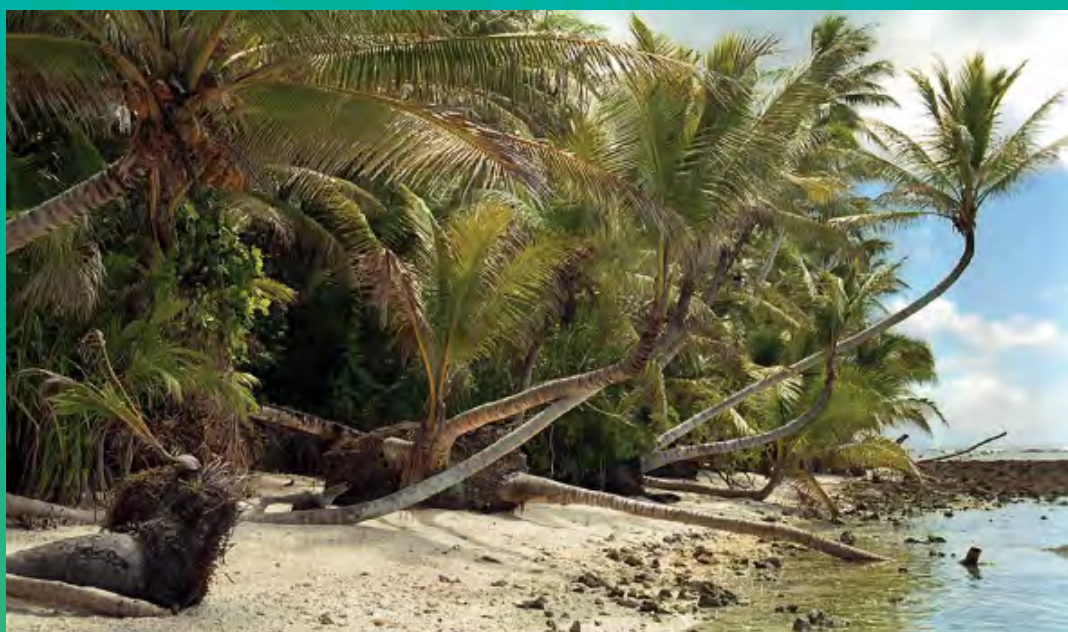




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Coconut Risk Management and Mitigation Manual for the Pacific Region



Compiled by R. Bourdeix, J. M. Sourisseau and J. Lin

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Coconut Risk Management and Mitigation Manual for the Pacific Region

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6. VIRAL DISEASES

By R. Bourdeix, T. McKenzie, M. A. M. Gruber, S. Boulekouran

Description

The risk is that viral diseases kill many coconut palms and/or greatly reduce their production. The diseases of greatest concern seem for now Vanuatu Foliar Decay and Guam Tinangaja viroid.

Coconut foliar decay (CFD) is a lethal disease of coconuts described only in Vanuatu. It is caused by a very small virus growing in the palm's phloem (where food is transported through the plant). The local cultivar 'Vanuatu Tall' (VTT) is the only cultivar that is fully tolerant to CFD, whereas introduced cultivars and hybrids are affected to different degrees.

As the CFD virus cannot be seen, the only way to identify coconut foliar decay is by symptoms and the presence of vector insects. The only known insect that transmits coconut foliar decay is a small planthopper called *Myndus taffini* (see <http://coconutpests.org//pests-and-diseases-of-coconut/coconut-foliar-decay> for images). Although the adult planthopper feeds on coconuts, breeding occurs on the roots of *Hibiscus tiliaceus* (hau [Hawai'ian], fau [Samoan], purau [Tahitian], and vau tree). However, *Hibiscus tiliaceus* and other plants growing near coconuts do not carry the virus.

The first sign of CFD infection is in the mid-section of the crown where fronds have a few yellowing leaflets. Yellowing will begin to spread and the whole frond will bend and be seen hanging through leaves that are still green, due to breakage near the base of the frond. As younger leaves age, they too will go through these stages. At the advanced stage of the disease, the leaves turn yellow with broken mid- leaf section hanging through green fronds and new green fronds emerging from the top of the crown. If palms are not tolerant to the disease, death will occur in infected palms after one to two years.

Tinangaja viroid (CTiVd) causes the lethal Tinangaja disease of coconut palm in Guam. It is related to the viroid (CCCVd) that causes the lethal Cadang-cadang disease of coconut palm in the Philippines, with about 64% DNA sequence identity. Symptoms of CTiVd differ from Cadang-cadang.

