A Global Strategy
for the conservation and use of Coconut Genetic Resources
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LA RECHERCHE AGRONOMIQUE POUR LE DÉVELOPPEMENT

COGENT
Coconut genetic resources for enhanced livelihoods

Bioversity International

3.5.2 Collecting for pest and disease resistance

Collecting actions may be directed to areas where disease resistance is expected to be found. These areas are not necessarily those under disease pressure.

These surveys will also often consist in collecting the few palms remaining alive in a zone devastated by a pathogen. Observations conducted notably in Mozambique indicate that it could be better to collect before reaching the stage where most of the palms are dead: In the fields threatened by high pressure of Phytoplasma disease, the rotting stems induce a proliferation of insects, such as *Oryctes* or *Rynchophorus* sp., which finally kills all the remaining palms, be they tolerant to Phytoplasma or not.

Within the next decade, the Strategy aims to collect about 100 populations having putative pest and disease tolerances. In such surveys, phytopathological aspects are crucial because of the risks of transmitting the pathogens with the germplasm. Thus, the use of quarantine centres and disease indexing methods appears as a necessity for releasing such collected germplasm to *ex situ* genebanks.

Large companies in Brazil are investing millions of dollars in producing coconut planting material, in optimizing plantation management and in coconut processing. However, they face the constant risk of losing consistent production due to pest and disease damage and the risk of introducing even greater disease problems, such as Lethal Yellowing Disease. Companies from Brazil would like to be able to access sources of interesting genetic material, as well as to participate in implementing strategies to protect the genetic material. Public-private participation will facilitate developing and implementing strategies of common interest for the crop. Establishing exclusion zones or quarantine for introducing new germplasm for breeding purposes would enhance effectiveness and efficiency. Private companies already operate in the acquisition of new genetic material. A large, worldwide programme would give greater security to private companies for new investments as well as the expansion of existing projects, ensuring profitability and reducing business risks, especially with regard to industry of tender coconut water, which is in expansion, with new companies working in the field every year.

3.5.3 Islands most isolated and/or endangered by climate change

Genetic diversity can be split into two dimensions; one concerned with adaptive variation and the other with neutral divergence caused by isolation. Different evolutionary processes suggest alternative strategies for collecting and eventually conservation. Planning should emphasize the survey protection of historically isolated lineages because these cannot be recovered (Moritz 2002).

It is envisioned to collect germplasm in remote small islands. These islands needs to be carefully selected using a multidisciplinary approach based on the following criteria:

- most endangered by climate change,
- most geographically remote and only accessible by boat (no airport) but preferably where people are living,

- islands where copra was never a business because traditional varieties will probably be better conserved,
- island where coconut was or is culturally important,
- and, as it is envisioned to collect more than coconut, islands having special interest for researchers working on the other concerned crops or animals.

Numerous historical data and information from old planters and their families will also be collected, so participation of an ethno-biologist to this survey will have to be considered.

This kind of survey may concern many archipelagos, such as Maldives, Tuvalu, Kiribati, Tuamotu, the many Indonesian atolls, etc. Highest priority is Tonga for reasons linked to cultural context and high isolation index of some islands. The choice of islands will also depend on willing cooperation of the host countries holding the germplasm. As the cost of such missions is high, COGENT Secretariat will strengthen links with international organizations, national museum, botanical gardens, universities and research institutions programming collecting expeditions in order to join existing collecting missions organized by national or international teams. During these missions, scientists involved (on behalf of COGENT countries) will follow the International Code of Conduct for Germplasm Collecting and Transfer[31]. It is envisioned to collect embryos and pollen from coconut populations, the majority of which will be directly (and only) conserved as cryopreserved material This activity is only envisioned when protocols for cryoconservation of coconut germplasm will be available.

The dynamics for the Pacific Region described in section 1.1.1 have important consequences regarding the appropriate methods for collecting Tall-type coconut germplasm. Palms with special characteristics will be sought within populations in farmers' fields. In many cases, the classical approach that consists of selecting palms at random in a given population seems no longer appropriate. Such a method samples and conserves an uncontrolled mix of traditional varieties[32]. Due to the low multiplication rate of the coconut palm, such mixes are of little interest to breeders, except in certain cases when prospecting for disease resistance. Thus, the collecting method will focus on the few palms having desirable traits within populations existing in farmers' fields. The number of fruits collected per population will probably be reduced when compared to previous surveys. A "change detection database" would allow visualizing increase or reduction of plantations, deforestation or reforestation, and coastal erosion[33]. It will help prioritizing the areas where endangered coconut germplasm must be collected.

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[31] SeeThe URL: http://www.fao.org/biodiversity/instruments/en/

[32] Some of the accessions collected in the Pacific region and presently conserved in *ex situ* genebanks are this kind of varietal mix: for instance Rangiroa tall, Rotuma Tall...

[33] SPC SOPAC Division Published Report 45.

The Strategy aims to collect embryos and pollen from 100 to 200 coconut populations, the majority of which will be directly (and only) conserved as cryopreserved material.

3.5.4 Filling geographical gaps

As discussed in section 2.4.3, gap analysis is applied to map the actual distribution, agro-climatic preferences, and potential distribution of coconut. Geographic Information Systems (GIS) are used to analyse spatial distribution of different coconut populations. The degree of variability expected to be found in new collecting areas is another important consideration. Information on allelic diversity in the coconut populations could provide an important criterion to guide future collecting.

A first analysis was conducted by the COGENT secretariat at country level. Accessions conserved in *ex situ* genebanks comes from only 45 countries and territories of which 30 are COGENT member-countries. According to FAO, there are 92 coconut producing countries and territories (CPCT), so 47 (51%) are not yet represented in the germplasm conserved *ex situ*. The ratio between coconut planted area and the number of accessions conserved *ex situ* was calculated by region. On average, this ratio is 90 accessions per million hectares, and ranges from 64 (Africa) to 282 (Pacific Region). This first approach indicates some basic trends, but it needs to be refinemd by adding other criteria. Based on this single geographical criterion, the higher the ratio, the higher the range of geographical diversity represented in the *ex situ* collections.

This analysis was pursued using predicted area calculated from the maps produced by Ecoclimatic Niche Modelling. Prioritization of areas for collecting will not consider only sizes of predicted areas, but their isolation status (for example isolated valleys will be preferred). The ethno-biological literature and, when available, predicted allelic diversity will also be taken in account.

Based on the sole geographic criterion, some areas like Latin America, the Caribbean and Africa should benefit from more accessions' registration and preservation. The Strategy aims to collect 100 to 200 populations following the approach of filling geographical gaps.

3.6 Strengthening the distribution and the safe movement of germplasm

The introduction of new accessions is generally driven by a specific goal, e.g. germplasm tolerant to phytoplasma diseases in countries that suffer significant losses due to these diseases. Another objective can be to introduce germplasm with resistance to diseases that are not yet present in the country, so that resistance can be incorporated into breeding lines as a safeguard in case of the accidental entry of the disease. Furthermore, countries may wish to introduce germplasm from a particular genetic group that is under-represented in their national germplasm collections, such as for instance compact dwarfs, aiming at broadening the genetic base of these collections. Each country generally have its own policy.