ICG - SAME APPRAISAL

BACKGROUND

The International Coconut Genebank for designated of South Asia and Middle East (ICG-SAME), is located at the Central Plantation Crops Research Institute, Research Centre, Kidu, Karnataka, India. The tripartite agreement between GOI-FAO-IPGRI, for hosting the ICG-SA, was signed by the Director General, Indian Council of Agricultural Research on behalf of Government of India on 30.10.1998. ICG-SAME conserves about 49 designated germplasm, which are regenerated from Indian germplasm through controlled pollination. In addition, ICG-SAME conserves accessions from regional member countries viz., 10 accessions from Bangladesh and 4 accessions from Sri Lanka. Further, representative germplasm of the Indian Ocean Islands is also conserved, namely one accession from Reunion and four accessions each from Mauritius, Seychelles, Comoros and Reunion.

STATUS AND MANAGEMENT

In terms of land ownership, the ICG location is leased land with a total area of 121 and 23.5 hectares for research trials belonging to the Forest Department with no access of perpetuity and subject to renewal as per agreement. Maintenance of the ICG is under CPCRI under the auspices of ICAR. There are 4 technical staff and two scientists in-charge of the activities in the genebank with 10 part time technical support staff. Maintenance support staff and administrative personnel are also available with 29 persons on a regular support and 40 seasonal hired labor.

The COGENT, when functioning under Bioversity International (Now under ICC), established five International Gene Banks (ICGs) across the Globe in 1999 designating five member countries as the “Host Country” for each five ICGs, namely;

a. ICG for South East and East Asia in Indonesia
b. ICG for South Asia and Middle East in India
c. ICG for South Pacific in PNG
d. ICG for Africa & Indian Ocean in Ivory Coast
e. ICG for Latin America & Caribbean in Brazil

The objective of these ICGs is to protect and conserve coconut germplasm for future generations.

An agreement has been signed between the host countries of the ICGs, the IPGRI and the FAO, placing coconut germplasm collections under the auspices of FAO (Annexure 01). Each ICGs has been assigned its member countries, out of the 35 member countries of COGENT depending on the geographical location of the countries in the world map. The list of member countries assigned to each ICG is given in the agreement.

Further to the above agreement, another agreement has also been signed between COGENT and its member counties on the providing/sharing of germplasm to their designated ICGs. This agreement needs to be renewed, as the agreement signed previously have automatically been expired after the COGENT was moved from Bioversity International to ICC in year 2019.

More than 1,000 coconut accessions representing more than 400 cultivars are now conserved within these international coconut field gene banks (ICGs) and in 19 other national coconut genebanks (NCGs) established by COGENT member countries across the world.

COGENT has been conducting gene bank appraisals, in order to assess their hosting agreement status, collection status as per the agreement, general maintenance status of the ICG, services & use of ICG, and future targets and work plans.

The first ICG appraisal of this series has been conducted and completed in September 2019 for the International Coconut Genebank for South Pacific (ICG-SP) in Papua New Guinea (PNG) and the second ICG appraisal was organised for the International Coconut Genebank for Africa and Indian Ocean (ICG-AIO) in January 2021. The corresponding appraisal reports are being finalized. For this year, the technical appraisal for ICG-SEA in Manado, North Sulawesi, Indonesia was conducted from 28th February to 15th March, 2022. Then followed by the ICG-LAC appraisal was conducted in Aracaju from April 09 to 17, 2022. The last ICG which was appraised was the ICG for South Asia and Middle East in Kasaaragod, Kerala, India from 21st to 23rd of May 2022.

The designated authority for the establishment, maintenance and exchange of coconut germplasm of the ICG-SAME in India is the Central Plantation Crop Research Institute (IPCRI), located in Kasaragod, India. CPCRI is one of the leading research institution designated to carry out coconut reserch under the Indian Council of Agrcutural Resarch (ICAR).

The following three members of the Appraisal Team physically participated in the appraisal mission for the ICG-SAME are the followung technical team namely:

1. **Dr. Lalith Parera**, Additional Director/ Coconut Breeder, Coconut Research Institute of Sri Lanka (lalithperera1234@yahoo.com)
2. **Mr. Vincent Johnson**, Former COGENT Coordinator, Bioversity International, France
3. **Ms. Mridula Kottekate**, Assistant Director/ICC (IPM Specialist)
4. **Ms. Erlene Manohar**, COGENT Coordinator (Plant Pathologist/Socioeconomist), a retired Deputy Administrator for Research and Development, Philippine Coconut Authority, Philippines in 2021.