From the time of the first symptoms of CTiVd death can take up to 15 years. The first obvious sign are yellow spots on the leaves, and small, thin, scarred nuts without a central kernel. As the disease progresses, leaf, flower and nut production slow down, and there is a general yellowing of the leaves, a tapering of the trunks, and death. Although diseased palms occur in small groups, it is not known how the disease spreads naturally.

Occurrence and severity

We do not know the exact distribution of the CFD across the 83 islands of Vanuatu. When an island is planted only with the resistant Vanuatu Tall variety, the disease remains completely invisible. Thus, some neighbouring islands, for example in the Solomon archipelago, may also be contaminated by this disease. The only way to check it would be to introduce perfectly healthy Malayan Red Dwarf seednuts on these islands. If these sensitive dwarfs die, it will mean that the disease is present.

The impact of CTiVd in Guam has been considerable. Coconuts in Guam are not used for copra, but are used for drinking, food and oil. Apart from these uses, coconuts play a landscaping role (including the tourist industry), in reducing coastal erosion, as windbreaks, and as shade for many plant species less tolerant to sunlight. Coconuts must be imported. The disease has probably strongly reduced the diversity of coconuts on the island. The related lethal coconut Cadang-cadang disease in the Philippines caused a total loss of 40 million coconut palms.

Mitigation and adaptation

For both diseases, the use of cutting tools (such as coconut hooks or sickles) without proper hygiene precautions should be avoided to prevent mechanical transmission of viroid. Tools should preferably be disinfected by wiping with freshly prepared 10% bleach solution plus 1% mineral or vegetable oil between trees.

The removal and destruction of infected trees is recommended, with replacement using healthy seedlings. Seednuts should be collected and selected from areas known to be viroid-free, or have very low incidence of the disease, and not moved internationally. In the past, healthy seednuts of the Vanuatu Tall variety have been sent from Vanuatu to Côte d'Ivoire gene bank (West Africa); then sent from Africa to more than 10 other countries worldwide. In Ghana this variety showed a tolerance to the Lethal Yellowing Disease.

The CFD viroid can be found in the roots, trunk, leaves and the nut including the husk and embryo, but it is unknown whether seeds carry it. Many seednuts are presently produced in Santo Island (where CFD is active) and sent to other Vanuatu islands, and no problem has been reported so far.

In the gene banks and seed gardens of the Vanuatu Agricultural Research Centre (VARTC), the damage caused by the CFD has been overcome by eradication of the host plant of the vector insect. However, *Hibiscus tiliaceus* is often planted as fences and has many traditional uses, so it is almost impossible to eradicate it from coconut farms.

From 1967 to 2008 a conventional breeding program was conducted in Vanuatu with the aim of creating hybrid planting material combining tolerance to CFD with improved copra yield and high copra weight per nut. An improved hybrid, obtained by crossing the Vanuatu Tall and the Rennell Island Tall varieties, was identified with a high degree of tolerance to CFD (less than 1% of trees were affected after 11 years of exposure to high disease pressure). The annual production of this improved hybrid ranged from 21.9- 28.6 kg of copra per tree, depending on the RIT parent, and was, on average, 34% higher than that of 'VTT Elite' an advanced cultivar obtained after four selection cycles of local VTT.

Actions to undertake

- Launch a program to determine the full extent of CFD disease in Vanuatu, of CTiVd in Guam and including neighbouring islands, as discussed earlier.
- Many aspects remain unknown about CFD disease in Vanuatu and need further research. The Malayan Red Dwarf (MRD) is the variety most sensitive to CFD. But MRD can be 'vaccinated' in the nursery, by being exposed to the insect vector and the CFD viroid, and then it does not die from the disease. Nobody has planted seednuts from these 'vaccinated' MRD, to see if the progeny is sensitive or not to CFD. Maybe the Vanuatu tall is not resistant to the CFD but is simply 'vaccinated'.

- The Vanuatu Tall is one of the most tolerant variety to Lethal Yellowing Disease in Ghana. Maybe this unusual kind of natural ‘vaccination’ helps the Vanuatu tall to tolerate the LYD disease. Or maybe there is a unique physiological and genetic reason why Vanuatu tall is tolerant to both LYD and CFD. Therefore, research on CFD is important, not only for Vanuatu and the Pacific region, but because it may help to understand and fight LYLD diseases, that cause much more damage globally than CFD.

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