

# Collection and utilization of coconut germplasm in different regions of India

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## Introduction

Coconut (*Cocos nucifera* L.) is one of the most important tropical crops in the world, and is grown in more than 93 countries. Bestowed with most congenial agro climatic conditions, diverse soil types and abundant water resources, coconut cultivation in India is making inroads and the area under the crop attained more or less a linear growth pattern. In India there is distinct difference in pattern of distribution of coconut cultivation

The four southern states; Kerala, Karnataka, Tamil Nadu and Andhra Pradesh are the main coconut growing areas in the country which together account for 90% of area and 93 % in production. In other areas, coconut is not contiguously grown. Major portion of coconut comes from the West Coast comprising of Kerala, Karnataka and Maharashtra followed by the East Coast of Andhra Pradesh, Orissa, Tamil Nadu and Pondicherry. In non-traditional states like Bihar, Chhattisgarh, Gujarat, West Bengal, Assam, Tripura, Nagaland, Manipur, Meghalaya, Arunachal Pradesh and Islands of Andaman & Nicobar and Lakshadweep also coconut cultivation has gained momentum.

## Genetic resources in coconut

Coconut genetic resources have been traditionally collected and conserved in major coconut producing countries with the objective of using these to improve the genetic makeup of their existing cultivars. Selected germplasm are generally used as: planting material to improve the coconut productivity in the country or a region, test material to determine the phenotypic and genotypic characters of value and, population base for breeding superior hybrids/ varieties.



**Kalpa Samrudhi**

Based on their origin, coconut germplasms could be categorized into: traditional varieties or landraces, as exotic varieties introduced into the country, or as modern varieties or hybrids resulting from a national breeding effort. Most coconut producing countries have a mixed population of landraces and introduced hybrids/varieties. There are continuing efforts to further improve cultivars through mass selection and hybridization.

As breeding material, the coconut germplasm are generally grouped according to their growth habit. In addition, the differences in their mating behaviour give the breeders flexibility in designing various breeding schemes to achieve their desired coconut ideotypes. The STANTECH manual described the following major classification of coconut:

**1. Tall palms**, sometimes referred to as var. typical (Nar.), are essentially cross-pollinating and therefore considered to be heterozygous. They are slow maturing and flower 6-10 years after planting, and can grow to a height of 20-30 m. They have an average economic life of 60-70 years.

**2. Dwarf palms**, sometimes referred to as var. nana (Griff.), are normally self-pollinating and therefore considered to be homozygous. They are believed to be mutants from Tall types with short stature, 8-10 m when 20 years old. They begin bearing from the third year sometimes at less than 1 m stem height but have a short productive life of 30-40 years.

There are also rare 'intermediate types' which do not express the phenotype normally associated with either the Talls or the Dwarfs. Natural crosses between Tall and Dwarfs occur sporadically in traditional populations. In some instances, such open-pollinated hybrids may become fixed as 'semi-Talls', which have the same mating behaviour as Dwarfs but grow faster. In the South Pacific, there is also a Niu Leka Dwarf, which has all the characteristics of a Tall type coconut, except for its short stature. These intermediate types have a good potential in broadening the genetic base of the breeding population but their parental value has yet to be fully evaluated.

### Coconut cultivars in India

The tall cultivar is extensively grown throughout India, while the dwarf is grown mainly for parent material in hybrid seed production and for tender coconuts. The tall cultivar generally grown along the west coast is called West Coast Tall, and the cultivar grown along the east coast is called East Coast Tall.



The local talls such as Tiptur Tall, Lakshadweep Ordinary, Goan Tall and Sakhigopal also grown in both the coast. Chowghat Dwarf Orange, Chowghat Dwarf Green, Malayan Yellow Dwarf and Malayan Orange Dwarf are some of the dwarf cultivars grown in India. Gangabondam, a local semi dwarf variety from Andhra Pradesh is also cultivated in selected areas.