Figure 1: The Appraisal team visited Kidu Gene Bank collection with the curator Dr. Niral (4th from left) and Executive Director of ICC, Dr. Jelfina Alouw (4th from left)

The team was assisted by the staff of the ICC, COGENT, Director and the Staff of CPCRI and the Staff of the Research Centre, Kidu. (Lists of participants to the meeting and field visit are attached, Annexure 2).

APPRAISAL PROCESS

1. Field visit of the in Appraisal Team in Kidu Research Centre of the CPCRI where ICG site is located.
2. Preliminary meeting was held with the Director/CPCRI, Curator of the ICG, Other research staff from the CPCRI main research station and with the Officer-In-Change of the Kidu Research Centre and his staff. Director/CPCRI, Curator/ICG and OIC/Kidu Research Centre with the detailed presentation outlining the research programme & activities of CPCRI (gene bank establishment history & present status, gene bank activities, data collection procedures, seed production programme, infrastructure facilities available, funding facilities and limitations in long-term maintenance of the ICG)
3. Appraisal team field observations of the ICG site on the conserved accession, its performances, field agronomic practices, pest & disease monitoring, other infrastructure facilities available, other national gene bank sites in Kidu, the seed production areas. breeding experiments, pollen processing facility and irrigation facility.
4. The appraisal team had focused group discussions in the field with the Director and other Staff of the CPCRI, ICG SAME Curator, Officer In-charge & Technical and Field staff of the of the Kidu Research Centre and Technical Staff of Pollen Processing Laboratory. The name boards displaying the variety names and other details established in the filed were taken as the proof of varieties planted in the Kidu ICG.

Figure 2: Director/CPCR making the presentation at the Kudu Auditorium

Figure 3: Part of the International gene bank coconut germplasm collection at Kidu Research Centre (CPCRI)

On the final day of the appraisal, the appraisal team, Executive Director of ICC, & Assistant Director of ICC, COGENT Coordinators (Ms. Erlene Manohar and Mr. Vincent Jonson via Zoom) had half a day session at a round table meeting at the Hotel Gold Finch In Mangalore and discussed the observations of the appraisal team with the research team of the ICG-SAME for additional information and further clarifications as exit conference of the appraisal process. The appraisal team gathered sufficient information and received clarifications through question-and-answer sessions with the staff of the CPCRI and the staff of the ICG-SAME.

POLICY IMPLICATIONS AND AGREEMENTS

A. Legal status of the arrangements between COGENT and the hosting country Governments in hosting the International Coconut Gene banks (ICGs).

The tripartite agreement between GOI-FAO-IPGRI, for hosting the ICG-SAME has been signed by the Director General, Indian Council of Agricultural Research on behalf of Government of India on 30th October 1999. This MOA is still in effect, as the agreement states that it is automatically renewed for further periods of 4 years unless notice of non-renewal is given in writing by either party not less than two years before the end of any of 4-year period.

B. Legal status of the land occupied by the IGG and Land tenure and similar problems presently encountered by the ICG

The designated ICG SMEA site is located in part of the Kudu Research Station of about 121 Ha in size belonging to CPCRI in Karnataka District. This station is beautifully surrounded by thick forest reserve. The location is strategically perfect as it is well protected by out side pollen contamination, benefited with healthy microclimate and least affected by pest and diseases preserving in the coconut growing areas. The site is on fertile virgin forest clearance therefore the performance of the cultivation is optimal. The location is further benefited by a perennial waster source (flowing river) adjacent to the station, which will provide water for irrigation during rain free period.

Out of the total area, ICG occupies 51.4 Ha. The rest of the area is occupied with an area planted to research trials (23.5 Ha), area planted to seed production (30 Ha), area for nursery (new Office building, roads, warehouse, screen house (5 Ha), area planted with other crops (3 Ha), area for coconut nursery (2.25 Ha), area planted to other crops (7.5 Ha), area occupied by buildings (0.57 Ha) and other uses (4.78 Ha). The ownership of the land of the Kidu research station is belonging to Forest Department and under lease agreement to CPCRI subjected renewal. No dispute regarding the land ownership has aroused as lease is under proper legal and mutual understanding between two Indian Government institutions. The CPCRI is managing the entire site with a separate staff cadre and engaged in planting and data collection in the germplasm accessions.

