



Coconut Breeding Initiatives in India and Sri Lanka

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In Sri Lanka a crop improvement programme in coconut is on, where farmer himself becomes the coconut breeder, a novel approach that could be considered for adoption by India at the grass root level. Sri Lanka is attempting to such a step with a view to increase the production of quality seedlings consequent to the need for high yielding planting material of coconut and also to evolve a suitable cultivar or hybrid appropriate to the needs of the urban areas. The country is in dire need of quality planting material.

Coconut is grown in 3.94 million ha in Sri Lanka covering all districts in the country and the crop is next to rice in importance. Coconut as a food supplement to Sri Lankans provides 15 % of dietary calories and 5 % protein. Five per cent of Sri Lankan population depends on this crop as the main source of income. The coconut sector contributes significantly to the

employment generation in the country and provides livelihood security to many. The sector also plays a vital role in sustaining a viable economy at village, district, regional and national level.

In technology development in the processing sector Sri Lanka is one of the leading coconut producing countries in the world. Desiccated coconut, coconut milk powder, coconut cream, coconut water beverage, toddy, treacle and jaggery are the available products in the edible product basket kit, and coir briquettes, cut pieces of husk, geotextiles, shell charcoal, and activated carbon are the non-edible products. Most of these products figure in the export sector of Sri Lanka. Export revenue derived from desiccated coconut alone was Sri Lankan Rs. 13,957 million while the net foreign exchange earned from export of coconut products in 2011 was Sri Lankan Rs.47,306 million (CDA2011).

Exploitation of Hybrid vigour

India was the first country to exploit heterosis or hybrid vigour in coconut. It was by J.S. Patel in 1934 who had attempted this by evolving a TxD hybrid. This was a breakthrough in crop improvement studies in coconut. Patel observed early germination, increased seedling collar girth, higher leaf number, early bearing and high yield in the progenies of a cross between the local tall and the local dwarf. So far more than 100 cross combinations have been developed in the country for evaluation of yield potential at Central Plantation Crops Research Institute (CPCRI), State Agricultural Universities and the centers under the All India Coordinated Research Projects under ICAR. Already 15 hybrids have been released for cultivation in different states of the country.

Sri Lanka made its kick start in coconut breeding in 1960s. One TxT and DxT combination viz.,

CRIC60 and CRIC65 were developed which subsequently led to the establishment of seed gardens for the mass production of seedlings to cater to the demand of high yielding planting material. Presently more than 50 per cent of seedling requirement is met from these combinations. Two more hybrids were evolved in 2004 by crossing Sri Lankan Tall x San Ramon (CRISL98) and Sri Lankan Green Dwarf x San Ramon (Kapruwana). A seed garden for the production of Tall x San Ramon alone was subsequently established for mass production of this particular hybrid. India maintains the world's largest repository of coconut germplasm with 400 collections (consisting of 268 indigenous and 132 exotic types) from 28 countries covering South Asia, South-East Asia, Caribbean Islands, Indonesian Islands, Pacific Ocean Islands, African countries, Bangladesh and Sri Lanka. Conservation and utilization of coconut biodiversity have resulted in development of 32 improved varieties, including 15 coconut hybrid varieties. The International Coconut gene bank for South Asia established at Kidu (Karnataka) is conserving 90 designated accessions.

In Sri Lanka systematic collection and conservation of coconut germ plasm programme initiated in 1983 which was intensified in 1994 and steps were taken to introduce exotic coconut germplasm from other coconut growing countries including India in 2002-2004. Under the germplasm collection programme, Coconut Research Institute, Sri Lanka identified a new dwarf with brown colour nuts, petioles and inflorescence in 1998 which was

later named as Sri Lanka Brown Dwarf (SBD). Evaluation and characterization of this variety showed that it was superior to other forms of dwarfs in the country in terms of nut number, kernel weight and tolerance to moisture stress. Therefore, crosses between Brown Dwarf x Sri Lanka Tall, its reciprocal and Brown Dwarf x San Ramon were made in 2003 with the objective of evolving other high yielding coconut hybrids with added qualification of high nut number and efficient water utilization. The hybrids were planted in four multi-locations during 2004 and 2005 representing different agro-ecological zones and in different soil types. These trials are in the 9th year and the recorded data has reportedly shown that crosses involving brown dwarf are promising and new coconut hybrids will be released to the growers in near future.

Breeding for Resistance

In India root wilt disease was first reported in 1882. The

etiological studies confirmed the disease of phytoplasma origin. Root wilt disease still evades a perfect control measure. But the production and productivity can be improved through proper management strategy. CPCRI has evolved different effective management strategies to contain the disease and to improve productivity of root wilt affected palms and gardens. Breeding for root wilt disease has resulted in a high yielding disease tolerant hybrid variety with Chowghat Green Dwarf as the female parent and West Coast Tall (WCT) as the male parent. This has been evaluated and released for the root wilt affected tracts under the name Kalpa Sankara. Chowghat Green Dwarf (CGD) and Malayan Green Dwarf (MGD) have been evaluated as root wilt resistant/tolerant varieties and have been released by the institute for cultivation in the root wilt affected tracts under the name Kalpasree and Kalparaksha respectively. Phenotypically healthy palms exhibiting tolerance to root wilt has



Sri Lanka Green Dwarf



Sri Lanka Green Brown



Chawghat Green Dwarf



Chawghat Yellow Dwarf



Sri Lanka Red Dwarf



Sri Lanka Yellow Dwarf

also been located in hot spot areas of the disease. Farmers collect seednuts from such 'Elite' palms.

