IMPORTANCE AND CURRENT STATUS OF THE COCONUT GERMPLASM CONSERVATION PROGRAMME IN SRI LANKA

C K Bandaranayaka
Geneticist/Plant Breeder,
Coconut Research Institute of Sri Lanka.

Conservation of threatened biodiversity is gaining its recognition and becoming more and more important in a rapidly changing world. During the recent past, major changes have occurred in the field of plant genetic resources conservation. Perhaps the most important change caused due to increased awareness is that the loss of biodiversity will directly affect the life on earth. The establishment of gene pools and the conservation of genetic resources are basic to crop improvement. Hence, maintenance of large assemblage of genetic diversity is a vital aspect since crop improvement objectives change over time and it is difficult to predict the future needs accurately.

Being a perennial crop with a persistent capacity for sexual reproduction, coconut gene pools serve in two ways; as a collection for breeder's work and as a base collection for conservation. Despite the necessity, it is very important to the country because there are original populations native to areas, which has not being subjected for any artificial selection. Therefore, a great possibility exists that these populations consist of genes or hereditary material responsible for smooth production over time in a specific area.

During the recent past there had been tremendous genetic erosion (permanent loss of hereditary material) in coconut due to urbanization and industrialization that took place in the major coconut growing areas of the country. The main causes for the loss are land fragmentation, replanting with improved material, the use of coconut palms as timber and natural disasters such as drought and cyclones. The conservation of endemic coconuts prior to replanting is considered of utmost importance. Therefore, a programme for systematic conservation of the native coconuts is a timely need to protect the existing populations. Even by now some of the valuable genetic material might have been lost forever and coconut genetic diversity could have been narrowed. If this continues further, one day the coconut breeding programme will face a severe crisis due to unavailability of superior genetic material with a wider genetic diversity, when trying to achieve future necessities of the industry.

Almost all the coconut collections are beset with problems emanating from the lack of a systematic classification. The present system of classification, i.e. dwarfs and tall is widely accepted for coconut and it is purely based on speed of germination, time taken for flowering, breeding behavior and other morphological characters. Having identified local accessions and means by which they can be distinguished, the genetic make-up of the coconut populations island-wide could therefore be identified and can be used for a systematic classification in the future. The same procedure can be used for foreign material as well. Hence, particular emphasis is placed on the need to conserve the original germplasm without restricting to either short term use of the collection, as a source of pollen for commercial hybrid production, or the long term use for fundamental breeding studies and systematic classification of coconut. The programme of collection and conservation of coconut germplasm was initiated in 1994 under an ADB funded project. The genetic material at risk i.e. the populations which are threatened due to senile plantations, land blocking, replanting etc. were collected by random sampling from locations decided on geographical distribution. The putative drought tolerant material from drought affected areas where annual rainfall is below 1000mm and are subjected to frequent droughts leading to genotypes for drought tolerance were collected as biased collections. All these material are now being conserved in *ex-situ* gene banks of the CRI.

The Coconut Research Institute initiated a systematic collection and conservation of coconut germplasm on 1984. Initial countrywide surveys were undertaken in 1986/87 to locate populations having different characters; Priority was given to drought tolerant material as changing weather patterns have caused severe losses in coconut production. This provided a good opportunity for identifying palms, which withstood the drought at least to some degree. Financial and manpower constraints brought this programme to an abrupt halt in 1990. However as a result of the said programme, 23 different accessions which are believed to be genetically different have been collected and established in two different locations (Bandirippuwa Estate and Pottukulama Research Station) of the country.

A systematic field evaluation of nine promising germplasm accessions (Moorock, San Ramon, St. Anne's, Maliboda, Walahapitiya, Margaret, Debarayaya, Ambakelle Tall and Ambakelle Special) was commenced in 1994 at Nariyapotta Block, Andigama Farm, Giriulla. Open pollinated progenies from 15 randomly selected palms (of the selected lot for conservation) have been used to represent each population. The objective of this experiment was to evaluate and characterize these populations to examine whether they inherit desirable characters, which would be used in future breeding, and to estimate genetic parameters to develop suitable collection strategies.

Pre-prospection, collection and recording of coconut germplasm is being carried out according to the guidelines of the International Plant Genetic Resources Institute (IPGRI). Seed nuts collected are subjected to nut component analysis and the balance for nursery evaluation. Selected seedlings in the nursery are established in *ex-situ* conservation blocks. In these collections a brief description of the environment and the soil type from where sampling was carried out and morphological characters of the sampling population are recorded for future reference.

There are altogether 11 *ex-situ* gene banks established by the CRI at different stages of the conservation programme. Six of which namely, Local Germplasm Block (LGB) established for conservation of seven indigenous tall coconut forms, Dwarf Palm Block (DPB) established for conservation of green, red and yellow dwarf coconut forms, Crop Museum

(CM) established as a collection of 13 different varieties and forms of coconut, Dikiri Palm Block (DIPB) established by planting dikiri embryo cultured seedlings, Old Variety Block (OVB) planted with different forms of coconut at a very early stage of CRI and Kotakande Gene Bank (KGB) planted with presumably eight drought tolerant collections are located in the Bandirippuwa Estate, Lunuwila. The biggest gene bank at the Pottukulama Research Station (PRS) have 22 accessions while Lenawa Gene Bank (LNGB, a sub station of the Coconut Cultivation Board (CCB) and Raddegoda Gene Bank (RGB, a private estate at Ridigama) hold 15 and 14 accessions respectively. Pallama (PGB) the latest gene bank holds 12 accessions with room for more additions. Kohombana Gene Bank (KOGB) serves a different purpose, conservation of eight tall ecotypes, collected from populations almost reaching senility, in the dry zone or dry intermediate zone.

Based on site information, the block-wise parameters and the nursery evaluation data, material collected would be screened and systematic evaluation trials would be setup for the most promising accessions. Material suitable for utilization will be crossed with genetically improved material such as those at the Isolated Seed Garden at Ambakelle in order to exploit hybrid vigor and also to generate a wider genetic variability for second and subsequent generations of selection. Based on this hypothesis, four accessions specially identified as drought tolerant (Kasagala, Debarayaya, Moorock, St. Anne's) has been used as pollen parents to cross with genetically improved Ambakelle Tall and the progeny now being evaluated with Ambakelle Special as the control.

CRI has also ventured a programme to assess the diversity of coconut in the country by studying the variation of nucleic acids especially deoxyribose nucleic acid (DNA). This is the macromolecule, which carry all the genetic information over generations. As evident from morphological and molecular descriptors, the population structure of the coconut in Sri Lanka is very limited largely comprising commercial tall coconuts and dwarf and a Philippine type, San Ramon with somewhat different genetic constitution. The genetic variability existing between these sub populations has already being utilized for production of improved cultivars, CRIC65 (dwarf x tall) and CRISL98 (tall x San Ramon). Therefore, chances of further genetic improvement with a substantial development with the existing germplasm is very remote unless our germplasm is enriched by introducing exotic varieties diverse origins. Three countries, India, Fiji and Ivory Coast have principally agreed to exchange germplasm with Sri Lanka and from these countries 23 varieties have been identified with specific traits (early bearing, high nut production, high copra outturn, high yield, drought tolerance, pest resistance etc.,) for importation. The only obstacle for importation of coconut is the risk of accidental introduction of diseases not prevalent in this country. CRI has developed *in-vitro* techniques for safe transfer of coconut planting material by way of embryos under strict quarantine conditions and as a results the Department of Agriculture has given the approval for the CRI to exchange coconut germplasm with other countries.