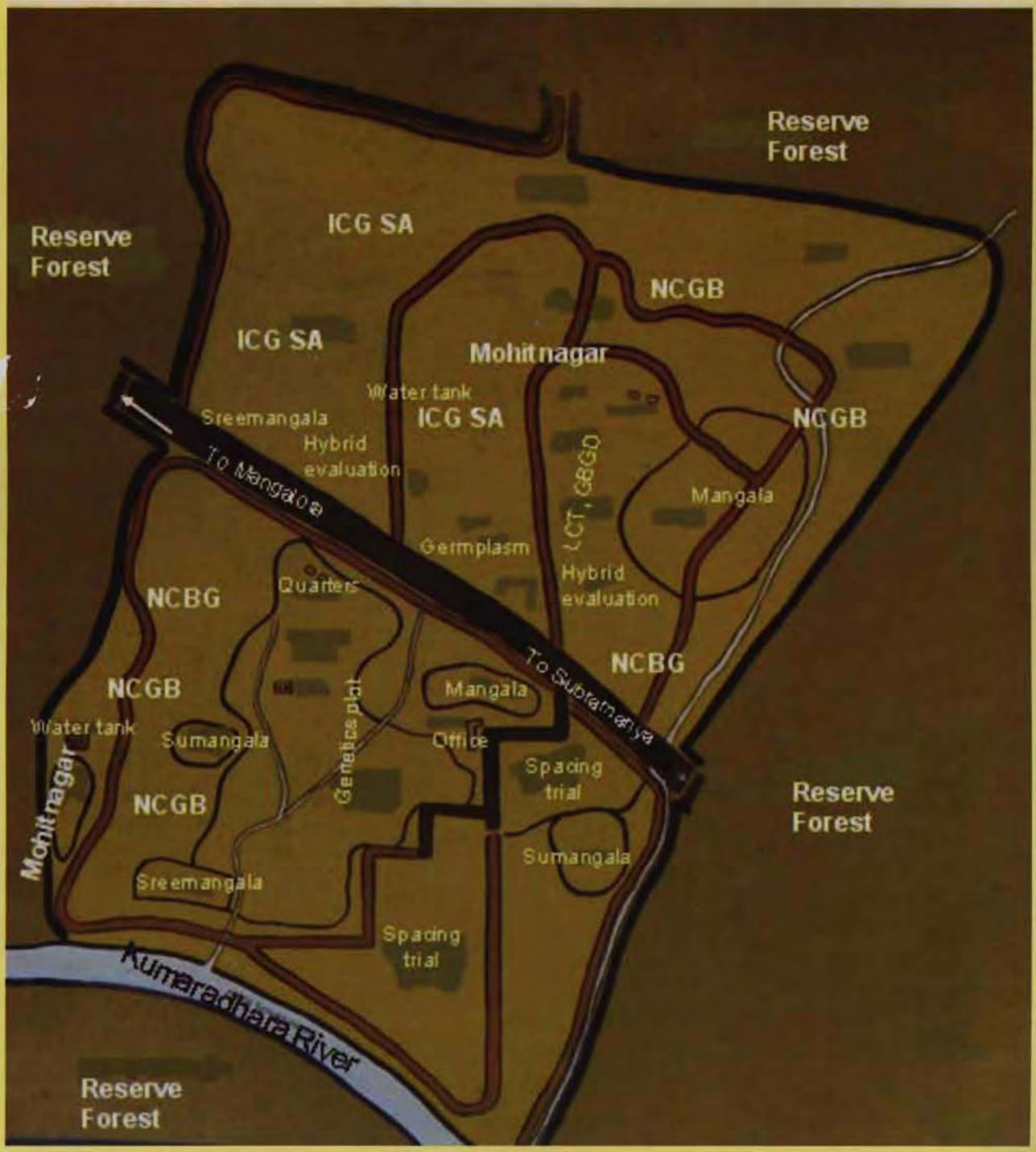
NATIONAL & INTERNATIONAL COCONUT GENE BANK AND NATIONAL SEED GARDEN FOR COCONUT, ARECANUT & COCOA

CENTRAL PLANTATION CROPS RESEARCH INSTITUTE
(Indian Council of Agricultural Research)
Research Centre, Kidu, Nettana - 574 230, Karnataka, India.

Lay out of the Research Centre



National & International Coconut Gene Bank and National Seed Garden for Coconut, Arecanut and Cocoa

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Front & Back cover:
CPCRI Research centre, Kidu

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PROFILE

This research centre was established under Central Plantation Crops Research Institute (CPCRI) in the year 1972 at Kidu with an aim to produce genetically superior planting materials of coconut, arecanut, cocoa and cashew. The centre was started as seed farm and later upgraded to Research Center in 2001. The centre began functioning with its office at Subramanya on 26.04.1972 with 60 ha of reserve forestland acquired on lease from government of Karnataka. Subsequently the office was shifted to the farm at Kidu on 15.8.1972. The farm was formally inaugurated on 14.04.1973 by Shri K. Shankar Alva (the then Co-operative Minister of Karnataka State) in a meeting presided over by Padmashri T.A. Pai. Another 60ha of land were added in December 1973. At present, the farm has 120 ha of lease land of which 92.5 ha are under coconut, 7.5 ha under arecanut, 0.5 ha under cashew and 2.5 ha under cocoa. International Coconut Gene Bank for South Asia under coconut genetic resources network (COGENT) was established at this centre in the year 1996. This centre has been renamed in 2001 as CPCRI Research centre and International Coconut Gene Bank for South Asia.

MANDATE

1. To produce breeders stock of parental materials in coconut, arecanut and cocoa.
2. To generate genetically superior planting materials of released varieties and promising cultivars of coconut, arecanut and cocoa.
3. To produce and supply of released hybrids of TxD and DxT combinations in coconut.
4. To establish compact blocks of released and promising cultivars of coconut and arecanut.
5. To establish clonal orchards of cocoa for hybrid seed production
6. To establish International Coconut Gene Bank for South Asia under COGENT of IPGRI.
7. To conserve the indigenous and exotic coconut collections in the field gene banks.
8. To function as experimental farm for the multidisciplinary research programmes of CPCRI

LOCATION

This centre is located in the Kidu Reserve Forest, Bilinele Village, Puttur Taluk, Dakshina Kannada District of Karnataka State. The centre is located at the 9th Km, on Subramanya-Uppinangadi road that connects NH-48 at Uppinangadi and the temple town Subramanya. It is 97 and 105 km from Mangalore and Kasaragod, respectively by road. Nearest railway station Subramanya road is 3 kms away from this centre connecting Mangalore city where the nearest air port is situated. The area is surrounded by reserve forest and is just about 25 kms from the Bisle Ghat forests known for wild life.

CLIMATE AND SOIL

The centre lies at latitude of 12.30°N and longitude of 75.20°E. Its altitude is 291.0m above the MSL. The average maximum temperature is 40°C in summer and 33°C in winter while the average minimum temperature is 24°C in summer and 18°C in winter. The annual rainfall varies between 2800mm and 3000mm. The soil is red laterite/ sandy laterite with high organic matter content.