TECHNICAL OBSERVATIONS

Status of Accessions

A. Type of varieties, populations, and accessions conserved in the ICG, with special emphasis on the accessions considered as active at the international level.

This section will focus only on the designated germplasm in the agreement only. Out of 49 designated accessions in the ICG-SAME agreement, one of the entries is MAWA or PB121 (serial No. 20 in the Annexure -1 of the agreement), which is a not a variety but a hybrid between dwarf x tall. This seems a mistake in the agreement from the COGENT side (then IPGRI) as hybrids are not qualified for germplam conservation in gene banks. In agreement with this observation by the appraisal team, it was noted that CPCRI has not considered MAWA as an entry in their Kidu gene bank as evident from the gene bank variety display boards which is a correct decision by CPCRI. Therefore, accordingly the Kidu is made-up to have established only 46 varieties. According to the curator of the genebank, Dr. Niral, a Senior Coconut Breeder, the genebanks entries in the Kidu ICG are regenerated materials from Indian national gene banks through controlled pollination. The appraisal team observed three planting lots in the gene bank as follows as evident by the variety display boards. Variety display boards were taken as the proof of varieties/accessions planted in the Kidu ICG.

A.1. Thirteen (13) Accessions planted in 1997 & 1999 (Figure 4)

The design is RBD with 3 replicates , Plot size: 15/30, total no. of palms: 900). The (03) accessions in this block were not designated accessions as per the agreement signed for the ICG as listed below (refer to Figure 4). Hence effective designated number of accessions for the ICG in this plot is 10. Panama Tall, Jamaica (1997 & 1999 panting lot, entry No. 05 of the name board), Laccadive Micro Tall (1997 & 1999 panting lot, entry No. 07 of the name board), East African Zanzibar Tall (1997 & 1999 panting lot, entry No. 13 of the name board)

A.2. Thirty five (35) Accessions planted in 2001 (Figure 5).

The design: RBD, Replication: 03, Plot size: 15/30, Total No. of Palms: 1790)
Within these 35 accessions, 06 accessions are duplicates of planting lot in 1997 & 1999, therefore effective designated accessions in this plot are 29 and 03 accessions planted in 2002 with RBD experimental lay-out. With 3 replicates, plot size is 30 and total number of palms is 210.

Accordingly total of 42 designated accessions out of 46 accessions (disregarding the MAWA hybrid) are planted in Kidu ICG as proofed by the name boards. The appraisal team observed that as evident form the gene bank variety listing name Boards in the field of the Kidu gene bank, out of qualified 46 designated varieties, only 42 varieties are available in Kidu ICG. Following varieties listed in the designated list of germplasm were noted absence in the ICG at Kidu as evident in the display name boards as proofs are:

(1) Kimos

(2) Kimmai
(3) Jamaica Sanabals
(4) Lakshdweep Micro

Figure 4: 1997 & 1999 panting lot at Kidu Gene bank

Figure 5: 2001 planting lot at Kidu Gene bank

Figure 6: 2002 planting lot at Kidu Gene bank

Further it was noted that following 5 designated germpalsms were duplicated in 1977 & 1999 planting lot and in 2001 planting lot in addition to East African Zanzibar Tall which is not in the designated list (refer Figure 4 and 5).

1. Benaulaim Tall (No. 2 in the name Board 1997 & 1999 planting lot)
2. Borneo Tall (No. 3 in the name Board 1997 & 1999 planting lot)
3. Kulasekharam Yellow Dwarf (No. 6 in the name Board 1997 & 1999 planting lot)
4. West African Tall (No. 11 in the name Board 1997 & 1999 planting lot)
5. West Coast Tall (No. 12 in the name Board 1997 & 1999 planting lot)

These duplications were identified as an optimistic move as with the increased number of replicates this will ensure representative genetic diversity in the original population.