In Sri Lanka a serious outbreak of phytoplasma disease similar to root wilt in India, hit the coconut population in the southern province of the country in 2006. Named after the first place of noticing the incidence, as Weligama Coconut Leaf Wilt Disease (WCLWD), this disease has changed the direction of the breeding programme. Developing WCLWD resistant coconut cultivars with the use of tolerant ones has been identified as the most appropriate and sustainable approach to manage the disease. The preliminary observation

observed lower susceptibility of Sri Lanka Green Dwarf to the WCLWD similar to the Chawghat Green Dwarf in India. Further a survey done in the area showed that there were resistant Sri Lanka Tall palms among the disease affected hotspot areas similar to Elite palms in root wilt hot spot areas. Therefore two experiments were planned and initiated first to screen the available coconut cultivars for tolerance to WCLWD and second to develop resistant hybrids between resistant tall palms and green dwarfs. Under the first experiment the coconut varieties/hybrids and cultivars were planted in the disease hot spot areas and

recorded the tolerance. The seedlings of different varieties expressed disease symptoms. The data are being collected to compare the resistance/susceptibility of the cultivars planted. Under the second experiment a breeding programme was conducted between healthy Sri Lanka Tall (SLT) from the hotspot area and Sri Lanka Green Dwarf previously identified as disease resistant, on par with the research carried out in India for developing Kalpasankara. Seedlings produced from these crosses will be evaluated in the field for the confirmation of the disease resistance.

When infestation of coconut mite became a serious menace in

Sri Lanka in late 1990's causing significant loss of yield, and when chemical and biological control measures were not very much effective, a breeding programme was started to evolve mite tolerant/resistant coconut cultivars as the best possible sustainable answer for coconut mite. In a study conducted at CRISL, coconut varieties, Gon thembili (GT), Sri Lanka Yellow dwarf (SLYD) and San Ramon (SR) were found presumably less susceptible to coconut mite. Thus these coconut varieties were recognized as prospective parents for developing new cross combinations for evaluating in mite infested areas to identify a new mite resistant/tolerant cultivar. Further it has been reported that the round shaped nuts are less susceptible to mite and hence Brazilian Green Dwarf was also used in the breeding programme. The crosses, GT x BGD, SR x BGD, DY x GT, SLT x BGD and BGD x GT were conducted under this programme and field trials are progressing to evolve mite resistant varieties.

The Magic Dwarfs

Coconut breeders all over the world till recently have mainly considered dwarf forms of coconut as combiners for production of inter-varietal hybrids. This attitude is slowly getting changed in many coconut growing countries. Dwarf coconuts have many useful attributes such as prolific bearing, and short stature by making easy for plucking fruits. Therefore, if a dwarf coconut variety can be improved to produce nuts of reasonable size to satisfy domestic culinary need while keeping its smaller stature, it has a great potential for small home gardens in urban areas where space for

coconut planting is getting reduced.

Sri Lanka currently has four local dwarf forms, viz., green, red, yellow and brown and two exotic forms, Cameroon Red Dwarf and Brazilian Green Dwarf. In India all available dwarf forms such as Chowghat Orange Dwarf (COD), Chowghat Green Dwarf (CGD), Malayan Yellow Dwarf (MYD), Malayan Green Dwarf (MGD), Malayan Orange Dwarf (MOD), and Gangabondam (GB) are being utilized as male or female parent in hybridization programme. COD has been found to exhibit a certain degree of resistance to mite infestation and this cultivar has been released as a variety suitable for tender nut purpose.

In India crossing Dwarf x Dwarf is also experimented and progenies have been planted in research stations for evaluation. Sri Lanka is also testing the performance of DxD for evolving a suitable cultivar for home gardens to satisfy daily culinary household needs. A crossing programme was initiated in 2008 and progeny planted in 2009. Two Urban Schemes are in vogue whereby 2-3 dwarf seedlings are supplied to house holders for planting in their limited land space for field testing the DxD hybrids. Here farmer or house owner himself becomes coconut breeder for experimenting.

Coconut Development Board in India has initiated a collaborative research for increasing the availability of hybrid seedlings of various combinations through academic institutions where post graduate courses in Botany, Zoology or Biotechnology are available. Colleges can identify mother palms of desirable Dwarfs in farmers' fields and can carry out



Kalpasankara - a cross between CGD and WCT

hybridization through skilled pollinators. This is in the context that hybrid seedling production from government farms does not satisfy the growing need of the farming community. Many academic institutions in Kerala, Tamil Nadu and Karnataka and a few NGOs have come forward to undertake research project. It is expected that hybrid seedlings from such project will be available by 2013/2014 planting season. Emulating the Sri Lankan programme India can also involve farmers in such programmes where farmer becomes the breeder. Our farmers should also rise to the occasion considering the need of the hour.

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