AREA AND CROPS

The centre has total area of 120 hectares of which 102 hectares are under cultivation and 15 hectares used for other purposes. Coconut is grown in 92.5 ha, Arecanut in 7.5 ha, Cocoa in 2.5 ha and cashew in 0.5 ha. An additional area to the extent of 500 ha adjoining to the farm is proposed to be acquired from the Forest Department, Karnataka State for extending International Coconut Gene Bank for South Asia under COGENT of IPGRI and also for strengthening the seed production activities in coconut, araecanut and cocoa. Planting details of Coconut, Arecanut and Cocoa are depicted in the tables 1, 2 and 3 respectively.

A view of coconut plantations at Kidu

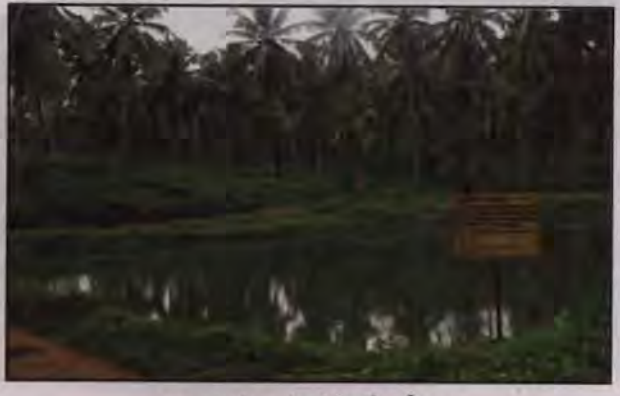
MILESTONES

- 1972: Acquisition of the land
- 1973: Construction of two pump-sheds for irrigation.
- 1974: Got electrical supply and obtained permission to draw water from Kumaradhara River.
- 1974: Construction of one store shed.
- 1975: Construction of 2 Nos. Type I quarter in new area.
- 1976: Construction of Semi-permanent office building.
- 1978: Casual labours absorbed in regular service.
- 1982: Construction of Tiffin room.
- 1984: Construction of 16 lakh ltrs. Capacity granite slab tank for irrigation; Small guest room and seven Nos. Type II quarter.
- 1989: Construction of Coconut shed and Granite slab tank of 7.5 lakh ltrs. capacity in new area.
- 1990: Procured instruments for establishing Agro-meteorological station; Scheme for production of planting materials in coconut.
- 1992: Scheme for production of planting materials in arecanut
- 1993: Purchase of Tractor for Farm.

- 1995: Purchase of Jeep (Mahindra & Mahindra).
- 1998: IPGRI/COGENT project to establish the International Coconut Gene Bank for South Asia at Kidu, Karnataka
- 1999: Two revolving fund schemes for producing quality-planting materials
- 2000: Installation of Solar powered electric fencing for new area; Installation of FAX machine, computer and laser printer.
- 2001: Installation of 20 KVA Generator.
- 2001: Construction of 2 Nos. Type II Residential quarters.
- 2001: Installation of sprinkler irrigation system to all Arecanut plots and micro-sprinkler system to 600 Coconut palms.
- 2001: Planting 2700 seedlings under ICG-SA program and installation of drip irrigation for the new seedlings.
- 2001: Elevation of the seed farm to research centre.
- 2002: Construction of Canteen and Store building.
- 2002: Construction of Type IV and Type III Residential quarters.
- 2002: Erection of agro-meteorological station.
- 2002: Planting of NCGB
- 2003: Installation of 72 BHP pump set for irrigation with drip irrigation for 2000 seedlings
- 2003: Blacktopping of farm roads, construction of drying yard.
- 2003: Purchase of lab equipments like BOD incubator, AC, Oven, pH meter etc.
- 2003: Purchase of computer and accessories, Camera
- 2004: Installation of solar street light systems in the farm.
- 2004: Planting of new collections in NCGB.
- 2004: Purchase of power tiller.
- 2004: Planting of Hirehalli Dwarf Arecanut compact block.
- 2005: Establishment of pollen processing lab.
- 2005: Installation of irrigation structures in new NCGB areas

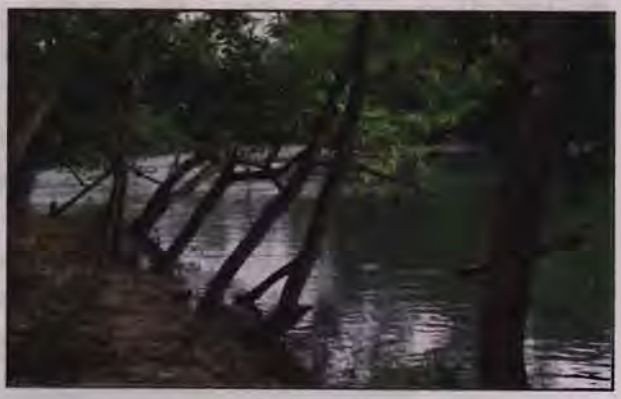
INFRASTRUCTURE

Old area of the farm (57.2 ha.) is protected with a barbed wire fencing while solar powered electric fencing protects the new area (62.8 ha.). The facilities of a tractor, two power tillers and a jeep are available for transportation of farm inputs and outputs, farm works and office use. The farm has a perennial source of water from the river Kumaradhara which is passing along the southern boundary of the farm. Two



Check dam inside the farm

granite slab lined water storage tanks are constructed at the high points of the farm, one each in new and old area, for irrigation from where the water flows to the most of the farm area on gravitation. two check dams have been constructed to conserve water flowing through the farm. Nine diesel and five electric pump sets are used for irrigation. Irrigation is by hoses/ sprinklers/ perforated aluminum pipes/ drips depending on need and area. 20 KVA Generator is installed to over come frequent power failure/load shedding. Agro-meteorology station is available inside the campus for recording weather data. The data is regularly sent to the Indian Meteorological department, Pune for further analysis. At present 9Nos, Type II quarters and 2Nos Type I Quarters are available. 2Nos, TypeIII & 1No Type IV quarters are under construction for the use of Officers &Staff. Two guestrooms are available within the campus. The office is functioning in a newly constructed store building temporarily and a permanent canteen building has been provided. Approximately 11-km mud road network is laid out for the smooth operation of Farm works besides 2km of road is black topped. This centre is headed by a Scientist-in-charge and has 2 administrative, 7 Technical staff including 1 Technical officer and 48 supporting staff members working. It is the highest revenue earner centre under the CPCRI umbrella. The sources of income are the sales of Arecanut seed nuts and seedlings; Coconut seed nuts and seedlings; Bulk Arecanut and Coconuts; Tender Coconuts; Cocoa; Cashew and other minor farm produces.



Kumaradhara River

The centre has laboratories for cytological works and pollen processing. A research microscope with image capturing unit, Electronic balance with 0.5 mg readability, Digital balance with 0.5g readability for cytological works. A pollen processing lab for facilitating hybrid seed production in coconut is established with all required equipments. Within this, the centre is equipped to supply coconut pollen throughout the country for effecting hybridization programmes in different localities.