The genetic resources in coconut are widely exploited through selection and hybridization for a number of desirable traits and have resulted in the development of many varieties in India. Breeding efforts are mostly confined to conventional approaches such as mass selection and hybridization, besides attempts to use individual palm selection for novel traits. Its perennial nature, heterozygosity, long juvenile phase and lack of technologies for mass propagation of palms with targeted traits are the challenges in breeding efforts. The research on coconut in India is being carried out by the institutions under the Indian Council of Agricultural Research (CPCRI, Kasaragod and AICRP on Palms) and the State Agricultural Universities located in different coconut growing states.

### Central Plantation Crops Research Institute, Kasaragod

The Central Plantation Crops Research Institute (CPCRI) hosts the International Coconut Genebank for South Asia (ICG-SA). The field genebank in Kidu Farm, Karnataka, which is the ICG-SA field genebank. CPCRI maintains the world's largest assemblage of germplasm collection of coconut (comprising 401 accessions: 269 indigenous and 132 exotic). The exotic collections are from 28 countries of South Asia, South-East Asia, Africa, Caribbean Islands, Indian Ocean Islands and Pacific Ocean Islands are maintained by undertaking the planting and maintenance of the field genebank. The National

Bureau of Plant Genetic Resources (NBPGR), New Delhi, collaborates with CPCRI on cryopreservation activities. Varieties released by CPCRI, Kasaragod is listed below:

- Released Fourteen improved varieties of coconut (Chandra Kalpa, Kera Chandra, Chowghat Orange Dwarf, Kalpa Pratibha, KalpaDhenu, Kalpa Mitra, Kalparaksha, Kalpasree, Kalpatharu, Kalpa Jyothi, Kalpa Surya and Kalpa Haritha, Kalpa Sresht and Kalpa Shatabdi).
- Released Five high yielding hybrids of coconut - Chandra Sankara, Kera Sankara, Chandra Laksha, Kalpa Samrudhi and Kalpa Sankara.
- Dwarf varieties viz., Chowghat Orange Dwarf, Kalpa Jyothi, Kalpa Surya were released exclusively for tender coconut.
- Kalpa Pratibha, Kalpa Haritha, Kalpa Samrudhi, Chandra Sankara, Kalparaksha and Kalpasree were released as dual purpose varieties suitable for copra and tender nuts
- Chandra Kalpa, Kalpa Mitra, Kalpa Dhenu, Kalpa Pratibha Kalpatharu and Kalpa Samrudhi are relatively tolerant to drought.

### All India Coordinated Research Project on Palms (AICRPP)

All India Coordinated Research Project on Palms (AICRPP), has been an important contributor to the region's specific coconut research and development effort. The concept of AICRP on Palms came into existence in 1972 to carry out the location specific research, and to address the region specific problems. At present, the project is implemented in 30 centers with its headquarters at Kasaragod; 15 centers are conducting research on coconut, eight on oil palm, four on arecanut, four on palmyrah and seven on cocoa. The coordinating centers are located in 13 states and one union territory covering 13 State Agricultural University's, one Central Agricultural University and four ICAR institutes.

Germplasm collection and conservation plays a prime role in crop breeding as the very objective of the activity is to preserve the genetic diversity of a particular plant or genetic stock for its use at any time in future. Research efforts were undertaken to conserve and evaluate coconut germplasms; collect, conserve and evaluate local germplasm collections and evaluate elite genotypes from germplasms in multi-location trials.

A total of 112 ecotypes of coconut have been

collected from Assam, Chhattisgarh, Odisha, West Bengal, Karnataka, Tamil Nadu, Andhra Pradesh and Maharashtra for desired traits and conserved for further evaluation and deposited in National Active Germplasm Site, CPCRI, Kasaragod.

Table 1. Genetic resources maintained at AICRP on Palms centres:		
Name of the centre	Number of accessions maintained	Number registered with NBPGR (IC Nos.)
Aliyarnagar	12	610368-79
Ambajipeta	13	610306-18
Arsikere	20	610333-52
Bhubaneshwar	11	612457-67
Jagdapur	10	610323-32
Kahikuchi	15	610353-67
Mondouri	10	612447-56
Navsari	4	610319-22
Ratnagiri	12	599111-16 599994-9
Veppankulam	7	599263-69
Varieties developed by the AICRP on Palms centres		

Evaluation of coconut germplasm and hybrids for their performance in different agro-climatic regions is one of the priority areas of research under AICRP on Palms. The germplasm maintained at different centres are used for location specific breeding programmes. Based on the comparative performance in evaluation trials, 20 high yielding varieties/hybrids have been released since its inception. The features of these varieties/hybrids are presented in table 2.

