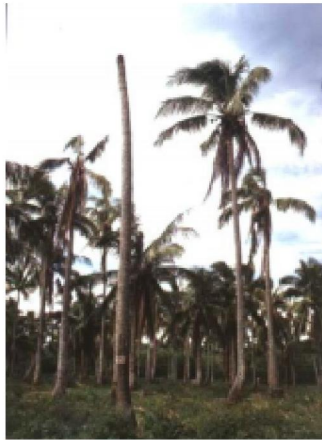


Cadang-Cadang Disease of Coconut

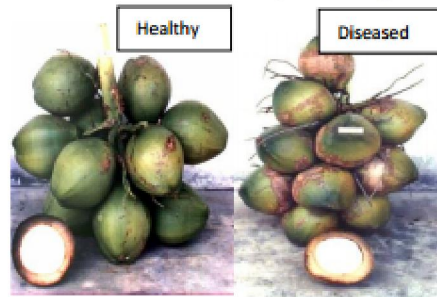


The name *Cadang-cadang* is derived from the Bicol term '*gadan-gadan*' which means dead or dying. It refers to a premature decline and death of coconut palms in the Philippines associated with viroid infection. The *Cadang-cadang* disease is the only record of a malady that has caused tremendous economic losses in the coconut plantations in the Philippines.

Symptoms of Cadang-Cadang

Palms infected with the *Cadang-cadang viroid* pass through a well-defined series of changes culminating in death. The diseased palms in the field are classified as being Early, Middle or Late stage.

In the Early stage, nuts become more rounded and have equatorial scarifications. Chlorotic leaf spots begin to appear and inflorescences become stunted. In the Middle stage, spathe, inflorescence and nut productions decline and then cease. Leaf spots become more numerous. During the Late stage, the fronds decline in size and number and the leaflets become brittle. Leaf spots coalesce, giving a general chlorosis. The crown size is reduced and later, the palm dies.



Economic Impact.

In the 1990s, Brazil imposed an import ban on desiccated coconut. Saudi Arabia followed suit rejecting entry of desiccated coconut, coconut in powdered and sliced form, fresh coconuts with husk, coconut fiber by-

products, nata de coco and Makapuno. Malaysia and Taiwan stopped the importation of fresh young coconut for fear of possible entry of the **Coconut Cadang-cadang Viroid (CCCVd)** or the disease and the alleged danger to human health.

In 2004, the PCA implemented a comprehensive *Cadang-Cadang* Disease Containment Program which also resulted to the issuance of a BPI Quarantine Administrative Order No. 13, Series of 2004 with the SUBJECT: Rules and Regulations Further Modifying BPI Administrative Order No. 15, Series of 1988 Entitled "*Declaring the Cadang-cadang as a Manageable Disease and Providing for a Containment and Quarantine Control Program in Affected Areas.*"

The ***Cadang-cadang* Disease Containment Program** has 3 components geared towards increasing coconut production and resumption of coconut exports:

- **The identification and accreditation of disease-free areas** assure importers that coconut will be sourced from disease-free areas that have been subjected to highly sensitive CCCVd detection techniques.
- **Establishment of buffer zones in Luzon and Visayas** will prevent further spread of the disease and confine it to *Cadang-cadang*-affected areas of the country.
- **Eradication of *Cadang-cadang* and rehabilitation of affected areas** will remove diseased palms and other possible sources of inocula in the field and replant with certified disease-free high yielding planting materials



Map of the Philippines showing **Cadang-cadang** infected areas

Geographical location

Cadang-cadang is widely distributed in the Bicol region, Northern Samar, Eastern Samar, Biliran and Quezon. At present, the northernmost boundary of disease occurrence is in Brgy. Magsikap, General Nakar, Quezon and the southernmost boundary is Calicon Is. Guiuan, Eastern Samar.

No diseased palms have been found in the provinces of Batangas, Laguna, Cavite, Aurora and other parts of northern Luzon, the rest of the Visayas and the whole of the island of Mindanao including Basilan.

Cadang-Cadang Viroid Indexing

PCA-ARC developed the procedures for the extraction of the *Coconut Cadang-cadang viroid* from palm tissues and detection by Molecular Hybridization Assay for a reliable diagnosis of *Cadang-cadang*. This diagnostic protocol satisfies the stringent requirements for certification of disease-free status of coconut production areas by using sensitive viroid diagnostic testing procedures in accordance with International Standards for Phytosanitary Measures.

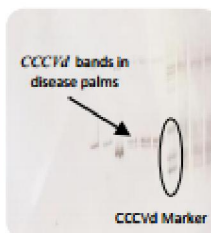


RNA Extraction from
coconut leaves

Polyacrylamide Gel
Electrophoresis
(PAGE) Assay



Molecular
Hybridization
Assay (MHA)



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