SEED GARDEN OF COCONUT

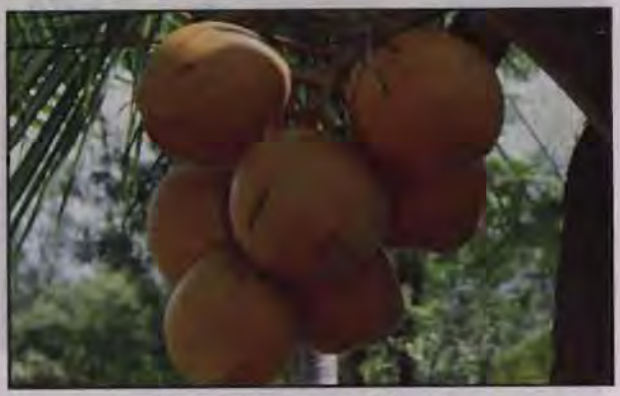
The centre has a well developed seed garden for production of quality seed in released varieties And hybrids of coconut. The major cultivars produced here are West Coast Tall (WCT), Chowghat Orange dwarf (COD), Andaman Ordinary (ADOT), East Coast Tall (ECT), Benaulim Tall (BENT), Laccadive Ordinary (LOT) and Gangabondam dwarf (GBGD). The seed nuts are collected from the selected mother palms of desirable traits and being distributed to the farmers. The general characteristics of the cultivars are presented here.

West Coast Tall (WCT)

West Coast Tall

This cultivar is in cultivation from very ancient times and considered as indigenous to the country. It is majestic in appearance, sturdy and yields economically for about 75 years or more. A fully grown palm of 27-30 years of age has an average of 36 functional leaves, with spherical or semispherical crown and shows 80 % regularity in bearing, producing 12-13 inflorescences per year. The average annual yield under rain fed condition ranges from 40-100 nuts per palm with a mean of 80 nuts. The WCT palms come to flowering in about 6-7 years under normal conditions. It has a copra content of 176 g/nut, the range being 135-200g. About 5000 to 7400 nuts are required to make one tonne of copra. The oil content of copra is 68%. The oil of this cultivar contains 4.1 % lauric acid and high saponification value (252.1). Hence it can be preferred for both edible purpose and soap manufacture. The WCT palms grow well in all types of soil and relatively tolerant to moisture stress in the soil. It is recommended for large scale cultivation in coastal regions of Kerala and Karnataka.

Chowghat Orange Dwarf (COD)



Chowghat Orange Dwarf

A dwarf cultivar has a thin stem with closely arranged leaf scars, a small compact crown with characteristic orange colour on leaf petioles, inflorescences and nuts. Comes to flowering in 3-4 years of planting with annual average yield of 65 nuts per palm. It has a mean copra content of 150g per nut and 6% oil. The cultivar is also known as "Gowrigathram" or "Chenthengu" and "Kenthali" in Kerala and Karnataka respectively. This cultivar was released by CPCRI in 1991 for tender nut purpose. The nut water is sweet with total sugar content of 7g/100ml. Sodium and Potassium contents in tender nut water are 20 and 2000 ppm respectively.

Andaman Ordinary (ADOT)

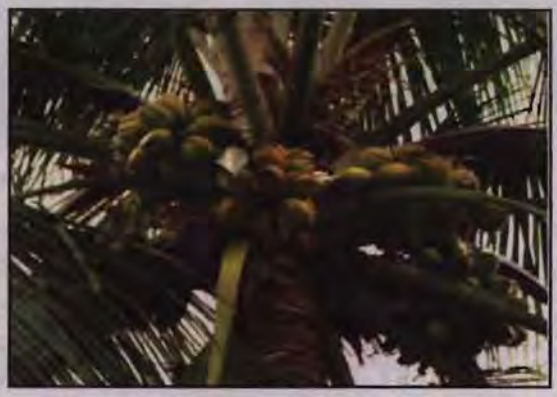
Largely grown in Andaman and Nicobar Islands. The palms are tall, massive and comparatively more vigorous than WCT in vegetative growth. The nuts are fairly large in size with average yield of 94 nuts per palm per year. The copra content is 169g per nut and nearly 5900 nuts are required to make one ton of copra. The oil content is 66%. This cultivar has been released as VPM 3 from Tamil Nadu Agricultural University.

East Coast Tall (ECT)

This is commonly grown in east coast of India. The palms take about 6-8 years for flowering with annual average yield of 70 nuts per palm. The nuts are smaller than those of WCT. The average copra content is 125g per nut with a range of 100-140 g per nut. The oil content is 64 %. About 7000 to 10000 nuts are required to make one ton of copra.

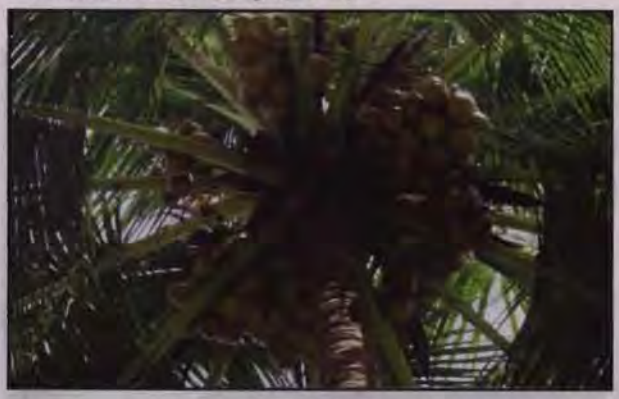
Benaulim Tall (BENT)

This is a cultivar from Goa, Konkan and Coastal Maharashtra. The palms resemble WCT but the nuts are small and round. The bunches are heavy, attractive with closely packed round nuts. The average nut yield is 150 per palm and the copra content is 152 g per nut with an oil of 64 %. This cultivar was released in 1987 by Konkan Krishi Vidyapeeth, Dapoli, Maharashtra under the name "Pratap" for commercial cultivation in Maharashtra state.



Benaulilm Tall

Laccadive Ordinary (LCT)



Laccadive Ordinary

Cultivar from Lakshadweep resembles WCT in growth habit and the nuts are comparatively smaller with three prominent ridges and triangular in shape. The annual nut yield varies from 87 to 178 nuts per palm with an average of 100 nuts with a copra content of 176 g per nut with 72% oil. The palm grows in all types of soil and it can withstand moisture stress. Released as "Chandrakalpa" by CPCRI in the year 1985 for large scale cultivation in Kerala, Karnataka, Andhra Pradesh and Maharashtra.

Gangabondam Dwarf (GBGD)

It is dwarf green cultivar mainly grown in East Godavari district of Andhra Pradesh, used for tender nut purpose. This cultivar has distinct and characteristic papaya shaped green nuts. Palms start bearing in 3-4 years with yield of 67 nuts per palm on an average. The copra content is 153 g per nut with 67 % oil. Because of its good combining ability, GBGD is used in making hybrid varieties as male parent.

Hybrids

The selected mother palms of the different cultivars are utilized for production of released hybrid combinations also. The hybrid combinations produced at CPCRI RC Kidu are as follows.

CHANDRASANKARA (COD x WCT): This hybrid is between COD x WCT and was released by CPCRI Kasaragod in 1985. It is a early bearing and high yielding hybrid with an average annual yield of 116 nuts per palm. The copra content is 215 g/nut.

CHANDRALAKSHA (LCT x COD): This is a tall x dwarf hybrid with an annual yield of 109 nuts per palm. This hybrid comes to bearing in about 6 years.