Figure 7: Pollen processing facility at Kidu

B. Level of maintenance and wellbeing of each of accessions in the ICG

Agronomy and Cultural Management

Biophysical Assessment

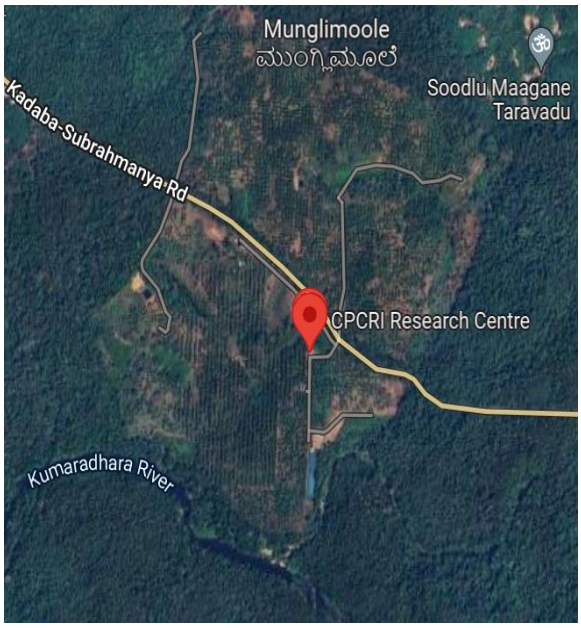

Figure 8: bird's eye view of ICG-SAME site

The International Coconut Genebank for South Asia and Middle East (ICG-SAME), forms part of the Kidu research centre, managed by the Central Plantation Crops Research Institute under the Indian Council of Agricultural Research (ICAR-CPCRI). The Kidu centre was established in 1972 with 60 ha of clear-fell forest land acquired on lease from Government of Karnataka. It began as a seed garden aiming to produce genetically superior planting materials of areca-nut, cashew, cocoa and coconut. In 1973 the farm was expanded with a further 60 ha. The ICG was established there in 1998. In 2001 site was upgraded to become a research centre.

Location

This centre is located in the Kidu Reserve Forest, Bilinele Village, Puttur Taluk, Dakshina Kannada District of Karnataka State, 97 and 105 km away from Mangalore and Kasaragod, respectively. The centre lies at latitude of 12.300 N and longitude of 75.200 E at 291m above sea level. The Kumaradhara river forms the site's the southern boundary, which also provides an all year round water supply used also for irrigation (fig 1). The soil is a red laterite sandy loam, (fig 2), with a high organic matter content and a **pH of 6**. The site slopes slightly to the south towards the river.

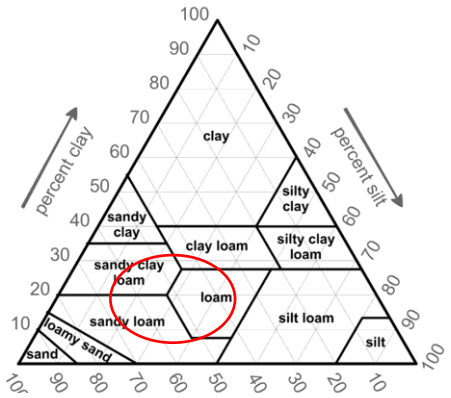

Figure 9: soil texture

Coconut is cultivated on 95 ha, arecanut on 7.5 ha and cocoa on 2.5 ha. The additional area of 500 ha adjoining to the farm hosts the Indian national collection of 407 accessions and the 49 accessions within the ICG. There is a high-water table and adequate annual rainfall (see figure 9).

Mandate

The Research centre is mandated to:

1. Produce parental materials and breeders stock in coconut, arecanut and cocoa.
2. Generate genetically superior planting materials of released varieties and promising cultivars of coconut, arecanut and cocoa.
3. Produce and supply released hybrids of T x D and D x T combinations in coconut.
4. Establish compact blocks of released and promising cultivars of coconut and arecanut.
5. Establish clonal orchards of cocoa for hybrid seed production.
6. Host International Coconut Gene Bank for South Asia under COGENT of IPGRI.
7. Conduct research on coconut, arecanut and cocoa.

Climatological Data

Located 12 degrees north of the equator, the site is subject to a tropical climate, receiving rainfall in most months and a significantly wetter season between April and July. Annual rainfall varies between 2800 mm and 4200 mm. It has fairly stable temperatures (average annual 26.7°C) and relative humidity (~80%), (Fig 10). 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, and a cooler period between April and October. It thus enjoys a climate that is highly conducive to coconut cultivation. The short dry season has little effect on the overall climate. On average the sun shines for around 250 hours per month between November and March, and around 200 hours per month between April and October (rainy season).