### Conclusion

Considering the substantial number of coconut accessions conserved *in situ* and *ex situ* worldwide, the available genetic variability for breeding manipulation is tremendous but hardly used. Current breeding programmes are using very few of these available germplasm. The main problem appears to be the lack of complete characterization (morphological, physiological and molecular) of most of the conserved germplasm which would give an indication of their potential as breeding materials. Ultimately, the germplasm collection and utilization programme should be able to significantly increase the choice of hybrid development, by maximizing the use of available genetic resources for breeding purposes and improving the quality of the planting materials for farmers. ■

Table 2. Varieties/hybrids released from AICRP on palms through selection and hybridization from germplasms

Variety	Year of Release	Breeding Method	Parents	Important traits	Institute/ University
Pratap	1987	Selection	Banawali	Tall palm with semicircular canopy and green colour round shaped nuts. Commence flowering 7-8 years after planting 140 to 145: nuts/palm/year, Copra yield: 145 g/nut, 3.5. t/ha and Oil content of 68 %	Dr.BSKKV, Maharashtra
Godavari Ganga	1991	Hybruduation	ECT x GBGD	The palm comes to bearing in four years after planting. Has the potential of 140 nuts/palm/year. Copra content 150 g/nut and out turn of 2.79 t/ha.	APAU, Andhra Pradesh
Kamrupa	2001	Selection	Assam Green Tall	Gives an average yield of 17600 nuts/ha/year 101 nuts/palm/year. This cultivar yields 16.3 kg copra/palm/year leading to a copra yield of 2.86 tonnes/ha and tender nut water of 253ml. Nut water contains 5.16g/100 ml of total sugar and 2294 ppm of potassium.	AAU, Assam
ALR (CN) 1	2002	Selection	Arasampatti local	Nut characters: Small to medium sized , Oblong shaped , Green coloured , Average nut yield : 126 nuts / palm / year; Copra content : 131 g / nut; Copra yield : 16.5 kg / palm / year; Oil content : 66.5 %	TNAU, Tamil Nadu
Kalyani Coconut -1	2007	Selection	Jamaican Tall	It gives 14066 nuts/ha/year with an average yield 80 nuts/palm/year. The copra content is 154 g/nut with copra yield of 12.3 kg/palm/year. Tender nut quality of the variety is good with 350 ml of water, 4.9 % of total sugar content and high potassium (2347 ppm) content.	BCKV, West Bengal
Gauthami Ganga	2007	Selection	Gangabondam,	average nut yield of 80 to 90 nuts/palm/year. Dwarf palm with semi circular canopy with oblong shaped green colour fruits. Yields 12813 nuts/ha/year with copra content of 156.7g/nut and an oil content of 68%.	ANGRAU, Andhra Pradesh
Kera Keralam	2007	selection	West Coast Tall	It is found to be promising and adaptive to wide ranging cultivation zones; comes to flowering in 58 months. Yields 147 nuts/palm/year with irrigation. In east coast region of Tamil Nadu, it recorded higher nut yield by 19 to 48 % over the previously released varieties.	TNAU, Tamil Nadu
Konkan Bhatye Coconut Hybrid -1	2007	Hybrid	GBGD x ECT	Tall palm with semi- circular bearing at 66 months with green colour oval shaped fruit. This hybrid yields 122 nuts/palm/year (20300 nuts/ha/ year) with copra yield of 22.08 kg/palm/year It is resistance to stem bleeding diseases and moderately resistance to leaf blight and bud rot.	Dr.BSKKV, Maharashtra
Kera Bastar	2007	Selection	Fiji Tall	The nut yield ranges from 110 to 117 nuts/palm/year with a copra yield of 2.5 to 3.1 tonnes/ha. Widely adapted to different agro- climatic zones. Quantity of tender nut water is 332ml and total sugar content in tender nut is 6.2g/100 ml.	IGKV, Chhattisgarh
Kalpa Dhenu	2007	Selection	IND 006 (AGT)	It is a regular bearer, relatively tolerant to drought. The palms are tall, robust and bear large, green nuts. It commences flowering in 67 months after planting. The quantity of tender nut water is 290 ml/nut.. It produces an average yield of 15012 nuts/ha, copra yield of 37 q/ha and oil yield of 24 q/ha.	CPCRI, Kasaragod
Kalpa Prathiba	2007	Selection	IND 016 (CCT)	It is suitable for tender nut and copra. The variety is a regular bearer, relatively tolerant to drought. The nuts are large, round in shape and predominantly green in colour. The quantity of tender nut water is 448 ml/ nut. It produces an average yield 15874 nuts/ha, copra yield of 41 q/ha and oil yield of 27 q/ha.	CPCRI, Kasaragod
Kalpa Mitra	2007	Selection	IND 022 (JVT)	It is a regular bearer, relatively tolerant to drought and produces large, yellowish green, oval shaped nuts. The variety is suited for west coast region of the country and West Bengal. Suitable for ball copra. The quantity of tender nut water is 495 ml. It produces an average yield of 13973 nuts/ ha, copra yield of 34 q/ha and oil yield of 22 q/ ha.	CPCRI, Kasaragod
Kalpatharu	2009	Selection	Tiptur Tall	Suitable for ball copra production. The average yield of 20300 nuts/ ha, copra yield of 35 q/ha and oil yield of 25 q/h. Recommended for rain fed and irrigated regions of Karnataka, Tamil Nadu and Kerala states.	UHS, Karnataka
Kalpa Samrudhi	2009	Hybrid	MYD x WCT	High yielder (104 nuts/palm/year) with higher copra out turn (3.1 t/ha) and oil content (68.0%) has been recommended for release for the region by AICRP on Palms, Kahikuchi centre in collaboration with CPCRI, Kasaragod. The hybrid is semi-tall, precocious.	CPCRI, Kasaragod