KERASANGARA (WCT x COD): This hybrid comes to bearing in 4-5 years and attains steady bearing by the 6th or 7th year after planting. The mean annual yield is 108 nuts/palm with a copra content of 187g/nut

LAKSHAGANGA (LCT x GBGD): This hybrid was released by Kerala Agricultural University. It comes to bearing in about 5 years. The mean yield is 108 nuts/palm/year and copra content is 195g/nut. The oil content is 70 percent.

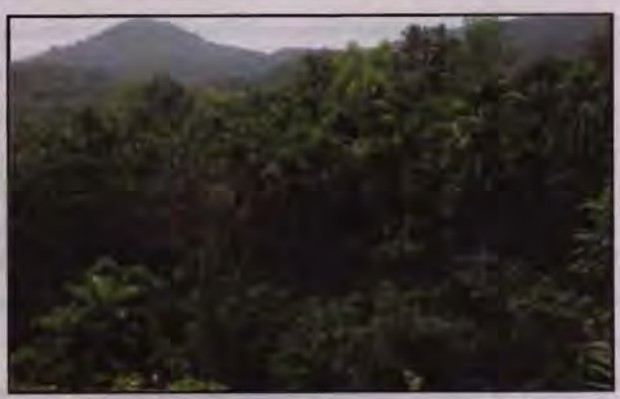
ANANDAGANGA (ADOT x GBGD): This is a hybrid between Andaman Ordinary and Gangabondam with an annual average yield of 95 nuts. The copra content is 216 g/nut and oil content is 68 percent.

KERAGANGA (WCT x GBGD): This is yet another hybrid released by KAU. The average annual yield is 100 nuts/palm. The copra content is 201 g/nut and oil content is 69 percent.

The coconut seed nut production, seedling production and distribution are presented in Table 4.

SEED GARDENS OF ARECANUT

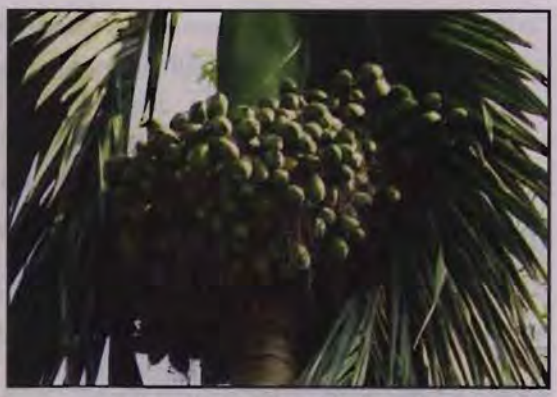
In Arecanut, four varieties have been released by CPCRI for commercial cultivation. They are Mangala, Sumangala, Sreemangala and Mohitnagar. Compact blocks of these four cultivars are maintained in isolation and seeds are produced and distributed to farmers. The characteristics of the areca cultivars are as follows.



View of Arecanut seed garden in isolation

Mangala

This is a selection from – with yield potential of kg chali per palm per year. Released from CPCRI and recommended for Karnataka and Kerala



A well set Mangala bunch

Sumangala

Selection from—. Average yield potential is 3.18 kg chali per palm per year. Released from CPCRI and suited for Karnataka and Kerala.

Sreemangala

Sreemangala

Selection from—. with average yield potential of 3.18 kg chali per palm per year. Released from CPCRI and suited for Karnataka and Kerala.

Mohitnagar

High yielding selection released from CPCRI suitable for West Bengal, Karnataka and Kerala with a yield potential of 3.67 kg chali per palm per year.

Mohitnagar

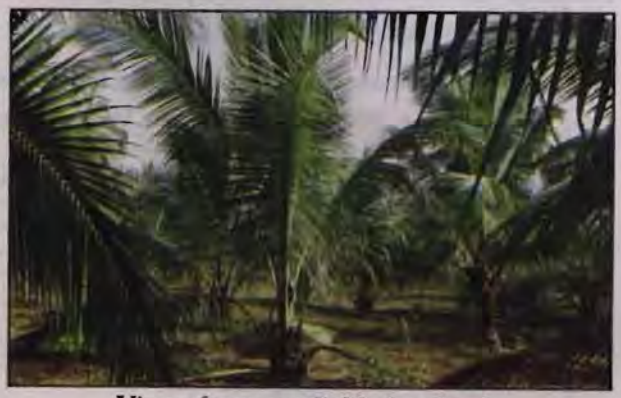
Besides these released high yielding varieties, a compact block of Hirahalli Dwarf has been planted in the year 2004 for production of Dwarf arecanut hybrids in future. Thereby the farm serves the generations with the changing technologies. The arecanut seed nut production, seedling production and distribution to farmers are presented in table 5.

Biclonal, triclonal and polyclonal orchards of Cocoa

High yielding clones of Cocoa was planted as biclonal, triclonal and polyclonal orchards for the production of hybrid cocoa pods. The hybrid cocoa pods are in high demand with the farmers. Besides, the centre supplies large quantities of cocoa scion material for the production of high yielding cocoa grafts at CPCRI RS, Vittal. The production and supply of cocoa seed pods and beans are presented in Table 6.

ESTABLISHMENT OF COCONUT FIELD GENE BANKS

International Coconut Gene Bank for South Asia (ICG SA):



View of cococut field gene bank

Maintaining genetic diversity is essential for the improvement of any crop and as such Coconut genetic diversity available in the form of different cultivars needs be assembled and conserved before it is lost due to selection pressure or natural calamities. By realizing this fact, the International Plant Genetic Resources Institute, Rome has developed a net work with several coconut growing member countries as International Coconut Genetic Resources Network (COGENT) for establishment of International Coconut Gene Bank in five different regions of the world with the following objectives.

1. To conserve rationally and regionally identified diversity.
2. To conserve internationally identified diversity.
3. To further assess the diversity, evaluate the performance of conserved germplasm and disseminate related information to coconut producing countries.
4. To make germplasm materials available to interested coconut producing countries in accordance with existing protocols and
5. To conduct research and training in relation to the above.

Accordingly, five sites in, India for South Asia (ICG-SA), Indonesia for South-East Asia (ICG-SEA), Papua New Guinea, for the South Pacific region (ICG-SPC), Cote d'Ivore for Africa and the Indian Ocean Region (ICG-AIO) and Brazil for Latin America and the Caribbean region were identified for the location of International Coconut Gene Banks. In India, the ICG SA is established at this farm in about 40 ha of land with all infrastructures for field management.

A large number of the coconut germplasm available at CPCRI has been multiplied and planted in the ICG-SA. Sixty-four Indian germplasm accessions have been planted in the ICG-SA since 1998 to 2005. This includes all the 49 Indian accessions in the list of designated germplasm under ICG SA project. 24 coconut accessions collected from six Pacific Ocean islands viz. Fiji, Papua New Guinea, American Samoa, Tonga, French Polynesia and Solomon islands, which has been maintained at World Coconut Germplasm Centre, Andaman also planted at this centre. In addition, exotic accessions collected as embryos from the Indian Ocean Islands of Mauritius (6 accessions), Madagascar (4 accessions) and Seychelles (5 accessions), Maldives (8 accessions), Comoros (5 accessions) and Reunion (3 accessions) were field planted at this centre after the culture of embryos *in vitro* for plantlet production. During 2004, 4 accessions which were collected from Sri Lanka,

Eleven accessions from Bangladesh were filed planted in ICG SA after embryo culture and nursery. Under the ICG SA project, 90 palms of each genotype has been planted for characterization, evaluation and utilization. Future aim of this project would be expanding the ICG with planting of 200 coconut accessions. The list of coconut collections conserved at this gene bank are as follows.