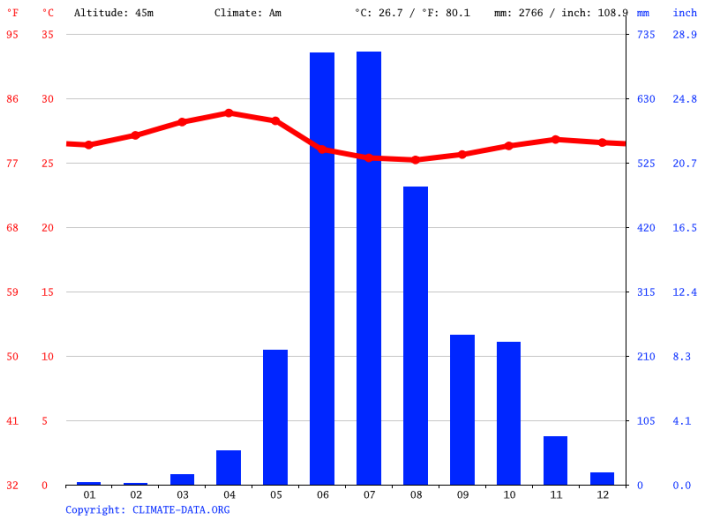

Figure 10: local climate (source climate-data.org)

Nutritional Status and Requirements

The accessions appear healthy indicating that crop nutrition is adequate in the agronomic context of such light soils. They also seem subject to little pest and disease pressure, partly on account of the site's isolation within the forest reserve (see section x for pests and diseases). Cultivations are done with a set of disc harrows (figure 11), which controls the weeds. Nitrogen-fixing cowpea (*Vigna unguiculata*) is sown as a green manure, which is ploughed in during the rainy season in June.

Figure11: ICG-SAME cultivation equipment (disc harrows)

Figure 12: CPCRI- vermicompost

Lime is applied to neutralise the acidic soil (pH 5 – 6), although there should be little nutrient lockup on account of low soil clay content. However routine manual fertiliser applications of: nitrogen (N- 50g); phosphates (P-320g); potash (K-1200g) per palm per year are applied within a 50cm radius. Nut husks are buried in a trench and trough regime to maintain organic matter and conserve soil moisture, and husks are used also as a mulch. Other compost is added, which has been treated against mites.

How well does the ICG's agronomic management follow the principles of good agricultural practice (GAP)?

Figure 13: site irrigation reservoir

The ICG's overall agronomic management seems satisfactory. The adequate rainfall is supplemented with drip irrigation in the drier months between November and April. An irrigation pond has been installed which is fed by the river. Our appraisal visit indicated that the ICG-SAME accessions are generally very well-maintained The accessions are **well-labelled**, and planted according to a standard triangular **spacing** regime of 7.5m for dwarf types and 9.5m for tall-types The appraisal has indicated that the accessions receive i) **adequate soil fertility management** ii) **adequate palm nutrition** iii) **adequate weed control** through cultivations (see above) and iv) **good pest and disease surveillance and control** measures (especially for phytophthora).

The accessions are well protected with a perimeter fence. Dwindling resources mean that **staff** and equipment are becoming insufficient to effectively maintain the accessions, which is very likely to compromise future maintenance.

Production Data

Table 1 summarizes production data provided by CPCRI (for accession-level production data, please see table x I annex x). Overall the palm productivity seems high, averaging 205 nuts per palm per year, again indicating sound agricultural practice.

Intercropping

Figure 14: CPCRI intercropping trials

Many practitioners recommend intercropping, and indeed the CPCRI experience suggests that banana, cacao, cloves, nutmeg, pepper, and pineapple are viable intercrops that could annually generate an extra 1.2 million INR (US$15,200) across the research centre's coconut area. However the ICG curator argues that intercropping is labour intensive and possibly interferes with the conservation mandate of the genebank by constraining certain operations. Although the seed garden provides some income from seednut sales, the revenues are not sufficient to offset the running costs of US215 per palm per year. (see section)

The level of maintenance in the ICG SAME as well as the entire Research Centre is commendable. Estate management/cultivations, weed control and cover crops are in very good condition. The station is equipped with all required machineries allowing tractor ploughing using disc plough, cultivator and rotavators.

No severe mineral deficiencies could be observed in palm in the ICG. Fertilizer application program presented to the appraisal team was satisfactory with manually each palm is applied with 500g N, 320g P and 1200g K per year in two splits (1/3rd during onset of monsoon (May-June) and rest 2/3rd post monsoon in Sept-October), along with boron 30 g per palm and 20 kg organic manure per palm.

