 

Virtual training on
"Collecting and managing information and data on coconut germplasm,"
organized by the Land Resources Division of the Pacific Community, Suva, Fiji.
(2024, August 20–21)

Phenotypic diversity and reproductive biology of the coconut palm
[Virtual training presentation] by Dr Roland Bourdeix

This online training module, led by Dr. Roland Bourdeix, explores fundamental concepts in coconut diversity, focusing on the distinction between **phenotype and genotype**, and the strategies of **in situ** versus **ex situ** conservation. A detailed glossary introduces key terms, such as accession, genotype, phenotype, in vitro, cryoconservation, and hybridization, providing a scientific foundation for learners.

The course illustrates how **environmental conditions strongly influence coconut phenotype**, even when genetic material remains constant. For instance, the Madang Brown Dwarf variety produced robust fruits in Papua New Guinea but yielded small, poor-quality fruits in degraded soils in Côte d'Ivoire—yet improved again when replanted in fertile Vanuatu. Such examples highlight the crucial interaction between genotype and environment in coconut development.

Coconut palms produce 12–16 fronds annually, and each frond’s axil may develop an inflorescence. These inflorescences carry both **male and female flowers**: the **female flowers** are round and located near the base, while **male flowers** are smaller, elongated, and found at the top of each spikelet.

Pollination occurs when male flowers release **pollen grains**, mostly in the morning, which can fertilize receptive female flowers. Depending on the variety, **pollination can be self- or cross-fertilizing**, influenced by the timing overlap of male and female flowering phases. For instance, **Dwarf varieties** often self-pollinate due to simultaneous flower opening, while **Tall varieties** typically cross-pollinate because of a delay between male and female phases.

Only a fraction (20–30%) of female flowers develop into mature coconuts due to factors like lack of pollen, pollinators, water stress, or nutrient deficiencies. The course highlights **“button shedding”**, or the early drop of unfertilized female flowers, which can be minimized through proper irrigation and fertilization.

Four main **flowering behavior groups** are identified, ranging from strictly cross-pollinating types to those capable of both self- and cross-pollination. The course also introduces the concept of **overlapping inflorescences**, where two flowering phases from the same palm can enable self-fertilization even without simultaneous male and female flowers on one spikelet.

Self-fertilization (autogamy) often leads to inbreeding depression in Tall-types, while Dwarf-types tolerate it better. The course defines these reproductive systems and underscores their implications for varietal selection and conservation.

A major theme is the **contrast between ex situ and in situ conservation**. Despite the vast global area of coconut cultivation (12 million ha), only about 1,000 ha are devoted to ex situ genebanks. Therefore, most coconut diversity is managed directly by farmers in situ. While ex situ methods allow controlled conservation, in situ management by farmers has been the driving force behind coconut varietal diversity.

The module concludes by advocating closer collaboration between scientists and farmers. Even small improvements in farmers' selection and conservation practices could yield significant benefits for long-term biodiversity. The course honors the legacy of Dr. Pons Batugal, a pioneer in coconut research and development.

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