Exotic coconut accessions from Pacific Ocean islands planted at CPCRI RC and ICG SA, Kidu during 2004 brought from World Coconut Germplasm Centre, Andamans.

Sl. No	Name of the accession	Origin
1	Solomon Tall	Solomon Islands
2	Rennel tall	Solomon Islands
3	Fiji Tall	Fiji
4	Niu Drau	Fiji
5	Niu Lekha Dwarf	Fiji
6	Niu Balavu	Fiji
7	Samoan Tall	American Samoa
8	Niu Oma Dwarf	American Samoa
9	Tutiala Tall	American Samoa
10	Niu Ui	Tonga islands
11	Niu Tankave	Tonga islands
12	Niu Hako	Tonga islands
13	Tahiti Tall	French Polynesia
14	Pao pao Tall	French Polynesia
15	Local tall – Haepiti	French Polynesia
16	Bora Bora Tall	French Polynesia
17	Rangiroa Tall	French Polynesia
18	Hari Papua Dwarf	French Polynesia
19	Rangiroa (Tiputa) Tall	French Polynesia
20	Kiriwana Tall	Papua New Guinea
21	Muwa Tall	Papua New Guinea
22	Nikkore Dwarf	Papua New Guinea
23	Kaveing Tall	Papua New Guinea
24	Natava Tall	Papua New Guinea

List of CPCRI coconut collections planted in ICG SA during 1997 to 2002

Sl. No.	Name of Accession	Origin
1.	Andaman Giant	India
2.	Andaman Ordinary	India
3.	Andaman Ranguchan	India
4.	Arasampati Tall	India
5.	Auckchung	India
6.	Ayiramkachi	India
7.	Barajaguli Tall	India
8.	Benaulim Tall	India
9.	Blanchissuse	Trinidad
10.	Borneo	Borneo
11.	British Solomon Islands	Solomon Islands
12.	Calangute	India
13.	Cameroon Red Dwarf	Ivory Coast
14.	Campbell Bay	India
15.	Car Nicobar	India
16.	Ceylon Tall	Sri Lanka
17.	Chandan Nagar Green Tall	India
18.	Chowghat Green Dwarf	India
19.	Chowghat Orange Dwarf	India
20.	Cochin China	Vietnam
21.	East Coast tall	India
22.	Federated Malay States	Malaysia
23.	Fiji Rotuma	Fiji
24.	Fiji Tall	Fiji
25.	Ghaighatta Tall	India
26.	Guam I	Guam
27.	Jamaican Sanblas	Jamaica
28.	Java	Indonesia
29.	Kappadam	India
30.	Katchal	India
31.	Kenya Tall	Kenya

32.	Kimmai	India
33.	Kimmos	India
34.	King coconut	Sri Lanka
35.	Kulasekaram Yellow Dwarf	India
36.	Kulasekharam Green Dwarf	India
37.	Kulasekharam Orange Dwarf	India
38.	Laccadive Micro	India
39.	Laccadive Ordinary	India
40.	Lifou Tall	Lifou
41.	Malayan Green Dwarf	Malaysia
42.	Malayan Orange Dwarf	Malaysia
43.	Malayan Yellow Dwarf	Malaysia
44.	MAWA	Ivory Coast
45.	Nadora tall	India
46.	Niu Hako	Tonga
47.	Panama Tall	Panama
48.	Pao Pao	French Polynesia
49.	Philippines Lono	Philippines
50.	Philippines Ordinary	Philippines
51.	S.S. Apricot	Malaysia
52.	S.S. Green	Malaysia
53.	Sakhigopal	India
54.	San Ramon	Philippines
55.	Sendagan Tall	India
56.	Spicata	India
57.	St. Vincent	Trinidad and Tobaga
58.	Standard Kudat	Borneo
59.	Tamaloo	India
60.	Tinisera	India
61.	Tiptur Tall	India
62.	West African Tall	Ivory Coast
63.	West Coast Tall	India
64.	Zanzibar	Zanzibar

Exotic coconut germplasm imported as embryos and planted in ICG-SA during 2000-2005

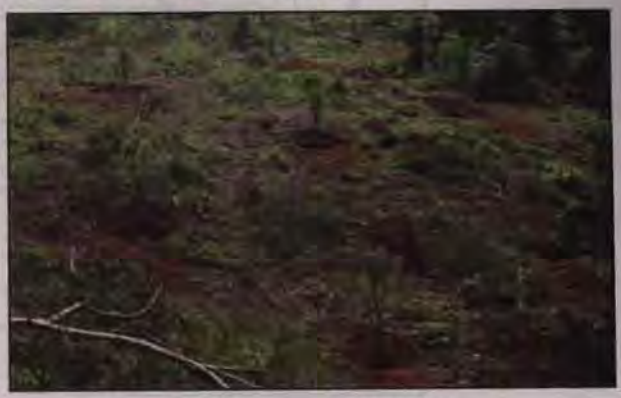
Sl. No.	Name of Accession	Origin
1.	Pemba Orange Dwarf	Mauritius
2.	Pemba Green Dwarf	Mauritius
3.	Pemba Red Tall	Mauritius
4.	Guelle Rose	Mauritius
5.	Sambava Tall	Madagascar
6.	West African Tall	Madagascar
7.	Sambava Green Tall	Madagascar
8.	Comoros Tall	Madagascar
9.	Coco LeRein Tall	Seychelles
10.	Coco LeHaut Tall	Seychelles
11.	Coco Bleu Tall	Seychelles
12.	Coco Raisin Tall	Seychelles
13.	Coco Gra Tall	Seychelles
14.	Comoros Tall	Comoros
15.	Comoros yellow dwarf	Comoros
16.	Comoros green Tall	Comoros
17.	Comoros Red Tall	Comoros
18.	Comoros Brown Tall	Comoros
19.	Coco Bleu	Reunion
20.	De La Reunion Tall	Reunion
21.	Coco Fesse	Reunion
22.	KDD Oblong Tall	Maldives
23.	KDD Yellowish Green Tall	Maldives
24.	King Kumbra (Hanimoodho)	Maldives
25.	Green Tall	Maldives
26.	Medium Round Tall (Hanimoodho)	Maldives
27.	Yellow Tall	Maldives
28.	Oblong Semi Tall (Hanimoodho)	Maldives
29.	Sri Lankan Red Dwarf	Sri Lanka
30.	Sri Lankan Yellow Dwarf	Sri Lanka
31.	Sri Lankan Green Dwarf	Sri Lanka
32.	Gonthembili	Sri Lanka
33.	Chinashukania Tall	Bangladesh
34.	Pubail Tall	Bangladesh
35.	Kayemkola Tall	Bangladesh
36.	Bagharpara Tall	Bangladesh
37.	Rupdia Tall	Bangladesh
38.	Khairtala Tall	Bangladesh
39.	BARI Narikel- I	Bangladesh
40.	BARI Narikel-II	Bangladesh
41.	Uzirpur Tall	Bangladesh
42.	Agailjhara Tall	Bangladesh

National Coconut Gene Bank (NCGB)

In order to collect and conserve the diverse indigenous coconut populations, a project under National Agricultural Technology Project on Plant Biodiversity was executed at CPCRI and sofar 212 accessions were collected from different states of the country through several exploration trips in the coconut growing zones of the country. These diverse and rare genotypes are being conserved in the field gene banks at this centre for further characterization and evaluation. The number of genotypes conserved from different states are as follows.