Pest and Disease Observations and Management

Pest and disease control programme was acceptable level with no or marginal pest or disease incidences in the entire field. It was observed that regular surveillance for pest & disease incidences are being carried out and as and when symptoms are found, suitable phyto-sanitary and control measures are carried out as per the standard package of practice of ICAR-CPCRI.

There is no major Pest infestation and disease incidence noticed in the ICG-SAME gardens during the visit of the appraisal team. It has been observed that the garden is well maintained. On discussion with the plant protection head of the institute it has been informed that regular monitoring schedule is followed in the garden. As reported by Dr. Vinayaka Hegde, head of Plant Protection division, the monitoring schedule followed is:

1. The pest and disease surveillance team is monitoring the pest and disease occurrence in the ICG-SAME coconut gardens in Kidu every month to monitor the disease and pest incidence. Every palm in the gene bank is closely monitored. Even slightest incidence of any pest or disease is noticed, the curative/CPCRI recommended control measures are being adopted immediately to prevent the further spread and to save the palm.
2. Apart from this, two technical persons who are trained in pest and disease identification is also going around the field gene bank every day to monitor the general field sanitation, irrigation and general health of the palms.
3. The major endemic pests and diseases of coconut in the gene bank area in Kidu are Coconut Rhinoceros Beetle (CRB), Red Palm Weevil (RPW), bud rot, stem bleeding and leaf spots. Hence, the following prophylactic disease and pest control measures are being taken to protect the palms. The team also develop a management packages/schedule for Rhinoceros beetle and Red palm weevil. This protocol is being followed as a regular pest management activities in the genebank to ensure preventive measures against rhinoceros beetle and red palm weevil:

    a) Maintenance of farm sanitation in coconut gardens by proper disposal of decaying organic debris and upkeep of palm hygiene by annual crown cleaning.

b) The top three-leaf axils are to be filled with powdered Neem cake/Marotti cake/ Pongamia cake @ 250 g/palm + fine sand (250 g) per palm during pre and post-monsoon months (May, September, December) as a prophylactic measure.

c) Placement of three perforated sachets containing chlorantraniliprole a.i. 0.4% (5 g) or fipronil (3 g) or three botanical cakes (2 g each) developed by ICAR-CPCRI during the monsoon phase. During the dry period, 100 ml of water is poured over the sachet for effective release of the molecule.

d) The breeding sites are treated with green muscardine fungus (*Metarhizium anisopliae)* .

e) Regular monitoring and looking out for any damage on the spindle region of the juvenile palms or seedlings at the collar region.

f) Extraction of beetles with GI hooks mechanically without causing further injury to the growing point of the palm and any such wounds are to be dressed with fungicide suspension.

g) While cutting fronds, petiole to a length of 120 cm is to be left on the trunk to prevent the entry of red palm weevils into the trunk.

h) Removal and burning of palms at an advanced stage of infestation for the destruction of various stages of the pest harbored inside the trunk.

i) Spot application of 0.02% imidacloprid 17.8 SL (@1.12 ml per litre of water) or 0.013% spinosad 2.5 SC (5 ml per litre of water) or 0.04% indoxacarb 14.5 EC (2.5 ml per liter of water) was found effective in the suppression of the pest.

In the case of diseases;

a) To prevent bud rot caused by *Phytophthora palmivora,* crown cleaning and application of Bordeaux mixture (1%) to palms before the onset of monsoon preferably in the last week of May or the first week of June. About 300 ml of Bordeaux mixture (1%) or chlorothalonil solution (3 g in 300 ml water) is poured into the base of the spindle. The same treatments are repeated in 2 months intervals.

b) If stem bleeding symptoms are noticed, affected tissues are removed completely using a chisel and the chiseled portion is smeared with hexaconazole (0.2%). After one or two days the treated portion is painted with coal tar. The chiseled diseased tissues are destroyed by burning.

c) Whenever severe leaf spots are seen, spraying of 0.2 % hexaconazole is undertaken for affected and nearby palms.

For the biosecurity plan, a national quarantine regulations are being followed in the germplasm importation. Clean planting materials free from pests and diseases are allowed in the genebank.

Water management was high standard with a drip irrigation system laid out in the entire area with a perennial water source (River) near by the site.

Weed management was above average with ploughing and machine weeding. The visit was done in rainy season; hence it was observed some weed growth but weed growth under controlled.