Kalpa Jyothi	2012	Selection	IND 058 (MYD)	Dwarf variety with yellow fruits, higher average yield of 114 nuts per palm per year under rainfed conditions with estimated copra yield of over 16 kg per palm per year.	CPCRI, Kasaragod
Kalpa Surya	2012	Selection	IND 048 (MOD)	Dwarf with Orange fruits for tender nut purpose. The average yield is 123 nuts per palm per year under irrigated conditions with estimated copra out turn of 23 kg per palm per year.	CPCRI, Kasaragod
Kalpa Sreshta	2014	Hybrid	MYD x TPT	The mean yield is 167 nuts/palm/year, with estimated high copra out turn of 35.9 kg/palm/year or 6.28t/ha copra. The hybrid is suitable for tender nut purpose; ball copra purpose also.	CPCRI, Kasaragod
Vasista Ganga	2014	Hybrid	GBGD x PHOT	Found promising based on its precocity, higher nut yield (125 nuts/palm/year), copra output (21.9 kg/palm/year), oil content (69% and oil yield 15.1 kg/palm/year) with good tender nut water content (395 ml) and TSS (6.20Brix).	Dr. YSRHU, Andhra Pradesh
Abhaya Ganga	2014	Hybrid	GBGD x LCOT	High yielding, precocious; having heavy bunches with average nut yield (128 nuts/ palm/year), copra output 21.7 kg/palm/year, oil content 72 % and oil yield 15.5 g/palm/year).	Dr. YSRHU, Andhra Pradesh
Kalpa Ganga	2014	Hybrid	GBGD x FJT	Nut yield of 120 nuts/ palm/year. Copra out turn of 3386 kg /ha. Short stature and suitable for ball copra production.	UHS, Karnataka
VPM 5	2015	Hybrid	LCOT x CCNT	The mean nut yield of the hybrid during the stabilized bearing period was 161 nuts/palm/year, which is 62.6 and 43.8 and higher than ECT and VHC 1 respectively. It has a copra content of 149.8 gm/ nut and oil content of 70.0 % with higher quantity of tender nut water (368 ml /nut) of good quality (4.8 °brix TSS).	TNAU, Tamil Nadu

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