Indigenous Coconut germplasm conservation at NCGB of CPCRI (RC), Kidu (collected & planted from 2000-2005).

Place of collection	Total
Kerala	30
Tamil Nadu	7
Andhra Pradesh	5
Goa & Maharashtra	8
Orissa	14
West Bengal	12
Andaman & Nicobar Islands	58
Lakshadweep Islands	26
Assam	4
Total	164



Establishment of NCGB

In addition to the above 4 Sri Lankan collections, 11 Bangladesh collections and 24 pacific ocean collections have been planted in the field gene banks during 2004-2005 for further evaluation and utilisation in future breeding programmes.

OTHER RESEARCH ACHIEVEMENTS

1. Spacing trial experiment with 2359 WCT planted in 1972 resulted in the conclusion that the optimum spacing for planting coconut is 7.5 x 7.5 m. In the spacing trial about 1200 mother palms have been earmarked for production of quality seed nuts.
2. A new coconut collection of Sixty Gudanjali Dwarf seedlings was planted in July 1993 in a compact block to use them in future breeding programs.
3. Selected F1 and F2 progenies (220 nos.) were planted in August 1993 in order to study the heterosis in respect of economic traits and workout correlation between the seedling characters and adult palm traits.
4. Under the coconut germplasm collection and documentation program, 19 embryos of Indian Ocean accessions brought from WCGC, Andaman and cultured at the Head quarters CPCRI, Kasaragod have been planted in 1996. Another set of 46 embryo culture seedlings of 10 collections from Indian Ocean Islands was planted in 1999. In 2001, 30 Embryo culture seedlings of 10 accessions from Indian Ocean Islands were planted. In 2004 and 2005, four accessions from Srilanka and 11 accessions from Bangladesh has been field planted with embryo culture seedlings. The accession Coco Bleu from Seychelles has started flowering in the year 2004.

5. In October 1996 Coconut Hybrid Evaluation trial comprising of 144 seedlings of 6 different combinations of Tall and Dwarf were planted. Another hybrid evaluation trial with 216 seedlings of 9 combinations Dwarf and Tall was planted in 1998.
6. A new experiment on evaluation of Dwarf X Dwarf cross combinations planted in the year 2003 involving 8 dwarfs. Of which, six parents crossed in diallel mating design and the cross combinations are under evaluation.
7. Research on soil and water conservation using engineering measures on the production and productivity of coconut and unit area production concluded that, in slopes of 14 to 16 per cent, providing trenches with coconut husk and planting pineapple as border will reduce soil erosion, conserve soil moisture, reduce soil nutrient loss and increase the coconut yield even under rain fed conditions of coconut based cropping systems.

Soil and water conservation in coconut based cropping systems

8. Variability on the *Eriophyid* mite tolerant traits of coconut genotypes showed that COD has less incidence of mite and LCT has severe incidence of mite. The studies are in progress.

Chowghat Orange dwarf with lessmite incidence

9. Studies on the integrated weed management, showed the treatment – Application of Glyphosate is effective in checking the weeds.

10. A new compact block of Mohitnagar arecanut variety has been established by planting 1672 seedlings in 1994 in order to meet the heavy demand for planting material.

11. In order to study the drought tolerance in cocoa, Progeny Trial-V comprising of 18hybrid combinations involving high yielding clones and drought tolerant lines have been planted in July 1996. (Photo)

12. In Progeny Trial IV, nine hybrids and seven parents are under evaluation for high yield and drought tolerance. The cocoa cross II-69 X NC 29/66 showed promising trend by yielding 2.21 Kg of Drybean /tree in the 5th year of planting.

13. The flora of the gene bank area has been identified and documented for sharing information during germplasm exchange and to include the medicinal plants identified in the coconut cropping systems.

PROJECTS IN OPERATION

A. Institute projects

1. Collection, Conservation, Cataloguing and Evaluation of Coconut Germplasm

- Kidu serves as the field genebank for coconut in the country.
- Accessions collected from different part of the country are conserved here for further evaluation and utilisation

2. Genetical investigations and breeding for high yield in Coconut

- Two hybrid evaluation trials involving 15 combinations of dwarf and tall are in progress at Kidu.
- A field trial is ongoing in Kidu to study the heterosis and genetics of recombination.
- A Dwarf X Dwarf trial involving eight dwarf coconut cultivars is being evaluated.

3. **Comparative yield trial of cocoa clones**
   - Yield trial has been initiated in Kidu with nine clones.

4. **Variablity for eriophyid mite tolerant traits in coconut genotypes**
   - Seven coconut genotypes are being evaluated for the tolerant traits

B. Externally Funded projects

1. **Strengthening the capability of International Coconut gene Bank For South Asia (ADB)**
   - Under this programme designated germplasm from India and member countries (Sri Lanka and Bangladesh) are collected and conserved in the International Coconut Genebank, Kidu.

2. **Plant Biodiversity (Enrichment of National Coconut Germplasm collection from Lakshadweep and A&N Islands – NATP funded))**
   - National Coconut Gene bank is established at Kidu for planting collections made under this programme.
   - 164 accessions are being established in the NCGB.

3. **Development and Evaluation of Soil and Water Conservation Measures and Land use Systems for Sustainable Crop Production in Western Ghats of Coastal Region (NATP)**
   - Bioengineering measures for checking soil erosion and run off by different treatments using multislot devisor.
   - Soil and water conservation by constructing contour benches, contour bunds etc.
   - Project concluded and the plot maintained for demonstrating to visiting farmers.

FUTURE THRUSTS

1. Establishment of compact parental blocks of identified promising cultivars of coconut, arecanut and cocoa so that the farm will act as a gene pool of valuable germplasm for the whole country.
2. Selection and inter-se pollination to generate uniform progenies of promising cultivars of coconut for future use in generating new hybrid combinations.
3. Play a major role in quality planting material production in coconut, arecanut & cocoa under the National Seed Project. Production of planting materials about 10 lakhs arecanut and 2 lakhs coconut and 0.5 lakhs cocoa will be the target.
4. Strengthening the hybrid seed production to meet the increasing demand among farmers for hybrid coconuts.
5. Strengthen International Coconut Gene Bank with addition of more than 200 newer diverse coconut accessions by extending the area of the centre. Upgrade the ICG SA as a International Centre for Advanced studies on Coconut with the collaboration of International Coconut community.
6. Strengthen National Coconut Gene Bank by conserving the unexploited diversity available in the country.
7. Strengthen scientific manpower and improve laboratory facilities
8. Strengthen manpower in all the categories by appointing at least fifty supporting staff, three technical and two administrative personnel to cope with the present workload.

