under any form of stress tend to be more susceptible to the damage caused by tristeza virus.

This in turn, shortens the productive lifespan of the orchard. It is important therefore to minimise stress factors in young grapefruit orchards. Take care not to over-irrigate or drought stress the trees and keep the root environment free of harmful organisms, and the foliage free of aphids.

### 2.2.2 Plant protection products

Protect trees during their non-bearing years from heavy infestations of the brown citrus aphid. This will minimise the chances of severe CTV strains being introduced into parts of the young trees which have not yet been systemically invaded by the mild strain. Aphids can be controlled with a number of products. Refer to the CRI citrus IPM guidelines (Chapter 3-2) for details.