The palms in the ICG are individually numbered serially in a similar patten across the accessions without being able to anyone distinguish the accessions by colour codes or by international variety codes. Upon inquiry it was noted that this was practiced intentionally not to make the data collecting staff be biased towards some accessions. For similar purpose, intercrops have not been practiced in the ICG as different intercrops planted in different patterns and different ages will have negative impact on the uniformity of data in the field. Thus, the ICG is planted as to monocrop only with coconut. Overall, the management of the research centre & the ICG and the performance of the plantation was impressive.

Figure 6: Individual Palm numbering at Kidu

C. Evidence of plans for additional collections and prospecting to be conducted and the funding sources for the planned collection activities for expanding the ICG.

It was noted that total financial resources for the gene bank were from the host government, India. Funding provided by other donors, and financial resources generated by the ICG are very limited. Hence it is required to look for external funding for the ICG for better and sustainable maintenance. Due to fund limitations, no further prospections and collections for the national gene banks were not happening currently.

D. Regeneration plans for the continuity of the accessions in the ICG.

The ICG-SMEA is still very young and regeneration plan will come in the years ahead. Regeneration is done by hand pollination of the respective varieties. In identified mother palms, emasculation of inflorescence, bagging for isolation followed by manual pollination from specific source of pollen is undertaken when at the receptivity of female flowers by using fertile pollen (possessing more than 30 % pollen viability under *in-vitro* germination assay. and bagging till seed set.

E. Current status of the research activities being conducted on the existing accessions and future R&D plans

Hybridization programme to produce new hybrids is a long-term objective and a programme at CPCRI. Many such evaluation trials of new D x T, T x D, T x T and D x D hybrids are being done in the field at CPCRI main site, at Kudu and in other regional stations. Inter-se regeneration for conservation and multilocation evaluation have been planned.

Figure 6: An example of hybrid evaluation trial planted at Kidu Research centre in 1998

F. Records of the number of accessions that have been requested for sharing by other COGENT member countries.

In the last 5 years, there had been no records of request for sharing germplasm from ICG, India and v*ice versa*. (There should be reasons for this situation coming from the curator)

G. Number of accessions that have been shared with other COGENT member countries.

ICG-SAME conserves accessions from regional member countries viz., 10 accessions from Bangladesh and 4 accessions from Sri Lanka. Further, representative germplasm of the Indian Ocean Islands is also conserved, namely one accession from Reunion and four accessions each from Mauritius, Seychelles, Comoros and Reunion.

H. Involvement of the genebank in research and conservation of other crops than the coconut palm (this increases the patrimonial value of the sites)

Intercrops have not been practiced in the ICG site as different intercrops planted in different patterns and different ages will have negative impact on the uniformity of data in the field. Thus, the ICG designated location in the Kidu is planted as to monocrop only with coconut. However, as a mandatory crops of CPCRI, Arecanut and Cocoa seed production site have been planted in the Kidu Research centre. Kindu site was observed to be planted with local and exotic cocoa as the cocoa germaplasm conservation site also.

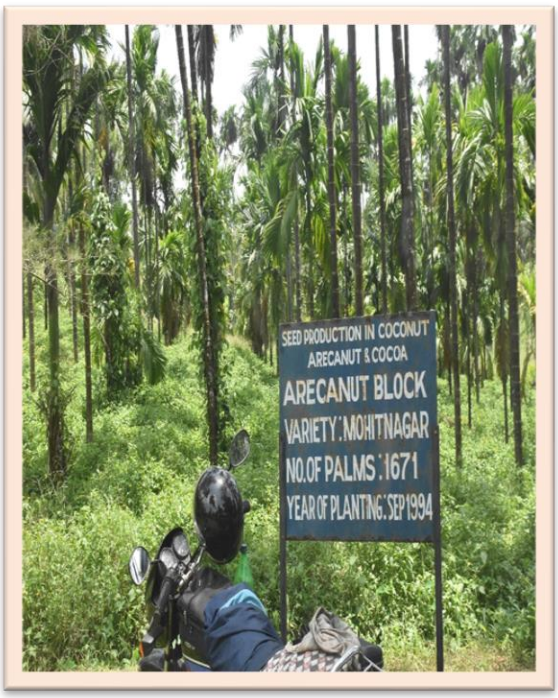

Figure 7: Seed production site for coconut, Arecanut and cocoa planted at Kidu Research centre in 1994