9. Black topping of farm roads to facilitate the farm mobility and managing it at international standards.
10. Strengthening pollen-processing laboratory and increasing the capacity of pollen supply to different agencies across the country for coconut hybridization programmes.
11. Establish tissue culture / embryo culture/ molecular biology laboratories to cater to the research needs of Gene Bank.
12. Construction of laboratory cum administrative building.
13. Facilitating the elevation of the Research Center to the status of Regional Station under CPCRI for advanced studies in coconut.

Table 1 – DETAILS OF COCONUT PLOTS

Plot	Area (Ha)	Variety*	Year Of Planting	No. Of Palms Planted	Existing Palms
GENETICS (Old Block)	20	WCT & Dwarf	1972 & 74	2613+2151	1672+1029
SPACING TRIAL	10	WCT	1972	2259	1636
GUDANJALI (in ST)	0.34	Gudanjali	1993	60	31
HYBRID TRIAL (in ST)	1.4	Hybrids	1996	240	188
EMBRYO CULTURED (in ST)	0.4	Exotic collections	1996, 1999 & 2001	95	88
LO, GB	20	LO & GB	1974	3242(LO) + 787(GB)	461+234
ICGB-SA	30	Diff. accessions	1997, 99 & 2001	4714	3741
F_1 & F_2 (in LO)	1.25	Diff. crosses	1993	220	175
ANDAMAN ORDINARY	1.8	AO	1991	323	254
MYD	1.2	MYD	1986	205	56
EAST COAST TALL (ECT)	1.40	ECT	1988	250	50
BENOLIUM	0.70	Benolium	1991	185	22
GERMPLASM (NGB)	1.4	Diff. accessions	1997	238	209
HET I	0.6	Hybrids	1998	216	180
HET II	1.02	Hybrids	1998	180	51
LO COMPACT BLOCK	1.02	LO	1998	180	158
GB COMPACT BLOCK	1.02	GB	1998	180	102
NCGB	20.00	164 accessions	2002,2003,2004, 2005	3400	3100
Dwarf X Dwarf hybrid trial	1.75	Hybrids	2003	202	185

[Lack of irrigation facility and insufficiency of protection from wild animals caused high mortality in the initial years of coconut planting.]

*Variety Details

Genetics: WCT, COD, CGD, MOD, MYD, MGD, KGD & GB

HET I (LO & GB plot): AO x CGD, PO x CGD, CGD x PO, LO x CGD, CGD x LO, WCT x CGD, CRD x WCT, WCT x CRD, COD x WCT, LO Self, WCT Self, AO Self

HET II: WCT x PRATAP, PRATAP x WCT, T.T x WCT, WCT x T.T, PO x WCT, WCT x PO, KOPPADAM x PRATAP, PRATAP x KOPPADAM, WCT x COD, COD x WCT

HET (F_1 & F_2): White F_2 (DxT), Yellow F_2 (DxT), Red F_2 (TxD), Green F_2 (TxD), DxT F_1 & TxD F_1

HET (In Spacing Trail): WAT x RET, WAT x RGT, WAT x NAT, PHO x GB, COD x WCT, WCT x COD and Self-pollinated progenies of Spicata, WCT, CGD, LO, CGD & WCT

Germplasm: Karkar, Carnicobar, Panama Tall, Guam-1, Seychelles, Pattukottai Green Tall, New Gunea, Zanzibar, Malayan Tall, Borneo, Standard Kudat, Fiji Rotuma, WAT, Jamaica Sanblass, Kerala collections and Lakshadweep collections

ICGB-SA: Given in the Table

NCGB: 164 Collections from different states of India, Pacific Ocean islands collections from WCGC- Andaman, Sri Lanka and Bangladesh

Dwarf X Dwarf Hybrid Trial : Cross combinations involving COD, GBGD, CRD, MYD, MOD, CGD, NLD, Hari Papua Dwarf along with parents.

Table 2 – DETAILS OF ARECANUT PLOTS

Variety	Area (Ha)	Year Of Planting	No. Of Palms Planted	Existing Palms
MANGALA*	0.73	1972	990	740
MANGALA (Inter se)	1.02	1986	1078+242	677
SUMANGALA (A)	0.60	1972	812	560
SUMANGALA (B)	0.82	1983 & 85	1121	994
SREE MANGALA (A)	0.60	1972 & 85	809	542
SREE MANGALA (B)	0.38	1986	509	495
SAIGON	0.66	1972 & 84	455	235
MOHITNAGAR	1.02	1983 & 85	1393	1232
MOHITNAGAR *(Inter se)*	1.28	1994	1671	1671
HIRAHALLI DWARF	0.25	2004	50	50

* About 600 seedlings replanted during 2005

Table 3 – DETAILS OF COCOA PLOTS

Plot	Area (Ha)	Variety/ Accession	Year Of Planting	No. Of Plants Planted
Polyclonal Orchards (New area)	0.80	1-14 1-56 III-105 NC 42/94	1986 1986 1986 1986	95 105 99 101
Biclonal Orchards New Area	0.40	NC 42/94 1-56	1987 1987	109 102
Mangala (Inter crop)		SEA-6 ICS-6	1987 1987	111 109
Sumangala B (Inter crop)		1-56 III-105	1987 1987	87 122
Sreemangala A (Inter crop)		1-14 NC 42/94	1987 1987	107 112
Mohitnagar A (Inter crop)		1-14 1-56	1987 1987	115 105
Sreemangala B (Inter crop)		1-14 N-20	1991 1991	118 126
Progeny Trial IV Sumangala A (Inter crop)		9 – Hybrids 7 – Parents	1991	372
Progeny Trial V Sumangala B (Inter crop)		18 Crosses	1996	220
Comparative yield trial of elite cocoa clones	0. 20	9 clones	2002	120

Table 4 - COCONUT PLANTING MATERIALS PRODUCTION AND DISTRIBUTION

Year	Particulars	Production	Distribution	Sown
1994-95	seed nuts	51522	5696	14534
	seedlings	12571	9065	
1995-96	seed nuts	56984	49201	3126
	seedlings	9284	4819	
1996-97	seed nuts	56821	35928	1064
	seedlings	2183	2135	
1997-98	seed nuts	29860	1536	4151
	seedlings	999	1943	
1998-99	seed nuts	52534	45811	4886
	seedlings	2834	4236	
1999-2000	seed nuts	35558	22975	7445
	seedlings	3524	3389	
2000-2001	seed nuts	68311	51286	12344
	seedlings	5329	4126	324 (planted)
2001-2002	seed nuts	72,818	60,354	7303
	seedlings	7979	4908	
2002-2003	seed nuts	25970	3486	9281
	seedlings	4488	6543	
2003-2004	seed nuts			8175
	seedlings			
2004-2005	seed nuts	25918	13744	10532
	seedlings	5159	4915	
2005-2006	seed nuts	62487	45207	13164
	seedlings	8134	7357	