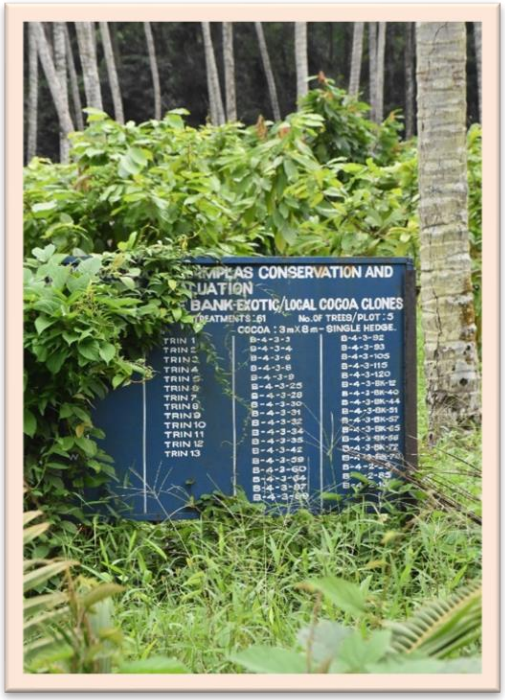

Figure 8: Cocoa germplasm conservation site

CONCLUSION

Seed Production

A well-organized seed nut production unit is available at the site. Seed nut and seedling production in all released varieties (Dwarf/Tall) and hybrids as well as production of planting material of parental lines and experimental crosses.

IT Facilities

All IT facilities developed by the CPCRI are used with almost all IT related equipment are available at the CPCRI. However, they require further unit of laptop and a drone to strengthen then facilities.

Technology Transfer

CPCRI has a well-established technology transfer division.

Research Conducted and Technical Papers Published

a) Thematic areas

- Improvement of coconut
- Biotechnological investigations
- Production technology
- Integrated disease management
- Integrated management of pests and nematodes
- Production physiology and value chain management
- Economics and statistical aspects of transfer of technology

b) Publications

- Sudha R., Niral V., Samsudeen K., Ganesh Khadke, Rajesh M.K. 2022. Genetic variability and multivariate; analysis to assess phenotypic diversity of coconut (*Cocos nucifera* L.) germplasm. Fruits 77(1):1-10 DOI: 10.17660/th2022/004
- Singh L.S.https://www.indianjournals.com/ijor.aspx?target=ijor:ijpgr&volume=33&issue=2&article=012 - aff001 , Das Alpana, Niral V., Acharya G.C. 2020. Study on flowering behavior of some local coconut (*Cocos nucifera* L.) genotypes under Assam condition. Indian Journal of Plant Genetic Resources 33(2): 217-223 https://doi.org/10.5958/0976-1926.2020.00031.5
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On-going researches

- Mature nut and tender nut morphology work
- Reproductive biology
- Oil yield estimation
- Physico-chemical properties estimation using total oil
- Fatty acid profiling of total oil
- Molecular characterization
- Evaluation for inflorescence sap yield and its quality
- Evaluation for milk yield and its quality
- Evaluation for fruit yield and its attributes

Capacity Building Initiatives (Training and Workshops)

Sl. No.	Training Title
1.	Integrated Nutrient Management and Nutrient Budgeting through advanced models to Improve Crop Productivity during Feb, 2020
2.	Basics of flow cytometry and its applications in Plant Biology. (Online) during May, 2020
3.	Data analysis using R (Online) during August, 2020.
4.	Application of Statistics in Science and Technology using SPSS (Online) during August 2020
5.	Intellectual Property rights in agricultural Research & Education in India (Online) during September, 2020

6.	Priority Setting Monitoring and Evaluation (PME) of Agricultural Research Projects during July, 2019.
7.	Recent Advances in Soil Health Improvement and Climate Change Mitigation during December, 2019
8.	Recent advances in bioinformatics in agricultural research: A practical perspective during December, 2019

Workshop Title
Workshop cum training programme on “Airborn Hyperspectral Remote Sensing during Feb, 2020.
Workshop on “Fundamentals of Proteogenomics for Beginners” duringJuly, 2019
Workshop and National seminar on Climate, flood and folklore was organized during Aug, 2019.
Workshop-cum-Training on Plant Health Management in Coconut was organized during May, 2019.
National Workshop on ‘Organic Farming in Plantation Crops - Present status and future Prospects’ during September 2019.
Swadeshi Science Congress, during 2020.
ICC-COGENT International Tissue culture workshop during 2022