Table 5 - ARECANUT PLANTING MATERIALS PRODUCTION AND DISTRIBUTION

Year	Seed nuts		Sprouts / Seedlings	
	Production	Distribution	Production	Distribution
1994-95	*6,495,25*	*6,08,100*	*51193*	*49815*
1995-96	*5,64,607*	*3,32,107*	*27,064*	*27,064*
1996-97	*4,91,630*	*4,62,680*	*15,908*	*15,908*
1997-98	*4,65,900*	*4,38,850*	*23762*	*23427*
1998-99	*4,84,142*	*4,68,714*	*21,441*	*26,151*
1999 - 2000	*7,36,352*	*6,89,427*	*25,155*	*25,155*
2000 – 2001	*6,65,443*	*6,09,263*	*37,899*	*36,349*
2001 - 2002	*1,56,507 + 12,344**	*1,55,912 + 1975*	*40,974*	*12,552*
2002 - 2003	*1,55,354*	*1,45,104*	*12,660*	*22,195*
2004 - 2005	*2,60,511*	*2,22,521*	*11,583*	*11,583*
2005 – 2006	*1,50,716*	*1,31,218*	*29,969*	*27,969*

* + inter se seed nuts

Table 6 – COCOA SEED BEAN AND BULK PRODUCTION

Year	Seed Pods (No.S)	Bulk (Kg)
1995 - 1996	5851	1407 (Beans)
1996 - 1997	8496	707 (Beans)
1997 - 1998	5665	722.8 (Beans)
1998 - 1999	7168	347 (Beans)
1999 - 2000	504	9,782 (Cocoa pods)
2000 – 01	1685	14,618 (Cocoa pods)
2001 - 2002	7,547	7,452 (Cocoa pods)
2002-2003	3492	3,043 Kg
2003-2004	-	8436 Kg
2004-2005	1927	4902 Kg
2005-2006	56	7648 Kg

Table 7 - PRODUCTION OF BULK COCONUT

Year	Bulk	Puny coconuts	Tender Nuts	Immature Fallen	Total
1995 - 96	1,55,268		2054	842	1,58,164
1996 - 97	1,29,786		1822	1632	1,33,240
1997 - 98	2,23,744		6185	459	2,30,386
1998 - 99	2,29,476		3601	232	2,33,309
1999 - 2000	1,14,689		13,882	588	1,29,159
2000 - 2001	2,19,126		25,275	773	2,45,174
2001 - 2002	2,22,923		20,467	240	2,43,630
2002-2003	2,05,692	16,046	3,486	-	2,25,224
2003-2004	1,93,111	55,489	2,341	-	2,50,941
2004-2005	1,78,887	73,995	1,738	-	2,54,620
2005-2006	1,75,764	86,111	1318	-	2,63,193

Table 8 – ARECANUT PRODUCTION

Year	Ripe Nuts Bulk (Kg)
1995 - 1996	23,063
1996 - 1997	26,525
1997 - 1998	27,622
1998 - 1999	18,955
1999 - 2000	21,561
2000 - 2001	39,281
2001 - 2002	47,003
2003 - 2004	21,168 (Dried unhusked)
2004 - 2005	15,838 (Dried unhusked)
2005 - 2006	8,500 (Dried unhusked)

Table 9 – FINANCIAL STATEMENT

Year	Revenue (In Rs.)	Expenditure (In Rs.)		
		Plan	Non-plan	Total
2005-2006	26,79,041/-	9,28,816/-	33,19,541/-*	42,48,357/-
2004-2005	31,21,793/-	3,43,027/-	25,16,519/-*	28,59,546/-
2003-2004	28,79,885/-	9,28,760/-	28,12,269/-*	37,41,029/-
2002-2003	21,84,954/-	6,60,322/-	45,53,885/-	52,14,207/-
2001-2002	25,96,169/-	15,24,474/-	19,42,303/-	34,66,777/-
2000-2001	35,21,839/-	10,96,603/-	16,61,379/-	27,57,982/-
1999-2000	34,88,893/-	14,98,847/-	9,11,314/-	24,10,161/-
1998-1999	28,07,298/-	12,28,591/-	2,06,989/-	14,35,580/-
1997-1998	23,75,758/-	8,64,005/-	24,706/-	8,88,711/-
1996-1997	17,23,508/-	4,63,218/-	2,96,187/-	7,59,405/-
1995-1996	19,89,684/-	8,86,705/	1,47,680/-	10,34,385/
1994-1995	16,08,226/-	6,60,088/-	1,55,641/-	8,15,729/-
1993-1994	10,07,472/-	7,25,000/-	2,00,000/-	9,25,000/-
1992-1993	8,05,138/-	92,487/-	3,30,000/-	4,22,487/-
1991-1992	10,17,415/-	6,89,000/-	1,50,000/-	8,39,000/-
1990-1991	5,92,695/-	1,33,000/-	1,67,500/-	3,00,500/-

* Exculding establishment charges around Rs.26,00,000 per annum.

PERSONS CONTRIBUTED TO THE DEVELOPMENT OF THE CENTRE

Directors

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Dr. M. K. Nair
Dr. K. U. K. Nampoothiri
Dr. V. Rajagopal

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Dr. R. V. Pillai
Dr. R. Dhanapal
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Dr. V. A. Parthasarathy
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Shri.Balappa
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Shri.Venkataramana
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Kum.Bhavani.N
Smt.Chandravathi.S
Smt.Chanravathi.B
Smt.Chennakka
Smt.Girija
Smt.Komalangi
Smt.Lolakshi
Smt.Mohini
Smt.Povamma
Smt.Prema Bai
Smt.Rukmini.M
Smt.Rukmini.S
Smt.Shivamma
Smt.Sundari
Smt.Susheela.S
Smt.Susheela.T

Rain fall data of C.P.C.R.I Research Centre, Kidu

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Jan.	-	-	23	33	3	-	-	-	-	-	-	-	20	13	8	-	-	-	29	-	-	-	-	-
Feb.	-	-	10	-	-	-	7	-	-	-	1	-	-	-	11	-	-	1	-	-	158	-	-	-
March	-	-	211	7	54	-	-	55	-	40	-	-	13	31	12	47	7	-	-	-	-	1	51	-
April	12	-	220	27	32	31	10	63	18	101	33	50	125	45	90	56	64	17	118	55	137	139	139	145
May	419	163	-	149	21	155	26	58	296	111	98	169	53	191	11	109	21	327	77	97	162	102	378	75
June	935	438	1404	1154	1113	522	147	571	689	665	625	384	837	307	538	540	612	466	620	621	680	859	783	920
July	1224	1338	1462	1788	1031	1040	953	762	705	954	738	804	1417	937	737	1035	915	976	538	855	850	1012	1002	2080
August	1288	1477	976	1109	1056	712	786	745	851	706	695	696	692	569	591	848	688	513	605	675	680	1053	1107	1150
Sep.	308	761	357	422	753	412	351	245	136	206	434	208	182	286	396	153	419	246	360	268	308	230	159	704
Oct.	264	381	317	145	339	814	234	128	273	176	168	371	263	85	290	176	247	551	252	306	266	327	302	514
Nov.	37	49	32	246	243	21	34	59	81	101	125	16	53	139	97	115	131	62	13	151	151	2	101	117
Dec.	-	90	-	54	18	0	-	-	-	-	-	89	-	-	22	59	14	-	16	1	-	-	-	-

View of Administrative office and Farm office

Trapezoidal water storage tank

A view of newly planted coconut germplasm

Clonal orchard of Cocoa

Arecanut seed production plot